The Bylaws of the Undergraduate Programs

Faculty of Engineering Technology

ElSewedy University of Technology

June 2025

Introduction

The Ministerial Decree No. (3273) was issued on 31/12/2023, approving the commencement of study at the Faculty of Engineering Technology and the approval of its academic regulations. Pursuant to this decree, study has commenced in the following programs:

1. Electrical and Electronic Engineering Technology Program
2. Computer Engineering Technology Program
3. Data Science and Artificial Intelligence Technology Program
4. Network and Cybersecurity Technology Program

The Ministerial Decree No. (1850 (of the year 2024 has been issued on, approving and adopting the modified academic bylaws and adding two new programs:

1. Information Technology Programs
2. Energy Engineering Technology Program

Since October 2024, Elsewedy University of Technology has prepared **the Game Development Technology Program** in collaboration with **Metropolia University of Applied Sciences** in Finland. This document shows the integration of this program into the curricula of Elsewedy university of Technology & Enriching Programs as part of this strategic partnership.

In the context of this document, **Articles (1 to 39)** restate the previously approved academic bylaws for the reader's convenience. **Articles (40)** present the new program, followed by the study plan and course descriptions.

Faculty of Engineering Technology

Vision

The Faculty of Engineering Technology at ElSewedy University of Technology seeks to become an international center of excellence in integrating engineering and digital technology into various scientific systems and fields, and to become a reliable source of knowledge and scientific production and education in engineering and digital technology.

Mission

- The Faculty of Engineering Technology at the ElSewedy University of Technology contributes to the provision of advanced technological educational programs that prepare graduates to work professionally in the fields of engineering technology and computer science in the local and global markets.
- The faculty also equips graduates of the university's various programs with the information, ethics, and skills required for the future.
- The faculty also contributes to the development of the field of engineering technology, digital technology, and computer technology through continuous scientific research, innovation, and creativity in a way that meets the economic and social needs of the country.

Goals

- Develop engineering technological education in terms of education environment, content, teaching methods, and training.
- Contribute to scientific research to deepen and produce knowledge in the fields of engineering technology, digital systems, computer science, and their applications.
- Develop performance evaluation methods and ensure sustainable quality
- Maintain excellence and increase the productivity of faculty and staff.
- Maximize the role of the faculty in industry and community service.
- Provide advanced skills and knowledge for career transformation and lifelong learning in the fields of engineering technology, digital systems, and computer science.
- Work to connect with engineering technological industries to provide training and employment opportunities for its graduates.

Scientific Departments

Article 1: Definition

- The faculty consists of several scientific departments, which have a direct relationship to the faculty's specialization.
- The scientific department is the main academic unit in building the faculty.
- The scientific department is responsible for scientific research and teaches courses for all programs that need courses in the department's specialization and bears the department code.
- The department is responsible for the scientific content of the subject and the nomination of teaching and training staff for each subject, in addition, the department is responsible for the continuous development of teaching methods and scientific content at the level of courses.
- The department consists of a specialized group of scientists, faculty members, engineers and technologists, whose general specialization is the specialization of the scientific department, but they vary in their specializations so that the department includes all its sub-disciplines.
- The department has a group of educational and research laboratories in all its subdisciplines, and its members are working continuously to update and develop them.
- The members of the scientific department conduct scientific research in the disciplines of the department and are keen to contribute effectively to the scientific system and knowledge production in their specialization.
- The members of the scientific department are responsible for developing and updating the teaching and training methods for the courses they teach while adhering to the quality system and performance indicators set by the university and the faculty.
- Faculty members and employees of the scientific department contribute to the university's initiatives and projects to serve the community, as well as develop cooperation with external industrial and specialized bodies, as well as Egyptian and international universities in their field of specialization.
- The members of the department are committed to high-level scientific publishing in their various disciplines.

Article 2: Departments

Department of Computer Engineering Technology

The department teaches and conducts scientific research in the following disciplines:

- ★ Software engineering
- ★ Computer networks.
- ★ Cybersecurity.
- ★ Artificial intelligence and machine learning
- ★ Computer architecture.
- ★ Computer systems.
- ★ Information systems.
- ★ Embedded systems.
- ★ Data science.
- ★ Distributed systems.
- ★ Digital Design.
- ★ Game Development.

The department manages the following laboratories:

- Programming Lab.
- Operating Systems Lab.
- Database and Security Lab.
- LINUX Lab.
- Network Security Lab.
- Programming and Algorithm Lab.
- Cyber Security Lab.
- Information Technology Lab.
- Software Engineering and Networking Lab
- IoT Lab.
- Smart Robotics Lab.
- Digital Design Lab.
- Game Development Lab.

Department of Electronic Engineering Technology

The department teaches and conducts scientific research in the following disciplines:

- ★ Analog and digital electronic circuits.
- ★ Electronics system design.
- ★ Communication systems and engineering.
- ★ Automotive, vehicle and aerospace electronics.

★ Integrated circuits and microelectronics.

The department manages the following laboratories:

- Circuits Lab.
- Electronics Testing and Measurement Lab.
- Microprocessor Lab.
- Analog and Digital Communication Lab.
- Signal and Image Processing Lab.
- Microwave Lab.

Department of Energy Technology

The department teaches and conducts scientific research in the following disciplines:

★ Energy Fundamentals
★ Energy Systems and Engineering
★ Energy Storage and Transmission
★ Fluid Mechanics and Machines
★ Sustainability and Environment
★ Operation and Maintenance of energy systems efficiently.
★ Measurements and Diagnostics

The department manages the following laboratories:

- Thermodynamics Lab
- Fluid Mechanics Lab
- Power Systems Lab
- Control Systems Lab
- Measurements and Instrumentation Lab
- Renewable Energy Labs (e.g., Solar Energy Lab, Wind Energy Lab)
- Electric Vehicles Lab
- Building Energy Efficiency Lab

Department of Electrical Power Engineering Technology

The department teaches and conduct scientific research in the following disciplines:

★ Generation, transmission, distribution and management of electrical energy.
★ Traditional, nuclear, and renewable energy.
★ Electrical machines, their design, performance, and control.
★ Electrical industrial systems and automation.
★ Protection and safety in electrical systems.

The department manages the following laboratories:

- Lab Circuits and Measurements Lab.
- Lab Installations & Maintenance Lab.
- Industrial Electronics Lab.
- Electric Traction Machines Lab.
- Power Systems and Smart Grid Lab.
- High Voltage Lab.

Department of Water Engineering Technology

The department teaches and conducts scientific research in the following disciplines:

- ★ Civil Engineering Fundamentals
- ★ Irrigation Engineering Fundamentals
- ★ Water Engineering Fundamentals
- ★ Agriculture Engineering Fundamentals

The department manages the following laboratories:

- Irrigation Instrumentation Lab
- Design of On-Farm Irrigation Systems Lab
- Agricultural Water Management Lab
- Wells and Pumps Lab
- Water Delivery System Lab
- Spatial Analysis Lab

Soil and Water Quality Lab

Study System

Article 3: General Rules

- The official language of instruction is English, and the academic regulations of the university determine the method of ensuring that the student is proficient in the English language. Textbooks, exercises, and exams are all in English.
- Programs follow the credit hour system (CH), which is followed in the United States of America, Canada, and several other countries. This is a measure of the hours of communication between teaching staff and the students in the classroom. Where one credit hour is equivalent to the contact hours as follows:
    - One hour lecture per week for a 15-week semester.
    - Two to three hours of exercise and labs per week for a 15-week semester.

- The academic regulations of the university must indicate the number of hours of lectures, exercises, and laboratories for each course.
- One Contact Hour is divided into 50 minutes of actual teaching and 10 minutes' break.
- For each course and program, the Student Workload (SWL) value must be set. It is defined as "the number of hours typically required to complete learning activities in course units in order to achieve their expected learning outcomes"
- The total student workload consists of:
    - The structured student workload, which is the contact hours specified for the course.
    - Unstructured student workload, which is the time students spend on their own self-study.
    - Complete course assignments, and prepare for all types of exams, such as assessment workload.
- Expected values per semester:
    - 16-20 credit hours.
    - 22 - 25 contact hours per week for 15 weeks.
    - 650 – 750 hours of total student workload.

Article 4: Study Levels

- Whenever the student completes 25% of the program requirements, he will be transferred from one level to the next. The following table shows the student's status based on the percentage of credit hours successfully passed.
- However, the student is allowed to move to the upper level, if the credit hours passed are less by one course than the required minimum.

Study Level	Student Status	Percentage of Passed CH
First Level	Freshman	0→25%
Second Level	Sophomore	25→50%
Third Level	Junior	50→75%
Fourth Level	Senior	75→100%

Article 5: Academic Semesters & Course Registration

- **The academic year comprises two main semesters, and one summer semester**:

    - **First main semester (fall)**: starts on Sunday of the third week of September, where it lasts for 15 weeks of teaching followed by two weeks of exams. Courses are registered within three weeks before the start of the semester.
    - **Second main semester (spring)**: starts in February and lasts for 15 weeks followed by two weeks of exams. Courses are registered within one week before the start of the semester.
    - **Summer semester**: starts in late June or early July and lasts for 7 weeks followed by one week of exams. Courses are registered within a week before the start of the semester.
- Course registration is not final until after the approval of the academic advisor and the approval of the program coordinator.
- New students are enrolled in the programs throughout the year, after fulfilling all program requirements and paying the admission fees, according to the students' situation.
- Registration for the summer semester is optional.

Article 6: Duration of Study

- The degree is awarded when the student meets the requirements for obtaining it as determined by the internal regulations of the university.
- The maximum allowed duration of study is twice the proposed period stipulated in the program if the internal regulations of the university do not stipulate otherwise, which does not include semesters frozen for reasons acceptable by the University Council, and after this period the student is dismissed from the program in which he is enrolled.

Article 7: Conditions for Registration of Courses

- The student can register courses in the main semesters with a total of around 16 credit hours per semester.
- The student can register courses in the main semesters with a maximum total of credit hours according to the following rules (after the approval of the academic advisor):
    - Up to 21 credit hours, for students with a GPA greater than or equal to 3.0
    - Up to 18 credit hours, for students with a GPA greater than or equal to 2.0. Registration in this number takes place in the first semester after the student enrolls.
    - Up to 12 credit hours, for students with a GPA of less than 2.0.

- The student can register courses in the summer semester with a maximum total of credit hours according to the following rules (after the approval of the academic advisor):
    - Up to 9 credit hours, for a student with a GPA greater than or equal to 3.0
    - Up to 6 credit hours, for students with a GPA less than 3.0
- In the student's first semester, the registration of courses in the study plan is available for up to 18 credit hours, and the previous rules are applied starting from his second semester.
- The student can register for one additional course above the above limits if this will lead to his graduation, after the approval of the academic advisor.
- Students studying without academic degrees are allowed to register for courses according to the rules of maximum hours. The student will receive a statement of the courses studied and the grades obtained in it.
- Students studying for an academic degree and students studying for nonacademic degrees can register as listeners in some courses. Students registered as listeners are not allowed to take the final course exam.
- The university has the right to determine the courses that are offered each semester and the methods of registering students in them, except for the courses specified as a prerequisite to study other courses or necessary for graduation, which must be made available for registration every main semester.
- An exception may be made to the previous conditions, after presentation to the Education Affairs Council and the approval of the University Council, in the event that any of the conditions conflict with the requirements of any study program and in the narrowest limits.

Article 8: Conditions for Granting Certificates and Technological Degrees

To obtain a Bachelor of Technology degree in the specialization, the student must:

- Successfully complete the required credit hours in the program in accordance with the prescribed conditions, provided that a minimum GPA of 2.0 is obtained upon graduation.
- Succeed in all courses that have (0) credit hours in his program.
- Undertake field training for the period specified for each program during the period of his study.
- Can study a number of courses at another university that has a cooperation agreement with the university in which the student is registered regarding the transfer of credit hours. This requires prior approval from the University Council, provided that the number of credit hours for these courses does not exceed half the number of credit hours required to obtain the degree in the program.

Article 9: Adding & Dropping Courses

- The student can add courses or drop courses from the courses in which he is registered until the end of the second week of the main semester, or the end of the first week of the summer semester.
- Adding or dropping courses should not result in violating the minimum or maximum number of credit hours registered per semester.

Article 10: Withdrawal from Courses

- The student can withdraw from any course he has registered for during the first ten weeks of the main semester or during the first five weeks of the summer semester.
- The student does not fail in the course from which he withdraws, provided that the withdrawal request is completed and approved within the specified time.
- The student obtains a grade of (W) for the course he withdrew from and is allowed to register for this course (full attendance and performance of all activities including exams) in subsequent semesters.
- For the elective course, the student is allowed to change it in subsequent semesters if he fails to pass it or withdraws from it. This is subject to the approval of the academic advisor and the requirements of his study program
- For non-scholarship students, tuition fees for the course withdrawn from will not be refunded. The next time a student registers for this course, he/she must pay the full tuition fees for that course. A student who withdraws from an entire semester without registering for any courses must pay the minimum tuition fee equivalent to a 12-hour fee.
- For scholarship students, these credit hours will be deducted from his/her scholarship, and he/she will have the right to register for this course free of charge only once.

Article 11: Incomplete Courses

- If the student does not attend the final exam of the course in a semester with an excuse acceptable to the committee concerned with the affairs of the program in which he is registered and approved by the university Council, the course is considered incomplete.
- The student receives a grade of (I) in the incomplete course, until the exam is conducted in this course. If the student does not take the final exam on the next available date for this course, he/she will receive an F grade on the course. A grade of (I) will not be included in the calculation of the student's GPA.

- The student takes the exam on the next available date for the exam, after paying the retake fee, which is equivalent to one credit hour fee, if applicable. The grades of this final exam are added to the grades of the semester work to calculate the overall grade for this course.

Article 12: Student Evaluation

- The marks of each course are distributed as percentages of the total marks of the course, and these marks are divided into the marks of the student's various activities, the marks of the mid-semester exam, the marks of the practical exam, and the marks of the final exam.
- The determination of the student's evaluation method and the distribution of course marks are left to the course designer. It depends on the nature of the course.
- The course description should stipulate the distribution of marks on different assessment methods. The University Council may amend the distribution of marks for a course based on the desire of the department concerned and announce that distribution to students before the start of the semester.
- The student must attend at least 75% of the total hours of exercises and laboratories of the course, to be allowed to attend the final exam of the course.
- It is not allowed that the percentage of final exam grades exceeds 40% of the total course grades, except for courses related to university requirements.
- In order for a student to succeed in a course, the minimum score that he must obtain in the final exam is 30% of the total grades of the final exam, otherwise the student will fail in this course regardless of the total grades obtained in this course and will receive a grade of (F) and this item does not apply to courses in which there is no final exam.
- The student fails the course if he obtains a grade of (F) (less than 50% of the course marks) or is denied attending the final exam due to exceeding the percentage of absence or cheating... etc. or did not attend the final exam without providing an acceptable excuse by the University Council.
- Courses that have (0) credit hours in which the grade is failed or passed. The student gets a grade but is not included in the GPA calculation. To pass these courses, the student must obtain more than 60% of the course marks.

Article 13: Course Grades

- The number of points for each course is calculated on the basis of the grades obtained by the student during his study of this course (activities - mid-term exam- practical exam - final exam - ... etc.). The following table shows how to calculate the number of points and grades obtained.

- The student must obtain the minimum to pass any course (D), which is used to calculate the student's cumulative average according to the grade on which he is registered:

Percentage	Points	Grade
95% up to 100%	4.3	A+
90% to less than 95%	4.0	A
85% to less than 90%	3.7	A-
80% to less than 85%	3.3	B+
75% to less than 80%	3.0	B
70% to less than 75%	2.7	B-
65% to less than 70%	2.3	C+
60% to less than 65%	2.0	C
57% to less than 60%	1.7	C-
54% to less than 57%	1.3	D+
50% to less than 54%	1.0	D
less than 50%	0.0	F

- For other courses on which the student registers as a listener, or is only required to pass the course (courses with zero credit hours or courses that are not included in the GPA), the course grades will be as follows:

Explanation	Grade
Listener (Audit)	AU
Pass	P
Fail	F
Withdrawn	W

Incomplete	I

Article 14: Course Repetition

- When repeating a course, it is required to attend all their contact hours and perform all activities including exams as is done with any student attending the course for the first time.
- The student's grade in the course after repetition does not exceed B+, and the grades of failure in previous attempts are not calculated when calculating the cumulative average, but all attempts remain in the student's record.
- The student can get his actual grade when he/she repeats a course he/she has passed, to improve his/her CGPA . This is limited to only there courses.
- The maximum limit for repeating a course is only six attempts, and if the course is elective, the student may change it.
- The student may repeat a maximum of three courses at each stage of the study to raise his grade, and in all cases the result of the repetition will be calculated whatever it is. Repeating any course once, unless the student fails in the repetition, he is considered a failure and is treated as a failure in the course.
- In all cases, all repetition attempts for all courses are recorded in the student's record.
- In case of necessity (incomplete number of authorized credit hours in the semester), a student who fails a prerequisite, with the recommendation of the academic advisor and the approval of the University Education Committee, may register in a course in conjunction with the prerequisite, and the student's success in the course is suspended until the student successfully passes the prerequisite.

Article 15: Retake The Final Exam for A Course

In some cases of necessity, the failing student may repeat the final exam for a course, according to the following rules:

- Submit a request to retake the exam on the form prepared for that.
- Approval of the academic supervisor and approval by the Academic Affairs Committee.
- The approval of the department concerned with teaching the course is required to repeat the test, and this is approved by the Academic Affairs Committee.
- Exam fees are not refundable.
- A date for re-exam is set before the start of the next semester.

The maximum grade for the course after re-exam is C+, regardless of the actual grades if they are higher than that or "F" if the student fails.

In the event that the student fails after retaking the exam, he must repeat the course again completely in the nearest semester.

Article 16: Dismissal from Study and Academic Warning

- A student receives academic probation if his/her GPA at the end of any major semester is less than 2.0.
- A student is dismissed from studying if he obtains a cumulative GPA less than 2.0 in six consecutive semesters excluding summer semesters. If a student's GPA exceeds 2.0 after any major semester, the number of consecutive academic probations is recalculated.
- The student is dismissed if his cumulative GPA is less than 1.0 after the first three semesters.
- The student is dismissed from the study if he does not meet the graduation requirements within the maximum period of study (twice the proposed period of study in the program):
- The period specified for studying the bachelor's degree in technology is four years, so the study for this degree does not last more than eight years.
- The student is dismissed from the study if he does not register in any courses for more than two consecutive main semesters during the period of his study without an excuse accepted by the university.
- A student who is subject to dismissal from study due to his inability to raise his GPA to at least 2.0 will have an additional and final opportunity to register in two consecutive main semesters in addition to the summer semester to raise his GPA to at least 2.0 and meet the graduation requirements, provided that he has successfully completed at least 80% of the total number of credit hours required for his graduation and that there is an opportunity for the student to raise his CGPA to at least 2.0.

Article 17: Calculation of the Cumulative Average (GPA)

- Course points achieved by the student are calculated as the number of credit hours for this course multiplied by the grade points according to the previous schedule.
- The total points achieved by the student in any semester are calculated as the total points of the courses passed by the student in this semester.
- The student's cumulative GPA at the end of any semester is calculated as the total point achieved by the student in all the courses studied divided by the

total number of credit hours for these courses, considering the rules related to repeating courses and improving their grades.

$$Cumulative\ GPA = \frac{\sum_{Courses} Grade\ Points * Credit\ Hours}{\sum_{Courses} Credit\ Hours}$$

- The cumulative GPA for graduation is the cumulative average at graduation, after passing all graduation requirements. A student can obtain a technological bachelor's degree if they achieve a cumulative GPA of at least 2.0 at the end of each stage.
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- The student's certificate must include all courses that were enrolled during the duration of the study, including courses in which he failed, withdrew, or was improved.

Article 18: Honors for Bachelor of Technology Programs

In order to receive an honors degree, a student must meet the following conditions:

- Maintain a cumulative GPA of 3.3 during the period of study in the program while achieving this average at least during all semesters of study.
- He should not have failed in any course during the period of his study in the program.
- No disciplinary sanctions were imposed during the period of his study.

Article 19: The Minimum Number of Students to Open a Course

- The minimum number of students required to open a course is 10 students, or 75% of the number of students enrolled in this level of the program, whichever is less.
- The minimum number of students required to open an elective course is 5 students or 25% of the number of students at this level of the program, whichever is lower.
- The opening of courses depends on the availability of teaching staff and the allocation of the necessary means.
- The Program Coordinator may make exceptions to these limits if necessary.

Article 20: Academic Advisor

An academic advisor is assigned to each student, who follows up and assists him in choosing courses each semester.

There may be more than one academic advisor in the program depending on the number of students enrolled in the program.

The academic advisor of the program is responsible for:

- Assisting the student in choosing his academic path as well as in determining the courses for each semester.
- Assist the student in choosing a field of training.
- Assisting the student in choosing the specialization and graduation project.

The academic advisor may ask the student to repeat courses in which the student has already passed or ask him to register for additional courses, in order to raise his cumulative average to the level required for graduation.

Article 21: Requests to Review the Results of Courses

- The student can submit a request to review the grades of the course within a week of the announcement of the result, after paying the prescribed fees in accordance with the university's regulations in this regard.
- In the case of a general complaint about a course, the committee is concerned with reviewing the students' grades and deciding on the grades of that course.

Article 22: Transfer between the Credit Hours system and the Semester System

- The university in which the student studied must be recognized in Egypt through the Supreme Council of Universities.
- To be considered for transfer, he must have obtained a grade of "C" or better in all courses studied at other universities to be considered for equivalence with their counterpart at the university.
- Students may be transferred from another semester system program from outside the university to any of the programs listed at the university, according to the admission regulations determined by the University Council as long as they do not pass 50% of the
- A set-off is made between the courses that the student has already passed in the semester system programs and the equivalent courses in the credit-hour programs.

- The following table is used to calculate equivalent grades when transferring the student from the semester system to the credit hour system.
- The cumulative average of students transferring to a credit-hour program is calculated based on the courses the student has studied under the umbrella of this program only, and what he has studied in any credit-hour program or the two-semester system in any other university is not considered. In all cases, a set-off is made for what he studied to be calculated within the requirements for obtaining the degree without calculating it in the calculation of the student's cumulative average.

Semester Based System	Credit Hours Based System	
Percentage	**Points**	**Grade**
95% up to 100%	4.3	A+
90% to less than 95%	4.0	A
85% to less than 90%	3.7	A-
80% to less than 85%	3.3	B+
75% to less than 80%	3.0	B
70% to less than 75%	2.7	B-
65% to less than 70%	2.3	C+
60% to less than 65%	2.0	C
57% to less than 60%	1.7	C-
54% to less than 57%	1.3	D+
50% to less than 54%	1.0	D
less than 50%	0.0	F

Article 23: General Provisions

- These regulations apply to students enrolled as of the semester following the issuance of the ministerial decision to adopt them.

- Unless stipulated in these rules, it is presented to the Education Affairs Council to make the appropriate recommendation, and then this recommendation is submitted to the University Council for approval.

Article 24: Student Responsibility

- All students should read academic policies and regulations carefully and be aware of them.
- Students are responsible for following all policies and procedures and meeting deadlines and requirements in accordance with the rules outlined.

Article 25: Student Privacy Rights

- The university is committed to developing policies and procedures to protect students' privacy rights.
- The university works to protect students' records and files, while disclosing them only to employees who have a justification for using them because it is within their job responsibilities.
- No data from the student's record is given without the written consent of the student, except for legally authorized bodies.

Student Admission Policy

Article 26: General Conditions for Applying

- The university announces all the programs in which the start of the study is approved, and the application procedures, steps and different dates are announced on the university's website, and the university considers equal opportunities for all applicants who meet the conditions required to apply.
- The student obtains a Bachelor of Technology after four years of study,
- He has the right to join the labor market. He may return to the university whenever he wishes and resume studying ruler.
- The university accepts those who have completed the secondary stage, "Mathematics" or the certificate of industrial technical education or their equivalent from the Egyptian certificates, and in the case of submitting a foreign certificate, it must be valid and recognized in the country granting the certificate and allow the applicant to enroll in the universities of this country.
- It is permissible to accept those who have completed the secondary school study of the "Scientific Science" division, subject to the approval of the Supreme Council of Universities, and special studies will be provided to him to complete

the study to be equivalent to what was studied by high school students, "Mathematics" Division.
- The announced conditions include the minimum total admission for each program related to the type of certificate, as approved by the competent councils of the Ministry of Higher Education.
- In addition to these conditions, the conditions and rules set by the specialized councils of the Ministry of Higher Education for admission are adhered to, which can change from year to year.
- Application is done through the university's website, with photocopies of all required documents, and the applicant is contacted in all steps by email.

Article 27: Nomination for Admission to the University

- If the student submits the originals of all the required documents, he will be informed of his initial nomination to study at the university.
- The student is required to pay the first installment of tuition fees within a specified period, after which his nomination for admission to the university will be final.

Article 28: Placement Tests

- As the university accepts students with different certificates, tests are made to determine the minimum scientific and skill level of the student, and this does not affect their final admission to the university.
- Determining the scientific and skill level of the student helps to control his level and qualifies him to succeed in his studies without obstacles.
- The tests include the students' basic abilities and knowledge in the following:
    - **English Language Test**: Determine the student's ability to read and write at the minimum required to start studying the English language courses prescribed in all programs.
    - **Computer skills**: determine the student's ability to deal with computers and familiarity with MS Office programs (Word, Excel,).
    - **Mathematics test**: Determining the minimum information required in mathematics from what was taught to high school students, "Scientific Mathematics" division.
    - **Physics test**: Determine the minimum information required in physics from what was taught to high school students, "Scientific Mathematics" Division.
- The university organizes educational and training courses to be attended by those who have a negative result in any of these tests, and these courses are

during the first semester of study and do not affect the student's registrations in the courses agreed upon with his academic advisor.

- If the competent authorities at the Ministry of Higher Education approve the admission of students who have a high school certificate “Science" division, they will be forced to study a mathematics course corresponding to “Mathematics 2” course that is taught to high school students, "Mathematics" division.

Graduate Attributes and Study Programs

Article 29: General Graduate Attributes

Graduates of ElSewedy University of Technology should be able to:

- Apply written, oral, and graphical communication in broadly defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.
- Collect, process, and interpret requirements and specifications to produce written, oral, and graphical project-related documents.
- Share knowledge and information with team members, superiors, and users.
- Work effectively within multi-disciplinary teams and respect all users, team members, and superiors.
- Communicate honestly and concisely in written, spoken, and visual manners.
- Comply with workplace health and safety practices and procedures in accordance with current legislation and regulations.
- Conduct standard tests, measurements, and experiments and analyze and interpret the results to improve processes.
- Prioritize and supervise tasks to maintain project schedules and deadlines.
- Respect laws and regulations related to the nature of work.
- Use a variety of thinking skills to anticipate, analyze, evaluate, and apply relevant information to solve problems.
- Demonstrate independent interest in technology.
- Think creatively and continuously to produce innovative ideas and solutions for product development and continuous evolution.
- Execute mathematical operations accurately.
- Follow scientific thinking and methodology in research and design solutions.
- Adapt personal abilities to work requirements.

Article 30: Awarded Degrees

ElSewedy University of Technology grants Bachelor of Technology (B.Tech.) degrees in the following specializations:

- Field of Computer Science Technology
    - Computer Science Technology Program
    - Data Sciences Technology Program
    - Network & Cyber Security Technology Program
    - Information Technology Program
    - **Game Development Technology Program**
- Field of Electrical Engineering Technology
    - Electrical & Electronic Engineering Technology Program
        - Electrical Engineering Power Technology Track
        - Electronic Engineering Technology Track
- Field of Energy Engineering Technology
    - Energy Engineering Technology Program
- Field of Water Engineering Technology
    - **Smart Water Engineering Technology Program**

Article 31: System of coding courses

The university offers different study programs. Each department teaches courses that fall within one of its specializations in any program at the university. The University Quality Unit monitors the performance of the instructors and informs the concerned department with the review reports of the instructors. The courses are directly related to the scientific departments. Therefore, the course code is related to the department responsible for teaching this course.

Department Code			**Course Number**		
A	A	A	Level	Specialization	Serial

Department code consists of three letters in English and is not repeated for any department inside the university. Course Number 3 numbers that reflect the level of the course, the specialization and a serial number of this course within this level/department/specialization.

Article 32: Departments Codes

Code	**Department**

EET	Department of Electronic Engineering Technology
CET	Department of Computer Engineering Technology
EPT	Department of Electrical Power Engineering Technology
GEN	General Courses
HUM	Humanities Courses
ENT	Department of Energy Technology

Article 33: Legend to Read Course Data

Code	**Department**
S	Semester Number
Course Code	Depart. Code + Course Number
Course Name	Title of the Course
LCT	Lecture
TUT	Tutorial
LAB	Laboratory
OTH	Training & Practical Activates
Total	Total Contact Hours
CH	Number of Credit Hours
SWL	Student Workload for the course

Article 34: Electrical & Electronic Engineering Technology Program

Certificates

- Associate Diploma Certificate: Electrical Engineering Technician
- Bachelor of Technology, B. Tech
    - Electrical Engineering Power Technologist Technologist
    - Electronic Engineering Technologist

About the Program

- Electrical and Electronics Engineering plays a significant role ranging from power industries to integrated circuits. It also involves the computation systems to control machines and robots. It deals with the design of electrical equipment, installation maintenance and operation in industries. This program builds a good foundation in power generation, transmission, and distribution. Electrical and Electronics also give exposure to instrumentation and process automation.
- This program also gives familiarity to modern tools used in circuits, machines, and power systems.
- The curriculum, designed in collaboration with industry, focuses on the Electrical, Electronics projects, and blends in-class academic learning with hands-on laboratory and field testing.
- Students will gain knowledge to assemble the machines, evaluate electrical equipment, maintain machines like transformers, circuit breakers, electrical panel boxes and troubleshooting. Students also gain knowledge in designing electrical circuits, drawing, simulating, and fabricating the PCB for specific applications.
- Students also gain knowledge in interfacing microcontrollers, microprocessors to electrical machines.
- A student can exit after two years with a Technological Diploma or continue two more years to receive a Bachelor of Technology, B. Tech in Electrical and Electronics Engineering.

Graduate Special Attributes

Graduates of this program should be able to:

- Be familiar with the mechanisms and standards of Electrical Power systems.
- Develop and design electronics and electrical systems.
- Identify the problems in the power, automation, and electronics industry.

- Apply knowledge in contractual obligations, applicable laws, standards, bylaws, codes, and ethical practices in the Power, Electrical and Electronics field.
- Assist in the scheduling, cost estimation and monitoring of the Power and Electrical industries.
- Apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology (electronic and digital technologies) to solve broadly defined engineering problems appropriate to Electrical and Electronics Engineering Technology.
- Design systems, components, or processes meeting specific needs for broadly defined engineering problems appropriate to Electrical and Electronics Engineering Technology.
- Conducting electrical tests and measurements and fault analysis; and acting effectively as a member of technical teams related to electrical and electronic maintenance.

Program Learning Outcomes (PLO)

Upon successful completion of this program, students should be able to:

- Apply knowledge in contractual obligations, applicable laws, standards, bylaws, codes, and ethical practices in the Power, Electrical and Electronics field.
- Assist in the scheduling, cost estimation and monitoring of the Power and Electrical industries.
- Apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology (electronic and digital technologies) to solve broadly- defined engineering problems appropriate to Electrical and Electronics Engineering Technology.
- Design systems, components, or processes meeting specific needs for broadly defined engineering problems appropriate to Electrical and Electronics Engineering Technology.
- Apply written, oral, and graphical communication in broadly defined technical and non-technical environments: and an ability to identify and use appropriate technical literature.
- Conduct standard tests, measurements, and experiments and analyze and interpret the results to improve processes.
- Function effectively as a member as well as a leader on technical teams related to Electrical and Electronics Engineering Technology.

More PLOs for Electrical Power Engineering Technology Track

- Use concepts, analysis, and applications of power systems to identify, formulate, and solve energy problems.
- Design power and energy systems to produce solutions that meet specified needs with sustainable, environmental, and economic factors.

More PLOs for Electronics Engineering Technology Track

- Use concepts and applications of embedded systems to identify, formulate, and solve engineering problems.
- Design digital integrated systems and produce solutions that meet specified needs with sustainable, environmental, and economic factors.

Job Opportunities

- Electronics Design and Development
- Manufacturing Systems
- Sales and Maintenance
- Technical Support
- Production and Operation
- Control and Instrumentation
- Onsite Plant Installation
- Quality Control
- Product Design and Development

Study Plan

- Students will learn relevant theoretical and practical knowledge to support their career as Electrical/Electronic Engineer/Technologist. Courses will be delivered with components of face-to-face classroom instruction and laboratories.
- This Electrical Power Engineering Technology track will cover the concept of Electrical Power Engineering technology especially in the areas of AC and DC machines, power system analysis, power system protection, smart grid, power transmission and distribution.
- This Electronics Engineering Technology track will cover the concept of Electrical and Electronics Engineering especially development of electronic and electrical circuits. Students will gain knowledge in electronics like analog and digital electronics, VLSI, VHDL Design, microprocessor, microcontroller, and embedded systems which play a significant role in Electrical technology.

Students will get additional skills in MATLAB to model the electrical systems and single line diagrams.
- A total of 120-140 credit hours will be required to graduate. They will have core and elective courses in Electrical and Electronics Engineering technology. Students can expect to spend an average of 25-28 contact hours per week in class workshops, and labs, with additional time spent studying, completing assignments, and doing research.

Study Plan Details

Study plan details are provided in (**Appendix A**).

Article 35: Computer Science Technology Program

Certificates

- Technological Diploma Certificate in Computer Science Technology
- Bachelor of Technology, B. Tech in Computer Science Technology

About the Program

- The field of software development is constantly growing across the globe and provides opportunities for high-paying jobs in an industry that is always evolving to meet the needs of the modern world.
- The curriculum, designed in collaboration with industry, blends in-class academic learning with hands-on laboratory. The student acquires knowledge and skills in programming, databases, operating systems, computer networking, algorithm design, software engineering, Artificial Intelligence, and project management.
- A student can exit after two years with a Technological Diploma or continue two more years to receive a Bachelor of Technology, B. Tech in Computer Science and Engineering.

Graduate Special Attributes

Graduates of this program should be able to:

- Comply with legal and ethical practices in computing.
- Develop and read software design drawings.
- Apply knowledge of programming, databases, operating systems, computer networking, algorithm design to computing problems.

- Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.
- Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of computer science.
- Function effectively as a member or leader of a team engaged in activities appropriate to computer science.

Program Learning Outcomes (PLO)

Upon successful completion of this program, students should be able to:

- Apply knowledge of programming, databases, operating systems, computer networking, algorithm design to computing problems.
- Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.
- Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of computer science.
- Communicate effectively in a variety of professional contexts. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- Function effectively as a member or leader of a team engaged in activities appropriate to computer science.

Job Opportunities

- Computer Application Programming
- Web Developing
- Technical Support
- Software Quality Assurance and Testing
- Information Systems Analysis and Consultation
- System Analysis
- Software Developing
- Database Administration
- Information Security Analysis

Study Plan

- Students will learn relevant theoretical and practical knowledge to support their career as Computer Science Technologist. Courses will be delivered through face-to-face classroom instruction and laboratory.

- The student acquires knowledge and skills in programming, databases, operating systems, computer networking, algorithm design, software engineering, Artificial Intelligence, and project management.
- A total of 120-140 credit hours will be required to graduate. They will have core and elective courses in computer science and engineering technology. Students can expect to spend an average of 25-28 contact hours per week in class and labs, with additional time spent studying, completing assignments, and DOI.

Study Plan Details

Study plan details are provided in (**Appendix A**).

Article 36: Data Sciences and AI Technology Program

Certificates

- Technological Diploma Certificate in Data Sciences and AI Technology
- Bachelor of Technology, B. Tech in Data Sciences and AI Technology

About the Program

- The field of Data Science is constantly growing across the globe and provides opportunities for high-paying jobs in an industry that is always evolving to meet the needs of the modern world.
- The curriculum, designed in collaboration with industry, blends in-class academic learning with hands-on laboratory. The student acquires knowledge and skills in programming, databases, data analytics, data visualization, data mining, big data, and project management.
- A student can exit after two years with a Technological Diploma or continue for two more years to receive a Bachelor of Technology, B. Tech in Data Science.

Graduate Special Attributes

Graduates of this program should be able to:

- Comply with legal and ethical practices in Data Science
- Design and develop solutions for data science projects.
- Apply knowledge of data science and analytics concepts in computational problems.
- Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.

- Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of Data Science.
- Communicate effectively in a variety of professional contexts.
- Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- Function effectively as a member or leader of a team engaged in activities appropriate to Data science.

Program Learning Outcomes (PLO)

Upon successful completion of this program, students should be able to:

- Apply knowledge of data science and analytics concepts in computational problems.
- Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.
- Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of Data Science.
- Communicate effectively in a variety of professional contexts.
- Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- Function effectively as a member or leader of a team engaged in activities appropriate to Data science.

Job Opportunities

- Data Architecture
- Data Analysis
- Business Analysis
- Business Intelligence Developing
- Marketing Analysis
- Data Analytics and Management
- AI Integration with Data Analytics
- AI Application Development

Study Plan

- Students will learn relevant theoretical and practical knowledge to support their career as Data science technologist. Courses will be delivered with components of face-to-face classroom instruction laboratories.
- The student acquires knowledge and skills in data analytics, data visualization, data mining, big data, and project management.

- A total of 120-140 credit hours will be required to graduate. They will have core and elective courses in Data science. Students can expect to spend an average of 25-28 contact hours per week in class and labs, with additional time spent studying, completing assignments, and doing research.

Study Plan Details

Study plan details are provided in (**Appendix A**).

Article 37: Network & Cyber Security Technology Program

Certificates

- Technological Diploma Certificate in Network & Cyber Security Technology
- Bachelor of Technology, B. Tech in Network & Cyber Security Technology

About the Program

- The field of Networking and network security is constantly growing across the globe and provides opportunities for high paying jobs in an industry that is always evolving to meet the needs of the modern world.
- The curriculum, designed in collaboration with industry, blends in-class academic learning with hands-on laboratory. The student acquires knowledge and skills in programming, data structures, databases, operating systems, computer networking, algorithm design, software engineering, Artificial Intelligence, Enterprise Network Service, and cyber security.
- A student can exit after two years with a Technological Diploma or continue two more years to receive a Bachelor of Technology, B. Tech in Network and Cyber Security

Graduate Special Attributes

Graduates of this program should be able to:

- Design and deploy the network models with configuration of network devices.
- Develop and read software design drawings, Network models and ensure the network security services after analyzing the security risk for organization.
- Apply knowledge of programming, databases, operating systems, computer networking, algorithm design, cyber and information security to computing problems.
- Analyze a complex computing problem and apply principles of computing, cyber security, and other relevant disciplines to identify solutions.

- Analyze a complex computing problem and apply principles of computing, cyber security, and other relevant disciplines to identify solutions.

Program Learning Outcomes (PLO)

Upon successful completion of this program, students should be able to:

- Apply knowledge of programming, databases, operating systems, computer networking, algorithm design, cyber and information security to computing problems.
- Analyze a complex computing problem and apply principles of computing, cyber security, and other relevant disciplines to identify solutions.
- Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of Networking and Cyber security.
- Communicate effectively in a variety of professional contexts.
- Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- Function effectively as a member or leader of a team engaged in activities appropriate to Network and Cyber security

Job Opportunities

- Computer/Application Programming
- Technical Support
- Information Systems Analysis and Consultation
- Software Developing
- Network Security Analysis and Consultation
- Network Administration
- IT Security
- Network Security Management
- Digital Forensics

Study Plan

- Students will learn relevant theoretical and practical knowledge to support their career as Network and cyber security Technologist. Courses will be delivered through face-to-face classroom instruction and laboratory.
- Effective technical communication will be emphasized throughout the program. The student acquires knowledge and skills in programming, databases, operating systems, computer networking, algorithm design, software engineering, Artificial Intelligence, Enterprise Network Service, and cyber security.

- A total of 120-140 credit hours will be required to graduate. They will have core and elective courses in Network and cyber security. Students can expect to spend an average of 25-28 contact hours per week in class and labs, with additional time spent studying, completing assignments, and doing research.

Study Plan Details

Study plan details are provided in (**Appendix A**).

Article 38: Information Technology Program

Certificates

- Technological Diploma Certificate in Information Technology
- Bachelor of Technology, B. Tech in Information Technology

About the Program

- The Information Technology program at Elsewedy University of Technology provides students with the essential knowledge and proficiencies to thrive in the ever-evolving field of IT. The comprehensive curriculum establishes a robust foundation in computer science, networking, security, and business fundamentals, preparing graduates for successful careers across diverse IT sectors.
- The program ensures students master the core principles of programming, computer architecture, and operating systems. It also cultivates expertise in database management, network design, and cloud computing, alongside developing strong cybersecurity awareness and exploring advanced security principles. Furthermore, the curriculum emphasizes understanding the integration of IT with business processes and information management.
- Students have the opportunity to customize their studies through a variety of IT electives, enabling specialization in areas such as network engineering, cybersecurity, information systems, or data analytics.
- The program focuses on developing practical skills, including honing communication and presentation abilities for effective technical reporting. Students gain valuable project management experience through hands-on capstone projects and learn industry best practices and ethical considerations relevant to information technology.
- Graduates emerge with the skills and knowledge highly sought after by employers across various IT sectors. The program prepares them for exciting

careers in fields such as network administration, software development, cybersecurity, data analysis, and many others.

Graduate Special Attributes

Graduates of this program should be able to:

- Demonstrate a solid foundation in computer science, encompassing proficiency in programming languages, computer architecture, and operating systems.
- Exhibit strong networking and communication skills, enabling them to design, manage, and troubleshoot computer networks effectively.
- Possess database management expertise, allowing them to proficiently organize and retrieve data using various database systems.
- Apply cloud computing knowledge to understand and utilize cloud-based IT services and their applications.
- Display comprehensive cybersecurity awareness, with the ability to identify and mitigate cybersecurity threats and vulnerabilities.
- Show in-depth knowledge in a chosen area of specialization, such as network engineering, information systems, or data analytics, gained through technical electives.

Program Learning Outcomes (PLO)

Upon successful completion of this program, students should be able to:

- Analyze, configure, and troubleshoot computer networks and network devices.
- Design and manage database systems to store, retrieve, and manipulate data effectively.
- Utilize cloud computing services and technologies to solve IT challenges.
- Assess and mitigate cybersecurity threats and vulnerabilities to ensure information system security.
- Analyze complex IT problems, identify root causes, and develop effective solutions.
- Plan, execute, and manage IT projects within defined timelines and budgets.
- Analyze the role of IT in organizations and its impact on business processes and objectives.

Job Opportunities

- System Administration
- Database Administration
- IT Project Management
- Securing Networks

- Network Design
- Network Operations Center (NOC) Management
- Business Systems Analysis
- IT Consultation
- Information Security Analysis
- Business Intelligence Analysis
- IT Support

Study Plan

- Students will learn relevant theoretical and practical knowledge to support their career as IT Technologist. Courses will be delivered through face-to-face classroom instruction and laboratory.
- Effective technical communication will be emphasized throughout the program. The student acquires knowledge and skills in system administration, networking, enterprise network infrastructure, network devices and security tools.
- A total of 120-140 credit hours will be required to graduate. They will have core and elective courses in IT. Students can expect to spend an average of 25-28 contact hours per week in class and labs, with additional time spent studying, completing assignments, and doing research.

Study Plan Details

Study plan details are provided in (**Appendix A**).

Article 39: Energy Engineering Technology Program

Certificates

- Technological Diploma Certificate in Energy Engineering Technology
- Bachelor of Technology, B. Tech in Energy Engineering Technology

About the Program

The Energy Engineering program at Elsewedy University of Technology provides a comprehensive education in the fundamentals and applications of energy conversion, utilization, and sustainability. Our program offers two distinct tracks: Industrial and Sustainability, allowing you to tailor your studies to your specific interests.

Industrial Track:

- Gain expertise in traditional and emerging industrial energy applications, with a focus on Oil & Gas, Renewable Energy, or Industrial Plants.
- Courses cover core concepts like heat transfer, multiphase flow, and industrial plant operations, alongside specialized electives in your chosen concentration.

Sustainability Track:

- Focus on energy efficiency and sustainable practices in the built environment and transportation sectors.
- Choose a specialization in Environmental Applications, Electric Vehicles (EVs), or Smart Buildings and Cities.
- Develop a strong understanding of building physics, renewable energy integration, and sustainable design principles.

Graduate Special Attributes

Graduates will possess the following special attributes:

- Strong foundation in energy fundamentals: A deep understanding of core energy concepts like thermodynamics, heat transfer, and fluid mechanics.
- Technical proficiency: The ability to apply engineering principles to solve complex energy challenges.
- Analytical and problem-solving skills: The ability to analyze data, identify problems, and develop effective solutions in the energy sector.
- Project management skills: The ability to plan, execute, and manage energy-related projects effectively.
- Sustainability focus: A strong commitment to developing and implementing sustainable energy solutions.
- Adaptability and lifelong learning: The ability to adapt to new technologies and advancements in the ever-evolving energy landscape.
- Effective communication skills: The ability to communicate technical information clearly and concisely to both technical and non-technical audiences.

Industrial Track

In addition to the overall program attributes, graduates of the Industrial Track will demonstrate:

- In-depth knowledge of specific industrial energy applications: Expertise in areas like oil & gas operations, renewable energy technologies, or industrial plant design (depending on chosen concentration).

- Ability to design and optimize industrial energy systems: The ability to apply engineering principles to improve the efficiency and sustainability of industrial energy use.
- Understanding of industry trends and regulations: Knowledge of current trends and regulations in the chosen industrial energy sector.

Sustainability Track:
In addition to the overall program attributes, graduates of the Sustainability Track will demonstrate:

- Expertise in sustainable energy practices: A deep understanding of energy efficiency principles and their application in buildings and transportation systems.
- Ability to design and implement sustainable energy solutions: The ability to develop and implement sustainable energy solutions for buildings, electric vehicles, or smart cities (depending on chosen concentration).
- Commitment to environmental responsibility: A strong awareness of environmental impacts and a commitment to developing sustainable solutions.

Program Learning Outcomes (PLO)

Upon successful completion of this program, students should be able to:

- Apply fundamental scientific and engineering principles to analyze and solve complex energy problems.
- Design and optimize energy systems for various applications, considering efficiency, sustainability, and economic feasibility.
- Utilize advanced engineering tools and software for modeling and simulation of energy systems.
- Demonstrate a comprehensive understanding of current and emerging energy technologies.
- Communicate technical information effectively in written and oral formats to both technical and non-technical audiences.
- Function effectively as part of a team to design, implement, and manage energy projects.
- Uphold ethical and professional standards in the practice of energy engineering.
- Adapt to the evolving energy landscape through continuous learning and professional development.

Additional Industrial Track PLOs:

- Design and analyze industrial energy systems, considering specific applications in oil & gas, renewable energy, or industrial plants (depending on chosen concentration).
- Apply advanced engineering principles to optimize energy efficiency and sustainability in industrial settings.
- Evaluate and select appropriate technologies for various industrial energy applications.
- Understand and comply with relevant regulations and standards in the chosen industrial energy sector.

Additional Sustainability Track PLOs:

- Design and implement sustainable energy solutions for buildings, electric vehicles, or smart cities (depending on chosen concentration).
- Integrate renewable energy technologies into sustainable energy systems.
- Analyze the energy performance of buildings and transportation systems.
- Develop strategies to improve the energy efficiency of the built environment and transportation sectors.
- Advocate for and implement sustainable practices in the energy sector.

Job Opportunities

- Design, develop, and optimize energy systems.
- Developing and managing renewable energy power plants.
- Implementing energy-saving measures in buildings.
- Identifying and implementing energy-efficient technologies and practices
- Analyzing energy policies and regulations
- Operate different energy facilities.
- Conducting energy audits to identify opportunities for energy savings.

Study Plan

- Students will learn relevant theoretical and practical knowledge to support their career as Energy Technologists. Courses will be delivered through face-to-face classroom instruction and laboratory. Additionally, emphasis will be given to developing skills in Energy, Sustainability, renewable energy, energy storage and transmission and smart system technology and tools.
- Effective technical communication will be emphasized throughout the program. The student acquires knowledge and skills in Energy and smart systems.
- A total of 120-140 credit hours will be required to graduate. They will have core and elective courses in energy. Students can expect to spend an average of

25-28 contact hours per week in class and labs, with additional time spent studying, completing assignments, and doing research.

Study Plan Details

Study plan details are provided in (**Appendix A**).

Article 34: Game Development Technology Program

Degree

- Bachelor of Technology, B. Tech in Game Development Technology

About the Program

- The field of game development is constantly growing across the globe and provides opportunities for high-paying jobs in an industry that is always evolving to meet the needs of the modern world.
- The curriculum, designed in collaboration with Metropolia university of applied sciences and the game industry, blends in-class academic learning with hands-on laboratory. The student acquires knowledge and skills in programming, 2D and 3D graphics principles, including modeling, texturing, animation, and rendering, and project management.
- A student receives a Bachelor of Technology, B. Tech in Game Development after almost 4 years of study.

Graduate Special Attributes

Graduates of this program have the following attributes:

- Graduates in game development possess a comprehensive skill set encompassing technical proficiency, creative problem-solving, artistic and design acumen, strong collaboration and communication abilities, project management and professionalism, and critical thinking and analytical skills.
- Technical Proficiency involves expertise in programming languages (C++, C#, Python), mastery of game engines (Unity, Unreal Engine), and the ability to implement and debug game mechanics, AI, and networking. This also includes competence in 2D/3D graphics (modeling, texturing, animation, rendering) and knowledge of version control systems like Git.
- Creative Problem Solving highlights the capacity to innovate game designs, analyze and overcome technical and design challenges, adapt to evolving technologies, and rapidly prototype game ideas.

- Artistic and Design Skills emphasize an understanding of visual design principles (composition, color theory, UI/UX), the ability to create and integrate game assets (characters, environments, sound), storytelling through interactive media, and effective game level design.
- Collaboration and Communication are crucial, including effective written and verbal communication, the ability to work in multidisciplinary teams (programmers, artists, designers), providing and receiving constructive feedback, and clear documentation. This also extends to complying with legal and ethical practices.
- Project Management and Professionalism encompass managing project timelines and deadlines, understanding game development pipelines, adhering to ethical and legal standards, demonstrating professionalism, committing to lifelong learning, and working within project scopes and budgets.
- Finally, Critical Thinking and Analytical Skills involve the ability to analyze existing games for their functionality, utilize game data to improve design, and effectively test and debug games to identify and resolve issues.

Program Learning Outcomes (PLO)

Upon successful completion of this program, students should be able to:

Cognitive Domain

- Understand and apply software engineering principles to game development.
- Gain in-depth knowledge of popular game engines (e.g., Unity, Unreal Engine) and their associated tools.
- Understand the principles of visual design and apply them to game development.
- Understand the principles of game physics and apply them to create realistic simulations.
- Learn the fundamentals of game design, including gameplay mechanics, level design, and narrative design.
- Develop an understanding of visual design principles, including composition, color theory, and UI/UX design.
- Learn to create compelling narratives and integrate them into game experiences.
- Understand the game development pipeline and production processes.
- Develop strong analytical and problem-solving skills to overcome technical and design challenges.
- Understand ethical and legal considerations in game development.

Psychomotor Domain

- Write efficient and effective code in relevant programming languages (e.g., C++, C#, Python).
- Use game engines to create interactive game experiences.
- Develop skills in 2D and 3D graphics, including modeling, texturing, animation, and rendering.
- Design and implement game mechanics, AI, and networking systems.
- Create and integrate game assets, such as characters, environments, and sound effects.
- Manage project timelines, budgets, and resources.
- Test and debug games.

Affective Domain:

- Develop strong communication and collaboration skills to work effectively in multidisciplinary teams.
- Provide and receive constructive feedback.
- Demonstrate professionalism and a commitment to lifelong learning.

Job Opportunities

- Game Programming
- Game Designing
- Game Production
- Game Quality Assurance
- Game Development Management
- Game Business Development
- Game Technology Consultation

Study Plan

- Students will learn relevant theoretical and practical knowledge to support their career as Game Development Technologist. Courses will be delivered through face-to-face classroom instruction and laboratory.
- Effective technical communication will be emphasized throughout the program. The student acquires knowledge and skills in game programming, game graphics programming, game design, game server programming, game business analysis and game development management.
- A total of 137 credit hours will be required to graduate. They will have core and elective courses in Game Development. Students can expect to spend an average of 20-25 contact hours per week in class and labs, with additional time spent studying, completing assignments, and doing research.

Study Plan Details

Study plan details are provided in (**Appendix A**).

Article 35: Smart Water Engineering Technology Program

Degree

- Bachelor of Technology, B. Tech in Smart Water Engineering Technology
    - **Irrigated Field Crops Under Pivot Track**
    - **Pivot Irrigation Technology Track**
    - **Water Management Technology Track**

About the Program

- The Bachelor's degree in Irrigation Program is a comprehensive four-year undergraduate program that combines theoretical knowledge with practical applications in modern irrigation engineering and water management. The program consists of 137 credit hours distributed across eight semesters, with an additional summer internship component, providing students with a well-rounded education in both technical and professional skills.
- The curriculum begins with a strong foundation in basic sciences and core engineering principles during the first year, including courses in chemistry, mathematics, physics, and soil science. Students develop essential academic skills through English composition, public speaking, and critical thinking courses. The program progressively builds upon this foundation, introducing specialized irrigation-related courses in subsequent years.
- In the second year, students advance to more technical subjects, including computer programming, Introduction to Soil, and groundwater and surface water hydrology. The program emphasizes project management and technical report writing skills, preparing students for professional communication in the field. A strong focus is placed on probability and statistics courses, which is essential for irrigation system design and analysis.
- The third academic year marks the beginning of specialization and in-depth study across its three main tracks: (1) Irrigated Field Crops Under Pivot Track, (2) Pivot Irrigation Technology Track, (3) Water Management Technology Track. The curriculum for each track includes a set of core common courses, in addition to specialized courses tailored to the specific focus of each track. This year emphasizes advanced studies in irrigation technologies and their management systems. Students explore subjects such as soil and water conservation

engineering, irrigation system design, and water treatment and reuse, alongside applied mathematics. They also gain knowledge in modeling soil and water processes, agricultural water management, and participate in a hands-on field training program (IRT Internship II) to enhance their technical and practical skills.

- The final year focuses on advanced irrigation system design and implementation. Students learn various irrigation methods, including surface, sprinkler, center pivot, and drip systems. The program culminates in both theoretical and practical capstone projects, allowing students to integrate their knowledge in real-world applications. Soil and water conservation engineering, along with modeling of soil-water processes, rounds out the technical expertise.
- Throughout the program, laboratory sessions and hands-on experience are emphasized, with dedicated lab hours accompanying major technical courses. A mandatory summer field study or internship program provides students with valuable industry exposure and practical experience. The curriculum also includes elective courses, allowing students to pursue specialized interests within the field.
- The program's structure ensures graduates develop comprehensive expertise in modern irrigation technologies, water resource management, and sustainable agricultural practices, preparing them for careers in irrigation engineering, water management, agricultural consulting, and related fields.
- A student receives a Bachelor of Technology, **B. Tech in Smart Water Engineering Technology** after almost 4 years of study.

Irrigated Field Crops Under Pivot Track

This agricultural-focused track prepares specialists in crop production systems utilizing center pivot irrigation technology. Students develop expertise in crop science, soil management, and agronomic practices specific to pivot-irrigated environments.

Pivot Irrigation Technology Track

This engineering-focused track emphasizes the technical aspects of center pivot irrigation systems, including design, installation, automation, monitoring, and maintenance of these sophisticated irrigation technologies.

Water Management Technology Track

This resource management-focused track addresses broader water resource challenges, including water conservation, quality assessment, watershed management, and policy implementation for sustainable water use

in agricultural and environmental contexts.

Graduate Special Attributes

The graduate attributes for the **Smart Water Engineering Technology** program are as follows:

Core Engineering and Scientific Knowledge

Graduates will have a strong foundation in fundamental principles, enabling them to:

- Apply knowledge of mathematics, physics, chemistry, and soil science to solve irrigation engineering problems.
- Utilize principles of fluid mechanics and hydraulics in the design of water delivery systems.
- Employ probability and statistics for system analysis and evaluation.
- Integrate a general background in electrical engineering for system maintenance and troubleshooting.

Design and Management of Irrigation Systems

Graduates will be proficient in designing, managing, and evaluating a variety of irrigation systems:

- System Design: Design a wide range of irrigation systems, including surface (furrow, border, basin), sprinkler, center pivot, and drip/micro-irrigation systems.
- Water Delivery: Create efficient water delivery systems, including pipelines and open channels.
- Performance Evaluation: Assess irrigation system performance to ensure uniformity and efficiency.
- Urban Systems: Design and operate irrigation systems for urban landscapes, parks, and golf courses.

Water Resource and Conservation Management

Graduates will be equipped to manage water resources sustainably:

- Agricultural Water Management: Calculate crop water requirements and implement effective irrigation scheduling.
- Hydrology: Demonstrate proficiency in groundwater and surface water hydrology.
- Soil and Water Conservation: Design erosion control measures, manage drainage systems, and apply water harvesting techniques.
- Water Quality: Manage irrigation water quality, address salinity, and implement water treatment and reuse strategies.

Technology Integration and Application

Graduates will be adept at using modern technology in irrigation engineering:

- Instrumentation and Automation: Apply instrumentation and communication systems, including sensors and SCADA, for monitoring and automating irrigation.
- Spatial Analysis: Use GIS and remote sensing for mapping, planning, and managing irrigation infrastructure.
- Data Management and Modeling: Develop and manage databases for irrigation operations and use numerical models to simulate and analyze soil and water processes.
- Smart Technologies: Implement precision and smart irrigation techniques, including variable rate irrigation.

Practical and Operational Skills

Graduates will possess hands-on skills for real-world applications:

- System Maintenance: Perform general repairs, electrical troubleshooting, and maintenance on irrigation systems, including small engines and pumps.
- Field Experience: Gain practical experience through mandatory internships, field studies, and hands-on laboratory work.
- Project Implementation: Apply theoretical knowledge to real-world challenges through comprehensive capstone projects that involve design, installation, and evaluation.

Professional and Management Competencies

Graduates will be prepared for the professional work environment with strong communication and management skills:

- Project Management: Apply project management principles to plan, execute, and manage irrigation projects.
- Communication: Prepare technical reports and effectively present technical information.
- Critical Thinking and Ethics: Conduct scientific research using critical thinking and apply principles of law, human rights, and ethics in professional practice.

Program Learning Outcomes (PLO)

Upon successful completion of this program, students should be able to:

Apply Core Engineering Knowledge

- Apply principles of mathematics, physics, chemistry, and soil science to irrigation engineering problems
- Utilize fluid mechanics and hydraulics concepts in water delivery system design
- Implement probability and statistics in system analysis and evaluation

Design Irrigation Systems

- Design surface irrigation methods including furrow, border, and basin systems
- Develop sprinkler, center pivot, and drip irrigation systems for various applications
- Create pipeline and open channel systems for efficient water delivery

Manage Agricultural Water Resources

- Calculate and implement crop water requirements and irrigation scheduling
- Evaluate irrigation system performance for uniformity and efficiency
- Apply precision irrigation techniques and variable rate irrigation methods

Implement Water Conservation

- Design erosion control and soil conservation measures
- Develop drainage system design and management strategies
- Apply water harvesting and storage techniques for sustainable use

Utilize Modern Technologies

- Apply instrumentation and communication systems for irrigation monitoring
- Implement GIS mapping and remote sensing for irrigation infrastructure
- Develop database management systems for irrigation operations

Maintain Irrigation Systems

- Conduct well construction and pump system operations
- Perform electrical troubleshooting and system maintenance
- Execute general repair skills and machine shop operations

Manage Urban Water Systems

- Design and operate urban irrigation systems for parks and landscapes
- Implement water demand management strategies
- Develop stormwater management and water reuse solutions

Apply Soil and Water Science

- Analyze soil water movement and retention characteristics
- Implement soil-plant-water relationship principles
- Measure and model soil water dynamics

Execute Project Management

- Prepare technical reports and documentation
- Apply project management principles to irrigation projects
- Conduct field measurements and system evaluations

Demonstrate Professional Practice

- Apply principles of law, human rights, and ethics in engineering practice
- Conduct scientific research with critical thinking
- Present technical information effectively through public speaking

Integrate System Knowledge

- Complete comprehensive capstone projects combining multiple aspects of irrigation engineering
- Apply theoretical concepts to practical engineering challenges
- Perform hands-on project work in real-world settings

Engage in Field Experience

- Gain practical experience through internships and field studies
- Conduct irrigation system design, installation, and operation
- Implement theoretical knowledge in real-world applications

Job Opportunities

- Agricultural Irrigation Management
  - Irrigation System Designer for large-scale farming operations
  - Agricultural Water Management Specialist
  - Precision Irrigation Consultant
  - Farm Systems Automation Engineer
  - Crop Water Management Specialist
- Irrigation Engineering and Consulting
  - Irrigation Systems Design Engineer
  - Technical Consultant for irrigation companies
  - Project Manager for irrigation installations
  - Hydraulic Systems Engineer
  - Water Resources Engineer
- Technology and Innovation
  - Smart Irrigation Systems Developer
  - Irrigation Control Systems Programmer
  - GIS Specialist for water management
  - Precision Agriculture Technologist
  - Irrigation Software Development Engineer
- Water Resource Management
  - Water Conservation Specialist
  - Watershed Manager
  - Water District Engineer

    - Groundwater Management Specialist
    - Water Rights Compliance Officer
- Equipment and Manufacturing
    - Product Development Engineer for irrigation equipment
    - Quality Control Engineer for irrigation systems
    - Technical Sales Engineer
    - Research and Development Specialist
    - Manufacturing Process Engineer
- Environmental and Conservation
    - Soil and Water Conservation Engineer
    - Environmental Impact Assessment Specialist
    - Sustainable Irrigation Consultant
    - Drainage Systems Engineer
    - Water Quality Management Specialist
- Urban and Landscape Irrigation
    - Urban Irrigation Systems Designer
    - Parks and Recreation Irrigation Manager
    - Golf Course Irrigation Specialist
    - Commercial Landscape Irrigation Consultant
    - Municipal Water Systems Engineer
- Research and Education
    - Research Engineer in irrigation technology
    - Agricultural Extension Specialist
    - Technical Trainer for irrigation companies
    - Product Education Specialist
    - Academic Research Assistant
- Government and Regulatory
    - Irrigation District Manager
    - Water Policy Advisor
    - Agricultural Program Specialist
    - Regulatory Compliance Officer
    - Conservation Program Manager
- International Development
    - Irrigation Project Manager for international agencies
    - Agricultural Development Specialist
    - Technical Advisor for irrigation projects
    - Water Resources Consultant
    - Sustainable Agriculture Specialist
- Business and Entrepreneurship

    - Irrigation Services Company Owner
    - Agricultural Technology Startup Founder
    - Equipment Distribution Business Manager
    - Irrigation Systems Contractor
    - Agricultural Business Consultant
- Project Management
    - Irrigation Project Manager
    - Construction Supervisor for irrigation systems
    - Site Development Coordinator
    - Installation Team Leader
    - Quality Assurance Manager

Study Plan

- Students will learn relevant theoretical and practical knowledge to support their career as Smart Water Engineering Technologist. Courses will be delivered through face-to-face classroom instruction and laboratory.
- Effective technical communication will be emphasized throughout the program. The student acquires knowledge and skills in irrigation engineering, water management, and irrigated field crops.
- A total of 137 credit hours will be required to graduate. They will have core and elective courses in Smart Water Engineering Technology. Students can expect to spend an average of 20-25 contact hours per week in class and labs, with additional time spent studying, completing assignments, and doing research.

Study Plan Details

Study plan details are provided in (**Appendix A**).

Engineering Technologies Bylaw

Bylaw Specifications Document

Bylaw Specifications

Departments

Code	Name	Specializations
GEN	Basic Engineering Science	Mathematics, Physics, Chemistry, Mechanics, Business,
CET	Department of Computer Engineering Technology	Computer Science, Computer Engineering, Network and Cyber Security, Data Sciences, Artificial Intelligence, Networks and Systems Administration, Projects and Training, Information System, Game Development,
EPT	Department of Electrical Power Engineering Technology	Electrical Engineering Technology, Instrumentation and Control Engineering Technology, Renewable Energy Technology, Electrical Power Engineering Technology, Advanced Power Engineering Technology, Project and Training,
EET	Department of Electronic Engineering Technology	Electrical Engineering Technology, Optical Engineering Technology, Electronics Engineering Technology, Instrumentation and Control Engineering Technology, Communication Engineering Technology, Projects and Training,
ENT	Department of Energy Engineering Technology	Energy Engineering Technology, Project and Training, Industrial, Environmental, Renewable Energy, Oil and Gas, EV, Smart Buildings and Cities,
WET	Department of Water Engineering Technology	Agriculture Technology, Irrigation Technology, Water Technology,
HUM	Humanities Courses	Language, Law, General Knowledge, Economics, History and Geography,

Programs Specifications

Computer Science Technology Program

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	
CET112	Object Oriented Programming	2	4	CET111
CET211	Data Structures & Algorithms	3	4	CET112
CET212	Operating Systems	3	3	
CET213	Software Engineering	3	3	CET112
CET214	Web Programming	3	3	CET112
CET218	Advanced Web Programming	4	3	CET214
CET215	Mobile Application Development	4	3	CET112
CET217	Software Testing and Quality Assurance	4	3	CET213
CET219	UI/UX Principles	4	3	
CET311	Design & Analysis of Algorithms	5	3	CET211
CET312	ERP Systems	6	3	CET112
CET313	Theory of Computation & Compiler Design	6	4	
CET3E1	CS Major Elective I	7	3	
CET4E1	CS Major Elective II	8	3	
CET416	DevOps	8	3	CET214
CET415	Digital Marketing Technologies	8	3	
CET414	Parallel Programming	8	3	CET211

Computer Engineering

Code	Course Name	Semester	CH	Prerequisites
CET322	Cloud Computing	5	3	CET212 AND CET161
CET321	Internet of Things	5	3	CET111
CET221	Computer Organization	7	3	CET121

Network and Cyber Security

Code	Course Name	Semester	CH	Prerequisites
CET231	Cyber & Information Security	5	3	CET161

Data Sciences

Code	Course Name	Semester	CH	Prerequisites
CET141	Database Management Systems	2	3	

Artificial Intelligence

Code	Course Name	Semester	CH	Prerequisites
CET251	Artificial Intelligence	6	3	CET111
CET352	Image Processing and Computer Vision	6	3	CET111

Networks and Systems Administration

Code	Course Name	Semester	CH	Prerequisites
CET161	Network Basics	2	3	

Projects and Training

Code	Course Name	Semester	CH	Prerequisites

CET191	CET Internship I	2	3	
CET291	CET Project I	3	2	
CET292	CET Project II	4	4	CET291
CET392	CET Internship II	6	3	CET191
CET491	CET Project III	7	4	CET292
CET492	CET Project IV	8	4	CET491

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN112	Applied Discrete Mathematics	2	3	
GEN211	Probability & Statistics	5	3	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN122	Principles of Physics	2	3	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	1	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites
HUMUE1	University Elective I	2	2	
HUM231	Presentation Skills and Technical Writing	3	2	HUM111
HUMUE2	University Elective II	5	2	
HUM431	Project Management	7	3	

Game Development

Code	Course Name	Semester	CH	Prerequisites
CET411	Game Programming	7	3	CET112

Study Plan

1	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM111	English Language I	2	2	60	HUM011
	HUM121	Principles of Law, Human Rights & Ethics	2	2	60	
	GEN111	Applied Mathematics I	5	4	150	GEN011
	CET111	Introduction to Computer and Programming	6	4	180	
	EPT111	Computer Aided Engineering Drawing	4	3	120	
			19	15	570	

2	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUMUE1	University Elective I	2	2	60	
	GEN112	Applied Discrete Mathematics	5	3	150	
	GEN122	Principles of Physics	4	3	120	
	CET112	Object Oriented Programming	6	4	180	CET111
	CET161	Network Basics	4	3	120	
	CET141	Database Management Systems	4	3	120	
	CET191	CET Internship I	6	3	180	
			31	21	930	

3	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM231	Presentation Skills and Technical Writing	2	2	60	HUM111
	CET211	Data Structures & Algorithms	6	4	180	CET112
	CET212	Operating Systems	4	3	120	
	CET213	Software Engineering	4	3	120	CET112
	CET214	Web Programming	4	3	120	CET112
	CET291	CET Project I	1	2	120	
			21	17	720	

4	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET215	Mobile Application Development	4	3	120	CET112
	CET217	Software Testing and Quality Assurance	4	3	120	CET213
	CET218	Advanced Web Programming	4	3	120	CET214
	CET219	UI/UX Principles	4	3	120	
	CET292	CET Project II	1	4	240	CET291
			17	16	720	

5	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUMUE2	University Elective II	2	2	60	
	GEN211	Probability & Statistics	5	3	150	GEN111
	CET231	Cyber & Information Security	4	3	120	CET161
	CET321	Internet of Things	4	3	120	CET111
	CET322	Cloud Computing	4	3	120	CET212 AND CET161
	CET311	Design & Analysis of Algorithms	4	3	120	CET211
			23	17	690	

6	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM311	English Language II	4	3	120	HUM111
	CET251	Artificial Intelligence	4	3	120	CET111
	CET312	ERP Systems	4	3	120	CET112
	CET313	Theory of Computation & Compiler Design	6	4	180	
	CET352	Image Processing and Computer Vision	4	3	120	CET111
	CET392	CET Internship II	6	3	180	CET191
			28	19	840	

7	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM431	Project Management	4	3	120	
	CET221	Computer Organization	4	3	120	CET121

	CET411	Game Programming	4	3	120	CET112
	CET3E1	CS Major Elective I	4	3	120	
	CET491	CET Project III	1	4	240	CET292
			17	16	720	

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET4E1	CS Major Elective II	4	3	120	
	CET414	Parallel Programming	4	3	120	CET211
	CET415	Digital Marketing Technologies	4	3	120	
	CET416	DevOps	4	3	120	CET214
	CET492	CET Project IV	1	4	240	CET491
			17	16	720	

Total	Credit Hours: 137

- HUMUE1: University Elective I
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk
- HUMUE2: University Elective II
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk
- CET3E1: CS Major Elective I
  - CET412: Selected Topic in Computer Science I
  - CET413: Product Management
  - CET431: Software Security
  - CET451: Neural Networks and Deep Learning
- CET4E1: CS Major Elective II
  - CET222: Embedded Systems
  - CET417: Advanced Software Engineering
  - CET418: Selected Topic in Computer Science II
  - CET452: Natural Language Processing

Data Science and Artificial Intelligence Technology Program

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	
CET112	Object Oriented Programming	2	4	CET111
CET211	Data Structures & Algorithms	3	4	CET112
CET212	Operating Systems	3	3	
CET214	Web Programming	3	3	CET112
CET216	Linux and Shell Programming	4	3	CET212
CET213	Software Engineering	5	3	CET112
CET414	Parallel Programming	8	3	CET211

Computer Engineering

Code	Course Name	Semester	CH	Prerequisites
CET322	Cloud Computing	5	3	CET212 AND CET161
CET321	Internet of Things	5	3	CET111

Network and Cyber Security

Code	Course Name	Semester	CH	Prerequisites
CET231	Cyber & Information Security	7	3	CET161

Data Sciences

Code	Course Name	Semester	CH	Prerequisites
CET141	Database Management Systems	2	3	
CET241	Cloud Databases	4	3	CET141
CET242	Data Analytics and Visualization	4	3	GEN211
CET341	Data Cleansing and Migration	5	3	CET141
CET344	Algorithms for Data Science	6	4	CET211
CET343	Big Data Analytics	6	3	CET242
CET342	Data Mining	6	3	CET111 AND CET141
CET3E2	DS Major Elective I	7	3	
CET4E2	DS Major Elective II	8	3	

Artificial Intelligence

Code	Course Name	Semester	CH	Prerequisites
CET251	Artificial Intelligence	4	3	CET111
CET351	Machine Learning	5	3	CET251
CET352	Image Processing and Computer Vision	6	3	CET111
CET451	Neural Networks and Deep Learning	7	3	CET351
CET453	Advanced Machine Learning	8	3	CET351
CET452	Natural Language Processing	8	3	CET251

Networks and Systems Administration

Code	Course Name	Semester	CH	Prerequisites
CET161	Network Basics	2	3	

Projects and Training

Code	Course Name	Semester	CH	Prerequisites
CET191	CET Internship I	2	3	
CET291	CET Project I	3	2	
CET292	CET Project II	4	4	CET291
CET392	CET Internship II	6	3	CET191
CET491	CET Project III	7	4	CET292
CET492	CET Project IV	8	4	CET491

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN112	Applied Discrete Mathematics	2	3	
GEN211	Probability & Statistics	3	3	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN122	Principles of Physics	2	3	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	1	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites
HUMUE1	University Elective I	2	2	
HUM231	Presentation Skills and Technical Writing	3	2	HUM111
HUMUE2	University Elective II	5	2	
HUM431	Project Management	7	3	

Study Plan

1	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM111	English Language I	2	2	60	HUM011
	HUM121	Principles of Law, Human Rights & Ethics	2	2	60	
	GEN111	Applied Mathematics I	5	4	150	GEN011
	CET111	Introduction to Computer and Programming	6	4	180	
	EPT111	Computer Aided Engineering Drawing	4	3	120	
			19	15	570	

2	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUMUE1	University Elective I	2	2	60	

	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	GEN112	Applied Discrete Mathematics	5	3	150	
	GEN122	Principles of Physics	4	3	120	
	CET112	Object Oriented Programming	6	4	180	CET111
	CET161	Network Basics	4	3	120	
	CET141	Database Management Systems	4	3	120	
	CET191	CET Internship I	6	3	180	
			31	21	930	

3	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM231	Presentation Skills and Technical Writing	2	2	60	HUM111
	GEN211	Probability & Statistics	5	3	150	GEN111
	CET211	Data Structures & Algorithms	6	4	180	CET112
	CET212	Operating Systems	4	3	120	
	CET214	Web Programming	4	3	120	CET112
	CET291	CET Project I	1	2	120	
			22	17	750	

4	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET216	Linux and Shell Programming	4	3	120	CET212
	CET241	Cloud Databases	4	3	120	CET141
	CET242	Data Analytics and Visualization	4	3	120	GEN211
	CET251	Artificial Intelligence	4	3	120	CET111
	CET292	CET Project II	1	4	240	CET291
			17	16	720	

5	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUMUE2	University Elective II	2	2	60	
	CET213	Software Engineering	4	3	120	CET112
	CET321	Internet of Things	4	3	120	CET111
	CET322	Cloud Computing	4	3	120	CET212 AND CET161
	CET341	Data Cleansing and Migration	4	3	120	CET141
	CET351	Machine Learning	4	3	120	CET251
			22	17	660	

6	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM311	English Language II	4	3	120	HUM111
	CET342	Data Mining	4	3	120	CET111 AND CET141
	CET343	Big Data Analytics	4	3	120	CET242
	CET344	Algorithms for Data Science	6	4	180	CET211
	CET352	Image Processing and Computer Vision	4	3	120	CET111
	CET392	CET Internship II	6	3	180	CET191
			28	19	840	

7	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM431	Project Management	4	3	120	
	CET231	Cyber & Information Security	4	3	120	CET161
	CET3E2	DS Major Elective I	4	3	120	
	CET451	Neural Networks and Deep Learning	4	3	120	CET351
	CET491	CET Project III	1	4	240	CET292

			17	16	720	

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET414	Parallel Programming	4	3	120	CET211
	CET4E2	DS Major Elective II	4	3	120	
	CET452	Natural Language Processing	4	3	120	CET251
	CET453	Advanced Machine Learning	4	3	120	CET351
	CET492	CET Project IV	1	4	240	CET491
			17	16	720	

Total	Credit Hours: 137

- HUMUE1: University Elective I
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk
- HUMUE2: University Elective II
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk
- CET3E2: DS Major Elective I
  - CET413: Product Management
  - CET431: Software Security
  - CET441: Business & Social Analytics
  - CET442: Selected Topic in Data Science I
- CET4E2: DS Major Elective II
  - CET417: Advanced Software Engineering
  - CET434: Cloud and IoT Security
  - CET443: Block Chain & Data Science
  - CET444: Selected Topic in Data Science II

Electrical Engineering Technology Program

Study Plan

1	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM111	English Language I	2	2	60	HUM011
	HUM121	Principles of Law, Human Rights & Ethics	2	2	60	
	GEN111	Applied Mathematics I	5	4	150	GEN011
	CET111	Introduction to Computer and Programming	6	4	180	
	EPT111	Computer Aided Engineering Drawing	4	3	120	
			19	15	570	

Total	Credit Hours: 15

Electrical and Electronic Engineering Technology Track

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	

Computer Engineering

Code	Course Name	Semester	CH	Prerequisites
CET121	Digital Logic Design	2	3	
CET221	Computer Organization	3	3	CET121
CET222	Embedded Systems	4	3	CET221

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET111	Electrical Circuits I	2	3	
EET211	Electrical Circuits II	3	3	EET111
EET213	Electric Circuit Design & PCB Manufacturing	4	3	EET211
EET212	Signals & Communication Systems Technology	4	3	GEN113
EET411	Microelectronics	8	3	EET231

Optical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET121	Fundamental of Optics	2	3	

Electronics Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET231	Electronics	3	3	EET111 AND GEN113 AND GEN121
EET331	Digital System Design	5	3	CET121
EET333	Electronic Circuits	5	3	EET231
EET332	Integrated Circuits Design	6	3	EET231
EET432	Communication Electronics	7	3	
EET3E1	EET Major Elective I	7	3	
EET4E1	EET Major Elective II	8	3	
EET431	VLSI Design	8	3	EET332

Instrumentation and Control Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET341	Electronics Measurements & Instruments	5	3	EET211

Communication Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET351	Digital Signal Processing	6	3	EET212
EET352	Random Signals & Noise	6	3	GEN211
EET451	Information Theory	7	3	
EET454	Adaptive Antennas	8	3	

Projects and Training

Code	Course Name	Semester	CH	Prerequisites
EET191	EET Internship I	2	3	
EET291	EET Project I	3	2	
EET292	EET Project II	4	4	EET291
EET391	EET Internship II	6	3	
EET491	EET Project III	7	4	EET292
EET492	EET Project IV	8	4	EET491

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	

Electrical Power Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT241	Industrial Control Engineering Technology I	3	3	GEN113
EPT243	Electrical Power Systems Technology I	4	3	EET211

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN113	Applied Mathematics II	2	4	GEN111
GEN311	Applied Mathematics III	5	4	GEN113
GEN211	Probability & Statistics	5	3	GEN111
GEN112	Applied Discrete Mathematics	6	3	

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN121	Physics for Electrical Engineering	2	4	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	1	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites
HUMUE1	University Elective I	2	2	
HUM231	Presentation Skills and Technical Writing	3	2	HUM111
HUMUE2	University Elective II	5	2	
HUM431	Project Management	7	3	

Study Plan

2	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUMUE1	University Elective I	2	2	60	
	GEN113	Applied Mathematics II	5	4	150	GEN111

	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	GEN121	Physics for Electrical Engineering	6	4	180	
	CET121	Digital Logic Design	4	3	120	
	EET111	Electrical Circuits I	5	3	150	
	EET121	Fundamental of Optics	4	3	120	
	EET191	EET Internship I	6	3	180	
			32	22	960	

3	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM231	Presentation Skills and Technical Writing	2	2	60	HUM111
	CET221	Computer Organization	4	3	120	CET121
	EET211	Electrical Circuits II	5	3	150	EET111
	EET231	Electronics	4	3	120	EET111 AND GEN113 AND GEN121
	EET291	EET Project I	1	2	120	
	EPT241	Industrial Control Engineering Technology I	5	3	150	GEN113
			21	16	720	

4	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET222	Embedded Systems	4	3	120	CET221
	EET212	Signals & Communication Systems Technology	5	3	150	GEN113
	EET213	Electric Circuit Design & PCB Manufacturing	5	3	150	EET211
	EET292	EET Project II	1	4	240	EET291
	EPT243	Electrical Power Systems Technology I	5	3	150	EET211
			20	16	810	

5	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUMUE2	University Elective II	2	2	60	
	GEN211	Probability & Statistics	5	3	150	GEN111
	GEN311	Applied Mathematics III	5	4	150	GEN113
	EET341	Electronics Measurements & Instruments	5	3	150	EET211
	EET331	Digital System Design	4	3	120	CET121
	EET333	Electronic Circuits	5	3	150	EET231
			26	18	780	

6	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM311	English Language II	4	3	120	HUM111
	GEN112	Applied Discrete Mathematics	5	3	150	
	EET351	Digital Signal Processing	4	3	120	EET212
	EET352	Random Signals & Noise	4	3	120	GEN211
	EET332	Integrated Circuits Design	4	3	120	EET231
	EET391	EET Internship II	6	3	180	
			27	18	810	

7	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM431	Project Management	4	3	120	
	EET432	Communication Electronics	4	3	120	
	EET451	Information Theory	4	3	120	
	EET3E1	EET Major Elective I	4	3	120	
	EET491	EET Project III	1	4	240	EET292
			17	16	720	

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	EET411	Microelectronics	4	3	120	EET231
	EET431	VLSI Design	4	3	120	EET332
	EET454	Adaptive Antennas	4	3	120	
	EET4E1	EET Major Elective II	4	3	120	
	EET492	EET Project IV	1	4	240	EET491
			17	16	720	

Total	Credit Hours: 137

- HUMUE1: University Elective I
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk
- HUMUE2: University Elective II
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk
- EET3E1: EET Major Elective I
  - EET421: Optoelectronics
  - EET433: Selected Topic in Electronics I
  - EET452: Modulation & Coding
  - EET453: Source Coding & Compression
- EET4E1: EET Major Elective II
  - EET412: Detection & Estimation
  - EET422: Integrated Optics
  - EET434: Selected Topic in Electronics II
  - EET455: Radar Technology

Electrical Engineering Power Technology Track

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	

Computer Engineering

Code	Course Name	Semester	CH	Prerequisites
CET121	Digital Logic Design	2	3	
CET221	Computer Organization	5	3	CET121
CET222	Embedded Systems	6	3	CET221

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET111	Electrical Circuits I	2	3	
EET211	Electrical Circuits II	3	3	EET111
EET213	Electric Circuit Design & PCB Manufacturing	4	3	EET211

Electronics Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET231	Electronics	3	3	EET111 AND GEN113 AND GEN121

Instrumentation and Control Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET341	Electronics Measurements & Instruments	5	3	EET211

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	
EPT211	Power Electronics I	4	3	EET211 AND EET231
EPT311	Power Electronics II	5	3	EPT211

Renewable Energy Technology

Code	Course Name	Semester	CH	Prerequisites
EPT231	Solar Cell Engineering	3	3	GEN123 AND EET111
EPT431	Renewable Energy Technology	8	3	GEN123

Electrical Power Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT241	Industrial Control Engineering Technology I	3	3	GEN113
EPT242	Electrical Machines I	4	3	EET211
EPT243	Electrical Power Systems Technology I	4	3	EET211
EPT341	Electrical Machines II	6	3	EPT242
EPT342	Electrical Power Systems Technology II	6	3	EPT243
EPT343	Industrial Control Engineering Technology II	6	3	EPT241
EPT441	Electrical Distribution and Smart Grid Technologies	7	3	

EPT442	Electrical Transmission Systems	7	3	EPT311
EPT3E1	EPT Major Elective I	7	3	
EPT4E1	EPT Major Elective II	8	3	

Advanced Power Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT456	High Voltage Engineering	8	3	EET211 AND EPT342
EPT457	Power Systems Analysis & Stability	8	3	GEN113 AND EET211 AND EPT342

Project and Training

Code	Course Name	Semester	CH	Prerequisites
EPT191	EPT Internship I	2	3	
EPT291	EPT Project I	3	2	
EPT292	EPT Project II	4	4	EPT291 AND EPT291
EPT392	EPT Internship II	6	3	EPT191
EPT491	EPT Project III	7	4	EPT292 AND EPT292
EPT492	EPT Project IV	8	4	EPT491 AND EPT491

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN113	Applied Mathematics II	2	4	GEN111
GEN311	Applied Mathematics III	5	4	GEN113
GEN211	Probability & Statistics	5	3	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN123	Heat Transfer and Thermodynamics	2	3	
GEN121	Physics for Electrical Engineering	2	4	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	1	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites
HUMUE1	University Elective I	2	2	
HUM231	Presentation Skills and Technical Writing	3	2	HUM111
HUMUE2	University Elective II	5	2	
HUM431	Project Management	7	3	

Study Plan

2	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites

	HUMUE1	University Elective I	2	2	60	
	GEN113	Applied Mathematics II	5	4	150	GEN111
	GEN121	Physics for Electrical Engineering	6	4	180	
	GEN123	Heat Transfer and Thermodynamics	4	3	120	
	CET121	Digital Logic Design	4	3	120	
	EET111	Electrical Circuits I	5	3	150	
	EPT191	EPT Internship I	6	3	180	
			32	22	960	

3	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM231	Presentation Skills and Technical Writing	2	2	60	HUM111
	EET211	Electrical Circuits II	5	3	150	EET111
	EET231	Electronics	4	3	120	EET111 AND GEN113 AND GEN121
	EPT241	Industrial Control Engineering Technology I	5	3	150	GEN113
	EPT231	Solar Cell Engineering	5	3	150	GEN123 AND EET111
	EPT291	EPT Project I	1	2	120	
			22	16	750	

4	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	EET213	Electric Circuit Design & PCB Manufacturing	5	3	150	EET211
	EPT242	Electrical Machines I	5	3	150	EET211
	EPT243	Electrical Power Systems Technology I	5	3	150	EET211
	EPT211	Power Electronics I	5	3	150	EET211 AND EET231
	EPT292	EPT Project II	1	4	240	EPT291 AND EPT291
			21	16	840	

5	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUMUE2	University Elective II	2	2	60	
	GEN211	Probability & Statistics	5	3	150	GEN111
	GEN311	Applied Mathematics III	5	4	150	GEN113
	CET221	Computer Organization	4	3	120	CET121
	EET341	Electronics Measurements & Instruments	5	3	150	EET211
	EPT311	Power Electronics II	5	3	150	EPT211
			26	18	780	

6	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM311	English Language II	4	3	120	HUM111
	CET222	Embedded Systems	4	3	120	CET221
	EPT341	Electrical Machines II	5	3	150	EPT242
	EPT342	Electrical Power Systems Technology II	5	3	150	EPT243
	EPT343	Industrial Control Engineering Technology II	5	3	150	EPT241
	EPT392	EPT Internship II	6	3	180	EPT191
			29	18	870	

7	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM431	Project Management	4	3	120	
	EPT441	Electrical Distribution and Smart Grid Technologies	5	3	150	

	EPT442	Electrical Transmission Systems	5	3	150	EPT311
	EPT3E1	EPT Major Elective I	4	3	120	
	EPT491	EPT Project III	1	4	240	EPT292 AND EPT292
			19	16	780	

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	EPT4E1	EPT Major Elective II	4	3	120	
	EPT456	High Voltage Engineering	5	3	150	EET211 AND EPT342
	EPT457	Power Systems Analysis & Stability	5	3	150	GEN113 AND EET211 AND EPT342
	EPT431	Renewable Energy Technology	5	3	150	GEN123
	EPT492	EPT Project IV	1	4	240	EPT491 AND EPT491
			20	16	810	

Total	Credit Hours: 137

- HUMUE1: University Elective I
    - HUM113: German Language
    - HUM114: Italian Language
    - HUM131: Innovation & Entrepreneurship
    - HUM132: Management and Leadership Skills
    - HUM133: Communication and Negotiation Skills
    - HUM141: Principles of Economics
    - HUM151: History of Engineering & Technology
    - HUM152: History of Art & Architecture
    - HUM153: The Character of Egypt
    - HUM154: Arabic Language
    - HUM161: Sustainability for Entrepreneurship
    - HUM162: Sustainability for Employment
    - HUM163: Health and Safety
    - HUM164: Social Responsibility
    - HUM171: Preparing Technical Reports
    - HUM172: Scientific Research & Critical Thinking
    - HUM251: Safety and risk
- HUMUE2: University Elective II
    - HUM113: German Language
    - HUM114: Italian Language
    - HUM131: Innovation & Entrepreneurship
    - HUM132: Management and Leadership Skills
    - HUM133: Communication and Negotiation Skills
    - HUM141: Principles of Economics
    - HUM151: History of Engineering & Technology
    - HUM152: History of Art & Architecture
    - HUM153: The Character of Egypt
    - HUM154: Arabic Language
    - HUM161: Sustainability for Entrepreneurship
    - HUM162: Sustainability for Employment
    - HUM163: Health and Safety
    - HUM164: Social Responsibility
    - HUM171: Preparing Technical Reports
    - HUM172: Scientific Research & Critical Thinking
    - HUM251: Safety and risk
- EPT3E1: EPT Major Elective I
    - EPT444: Industerial Networks
    - EPT451: Operation and control of Power Systems
    - EPT452: Power System Protection & Switchgear
    - EPT453: Selected Topic in Electrical Power I
- EPT4E1: EPT Major Elective II
    - EPT443: Energy Management
    - EPT454: Electrical Drives Systems
    - EPT455: Electrical Installations and Energy Utilization
    - EPT458: Selected Topic in Electrical Power II

Energy Engineering Technology Program

Study Plan

1	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM111	English Language I	2	2	60	HUM011
	GEN131	Principle of Chemistry & Material Science	5	4	150	
	EPT111	Computer Aided Engineering Drawing	4	3	120	
	CET111	Introduction to Computer and Programming	6	4	180	
	GEN111	Applied Mathematics I	5	4	150	GEN011
			22	17	660	

2	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUMUE1	University Elective I	2	2	60	
	ENT191	ENT Internship I	6	3	180	
	GEN123	Heat Transfer and Thermodynamics	4	3	120	
	ENT111	Energy, Development and Environment	5	4	180	
	GEN121	Physics for Electrical Engineering	6	4	180	
	GEN113	Applied Mathematics II	5	4	150	GEN111
			28	20	870	

3	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM121	Principles of Law, Human Rights & Ethics	2	2	60	
	ENT291	ENT Project I	1	2	120	
	EPT431	Renewable Energy Technology	5	3	150	GEN123
	EET111	Electrical Circuits I	5	3	150	
	ENT211	Energy Systems I	4	3	120	
	ENT212	Thermal Engineering	4	3	120	GEN123
			21	16	720	

4	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM251	Safety and risk	2	2	60	
	ENT292	ENT Project II	1	4	240	
	ENT213	Energy Storage and Transmission	4	3	120	
	GEN241	Engineering Mechanics: Static and Dynamics	5	4	180	
	GEN211	Probability & Statistics	5	3	150	GEN111
			17	16	750	

5	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM431	Project Management	4	3	120	
	ENT314	Principles of Ecology	6	4	180	
	ENT313	Fluid Machines	4	3	150	
	EET211	Electrical Circuits II	5	3	150	EET111
	EPT241	Industrial Control Engineering Technology I	5	3	150	GEN113
			24	16	750	

6	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	ENT391	ENT Internship II	6	3	180	
	HUM311	English Language II	4	3	120	HUM111
	ENT312	Innovative Energy Technologies	4	3	150	

	ENT315	Operation and maintenance	4	3	150	
	ENT311	Energy systems II	4	3	150	ENT211
	ENT316	Measurements and diagnostics	6	4	180	
			28	19	930	

Total	Credit Hours: 104

- HUMUE1: University Elective I
    - HUM113: German Language
    - HUM114: Italian Language
    - HUM131: Innovation & Entrepreneurship
    - HUM132: Management and Leadership Skills
    - HUM133: Communication and Negotiation Skills
    - HUM141: Principles of Economics
    - HUM151: History of Engineering & Technology
    - HUM152: History of Art & Architecture
    - HUM153: The Character of Egypt
    - HUM154: Arabic Language
    - HUM161: Sustainability for Entrepreneurship
    - HUM162: Sustainability for Employment
    - HUM163: Health and Safety
    - HUM164: Social Responsibility
    - HUM171: Preparing Technical Reports
    - HUM172: Scientific Research & Critical Thinking
    - HUM251: Safety and risk

Energy Engineering Technology Environmental Track

Study Plan

7	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	ENT491	ENT Project III	1	4	240	
	ENT434	Building technical systems design and maintenance	4	3	120	
	ENT433	Building Physics	4	3	150	
	ENT432	Technical design: theory and application	4	3	150	
	ENT431	Sustainability and the Built environment	6	4	180	
			19	17	840	

Total	Credit Hours: 121

Energy Engineering Technology Environmental Track Environmental Concentration

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET111	Electrical Circuits I	3	3	
EET211	Electrical Circuits II	5	3	EET111

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	

Renewable Energy Technology

Code	Course Name	Semester	CH	Prerequisites
EPT431	Renewable Energy Technology	3	3	GEN123

Electrical Power Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT241	Industrial Control Engineering Technology I	5	3	GEN113

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN113	Applied Mathematics II	2	4	GEN111
GEN211	Probability & Statistics	4	3	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN123	Heat Transfer and Thermodynamics	2	3	
GEN121	Physics for Electrical Engineering	2	4	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	3	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites

HUMUE1	University Elective I	2	2	
HUM251	Safety and risk	4	2	
HUM431	Project Management	5	3	
HUMUE2	University Elective II	8	2	

Chemistry

Code	Course Name	Semester	CH	Prerequisites
GEN131	Principle of Chemistry & Material Science	1	4	

Mechanics

Code	Course Name	Semester	CH	Prerequisites
GEN241	Engineering Mechanics: Static and Dynamics	4	4	

Energy Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
ENT111	Energy, Development and Environment	2	4	
ENT211	Energy Systems I	3	3	
ENT212	Thermal Engineering	3	3	GEN123
ENT213	Energy Storage and Transmission	4	3	
ENT313	Fluid Machines	5	3	
ENT314	Principles of Ecology	5	4	
ENT311	Energy systems II	6	3	ENT211
ENT312	Innovative Energy Technologies	6	3	
ENT316	Measurements and diagnostics	6	4	
ENT315	Operation and maintenance	6	3	

Project and Training

Code	Course Name	Semester	CH	Prerequisites
ENT191	ENT Internship I	2	3	
ENT291	ENT Project I	3	2	
ENT292	ENT Project II	4	4	
ENT391	ENT Internship II	6	3	
ENT491	ENT Project III	7	4	
ENT492	ENT Project IV	8	4	

Environmental

Code	Course Name	Semester	CH	Prerequisites
ENT433	Building Physics	7	3	
ENT434	Building technical systems design and maintenance	7	3	
ENT431	Sustainability and the Built environment	7	4	
ENT432	Technical design: theory and application	7	3	
ENT437	Energy diagnosis & implementation measures	8	3	
ENT436	Energy Efficiency in the building sector	8	3	
ENT435	Renewable energy systems for building integration	8	4	

Study Plan

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	ENT435	Renewable energy systems for building integration	6	4	180	
	ENT436	Energy Efficiency in the building sector	4	3	120	
	ENT437	Energy diagnosis & implementation measures	4	3	120	

	ENT492	ENT Project IV	1	4	240	
	HUMUE2	University Elective II	2	2	60	
			17	16	720	

Total	Credit Hours: 137

- HUMUE2: University Elective II
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk

Energy Engineering Technology Environmental Track EV Concentration

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET111	Electrical Circuits I	3	3	
EET211	Electrical Circuits II	5	3	EET111

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	

Renewable Energy Technology

Code	Course Name	Semester	CH	Prerequisites
EPT431	Renewable Energy Technology	3	3	GEN123

Electrical Power Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT241	Industrial Control Engineering Technology I	5	3	GEN113

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN113	Applied Mathematics II	2	4	GEN111
GEN211	Probability & Statistics	4	3	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN123	Heat Transfer and Thermodynamics	2	3	
GEN121	Physics for Electrical Engineering	2	4	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	3	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites
HUMUE1	University Elective I	2	2	

HUM251	Safety and risk	4	2	
HUM431	Project Management	5	3	
HUMUE2	University Elective II	8	2	

Chemistry

Code	Course Name	Semester	CH	Prerequisites
GEN131	Principle of Chemistry & Material Science	1	4	

Mechanics

Code	Course Name	Semester	CH	Prerequisites
GEN241	Engineering Mechanics: Static and Dynamics	4	4	

Energy Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
ENT111	Energy, Development and Environment	2	4	
ENT211	Energy Systems I	3	3	
ENT212	Thermal Engineering	3	3	GEN123
ENT213	Energy Storage and Transmission	4	3	
ENT313	Fluid Machines	5	3	
ENT314	Principles of Ecology	5	4	
ENT311	Energy systems II	6	3	ENT211
ENT312	Innovative Energy Technologies	6	3	
ENT316	Measurements and diagnostics	6	4	
ENT315	Operation and maintenance	6	3	

Project and Training

Code	Course Name	Semester	CH	Prerequisites
ENT191	ENT Internship I	2	3	
ENT291	ENT Project I	3	2	
ENT292	ENT Project II	4	4	
ENT391	ENT Internship II	6	3	
ENT491	ENT Project III	7	4	
ENT492	ENT Project IV	8	4	

Environmental

Code	Course Name	Semester	CH	Prerequisites
ENT433	Building Physics	7	3	
ENT434	Building technical systems design and maintenance	7	3	
ENT431	Sustainability and the Built environment	7	4	
ENT432	Technical design: theory and application	7	3	
ENT435	Renewable energy systems for building integration	8	4	

EV

Code	Course Name	Semester	CH	Prerequisites
ENT462	Electric Vehicles Technology	8	3	
ENT461	Electrical Chargers Technology	8	3	

Study Plan

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites

	ENT435	Renewable energy systems for building integration	6	4	180	
	ENT461	Electrical Chargers Technology	4	3	120	
	ENT462	Electric Vehicles Technology	4	3	120	
	ENT492	ENT Project IV	1	4	240	
	HUMUE2	University Elective II	2	2	60	
			17	16	720	

Total	Credit Hours: 137

- HUMUE2: University Elective II
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk

Energy Engineering Technology Environmental Track Smart Buildings and Cities

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET111	Electrical Circuits I	3	3	
EET211	Electrical Circuits II	5	3	EET111

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	

Renewable Energy Technology

Code	Course Name	Semester	CH	Prerequisites
EPT431	Renewable Energy Technology	3	3	GEN123

Electrical Power Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT241	Industrial Control Engineering Technology I	5	3	GEN113

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN113	Applied Mathematics II	2	4	GEN111
GEN211	Probability & Statistics	4	3	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN123	Heat Transfer and Thermodynamics	2	3	
GEN121	Physics for Electrical Engineering	2	4	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	3	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites

HUMUE1	University Elective I	2	2	
HUM251	Safety and risk	4	2	
HUM431	Project Management	5	3	
HUMUE2	University Elective II	8	2	

Chemistry

Code	Course Name	Semester	CH	Prerequisites
GEN131	Principle of Chemistry & Material Science	1	4	

Mechanics

Code	Course Name	Semester	CH	Prerequisites
GEN241	Engineering Mechanics: Static and Dynamics	4	4	

Energy Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
ENT111	Energy, Development and Environment	2	4	
ENT211	Energy Systems I	3	3	
ENT212	Thermal Engineering	3	3	GEN123
ENT213	Energy Storage and Transmission	4	3	
ENT313	Fluid Machines	5	3	
ENT314	Principles of Ecology	5	4	
ENT311	Energy systems II	6	3	ENT211
ENT312	Innovative Energy Technologies	6	3	
ENT316	Measurements and diagnostics	6	4	
ENT315	Operation and maintenance	6	3	

Project and Training

Code	Course Name	Semester	CH	Prerequisites
ENT191	ENT Internship I	2	3	
ENT291	ENT Project I	3	2	
ENT292	ENT Project II	4	4	
ENT391	ENT Internship II	6	3	
ENT491	ENT Project III	7	4	
ENT492	ENT Project IV	8	4	

Environmental

Code	Course Name	Semester	CH	Prerequisites
ENT433	Building Physics	7	3	
ENT434	Building technical systems design and maintenance	7	3	
ENT431	Sustainability and the Built environment	7	4	
ENT432	Technical design: theory and application	7	3	
ENT435	Renewable energy systems for building integration	8	4	

Smart Buildings and Cities

Code	Course Name	Semester	CH	Prerequisites
ENT472	Light Current and Digital Systems Technologies	8	3	
ENT471	Smart Buildings and Cities Platforms	8	3	

Study Plan

8	Code	Course Name	Contact	Credit Hours	SWL	Prerequisites

			Hours			
	ENT435	Renewable energy systems for building integration	6	4	180	
	ENT471	Smart Buildings and Cities Platforms	4	3	120	
	ENT472	Light Current and Digital Systems Technologies	4	3	120	
	ENT492	ENT Project IV	1	4	240	
	HUMUE2	University Elective II	2	2	60	
			17	16	720	

Total	Credit Hours: 137

- HUMUE2: University Elective II
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk

Energy Engineering Technology Industrial Track

Study Plan

7	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	ENT491	ENT Project III	1	4	240	
	ENT424	Industrial Plants I	4	3	120	
	ENT421	Heat and Mass Transfer Equipment I	4	3	150	
	ENT423	Multiphase flow	4	3	150	
	ENT422	Energy Scenario and Modelling	6	4	180	
			19	17	840	

Total	Credit Hours: 121

Energy Engineering Technology Industrial Track Industrial Concentration

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET111	Electrical Circuits I	3	3	
EET211	Electrical Circuits II	5	3	EET111

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	

Renewable Energy Technology

Code	Course Name	Semester	CH	Prerequisites
EPT431	Renewable Energy Technology	3	3	GEN123

Electrical Power Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT241	Industrial Control Engineering Technology I	5	3	GEN113

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN113	Applied Mathematics II	2	4	GEN111
GEN211	Probability & Statistics	4	3	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN123	Heat Transfer and Thermodynamics	2	3	
GEN121	Physics for Electrical Engineering	2	4	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	3	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites

HUMUE1	University Elective I	2	2	
HUM251	Safety and risk	4	2	
HUM431	Project Management	5	3	
HUMUE2	University Elective II	8	2	

Chemistry

Code	Course Name	Semester	CH	Prerequisites
GEN131	Principle of Chemistry & Material Science	1	4	

Mechanics

Code	Course Name	Semester	CH	Prerequisites
GEN241	Engineering Mechanics: Static and Dynamics	4	4	

Energy Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
ENT111	Energy, Development and Environment	2	4	
ENT211	Energy Systems I	3	3	
ENT212	Thermal Engineering	3	3	GEN123
ENT213	Energy Storage and Transmission	4	3	
ENT313	Fluid Machines	5	3	
ENT314	Principles of Ecology	5	4	
ENT311	Energy systems II	6	3	ENT211
ENT312	Innovative Energy Technologies	6	3	
ENT316	Measurements and diagnostics	6	4	
ENT315	Operation and maintenance	6	3	

Project and Training

Code	Course Name	Semester	CH	Prerequisites
ENT191	ENT Internship I	2	3	
ENT291	ENT Project I	3	2	
ENT292	ENT Project II	4	4	
ENT391	ENT Internship II	6	3	
ENT491	ENT Project III	7	4	
ENT492	ENT Project IV	8	4	

Industrial

Code	Course Name	Semester	CH	Prerequisites
ENT422	Energy Scenario and Modelling	7	4	
ENT421	Heat and Mass Transfer Equipment I	7	3	
ENT424	Industrial Plants I	7	3	
ENT423	Multiphase flow	7	3	
ENT427	Advanced Heat and Mass Transfer Processes	8	3	ENT421
ENT426	HVAC and Cooling Technologies	8	3	
ENT425	Sustainable Development and SDGs interlinkages	8	4	

Study Plan

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	ENT425	Sustainable Development and SDGs interlinkages	6	4	180	
	ENT426	HVAC and Cooling Technologies	4	3	120	
	ENT427	Advanced Heat and Mass Transfer Processes	4	3	120	ENT421

	ENT492	ENT Project IV	1	4	240	
	HUMUE2	University Elective II	2	2	60	
			17	16	720	

Total	Credit Hours: 137

- HUMUE2: University Elective II
    - HUM113: German Language
    - HUM114: Italian Language
    - HUM131: Innovation & Entrepreneurship
    - HUM132: Management and Leadership Skills
    - HUM133: Communication and Negotiation Skills
    - HUM141: Principles of Economics
    - HUM151: History of Engineering & Technology
    - HUM152: History of Art & Architecture
    - HUM153: The Character of Egypt
    - HUM154: Arabic Language
    - HUM161: Sustainability for Entrepreneurship
    - HUM162: Sustainability for Employment
    - HUM163: Health and Safety
    - HUM164: Social Responsibility
    - HUM171: Preparing Technical Reports
    - HUM172: Scientific Research & Critical Thinking
    - HUM251: Safety and risk

Energy Engineering Technology Industrial Track Oil and Gas Concentration

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET111	Electrical Circuits I	3	3	
EET211	Electrical Circuits II	5	3	EET111

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	

Renewable Energy Technology

Code	Course Name	Semester	CH	Prerequisites
EPT431	Renewable Energy Technology	3	3	GEN123

Electrical Power Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT241	Industrial Control Engineering Technology I	5	3	GEN113

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN113	Applied Mathematics II	2	4	GEN111
GEN211	Probability & Statistics	4	3	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN123	Heat Transfer and Thermodynamics	2	3	
GEN121	Physics for Electrical Engineering	2	4	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	3	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites

HUMUE1	University Elective I	2	2	
HUM251	Safety and risk	4	2	
HUM431	Project Management	5	3	
HUMUE2	University Elective II	8	2	

Chemistry

Code	Course Name	Semester	CH	Prerequisites
GEN131	Principle of Chemistry & Material Science	1	4	

Mechanics

Code	Course Name	Semester	CH	Prerequisites
GEN241	Engineering Mechanics: Static and Dynamics	4	4	

Energy Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
ENT111	Energy, Development and Environment	2	4	
ENT211	Energy Systems I	3	3	
ENT212	Thermal Engineering	3	3	GEN123
ENT213	Energy Storage and Transmission	4	3	
ENT313	Fluid Machines	5	3	
ENT314	Principles of Ecology	5	4	
ENT311	Energy systems II	6	3	ENT211
ENT312	Innovative Energy Technologies	6	3	
ENT316	Measurements and diagnostics	6	4	
ENT315	Operation and maintenance	6	3	

Project and Training

Code	Course Name	Semester	CH	Prerequisites
ENT191	ENT Internship I	2	3	
ENT291	ENT Project I	3	2	
ENT292	ENT Project II	4	4	
ENT391	ENT Internship II	6	3	
ENT491	ENT Project III	7	4	
ENT492	ENT Project IV	8	4	

Industrial

Code	Course Name	Semester	CH	Prerequisites
ENT422	Energy Scenario and Modelling	7	4	
ENT421	Heat and Mass Transfer Equipment I	7	3	
ENT424	Industrial Plants I	7	3	
ENT423	Multiphase flow	7	3	
ENT425	Sustainable Development and SDGs interlinkages	8	4	

Oil and Gas

Code	Course Name	Semester	CH	Prerequisites
ENT451	Fuel and Energy Transmission	8	3	
ENT452	Selected Topics in Petroleum and Energy Engineering	8	3	

Study Plan

8	Code	Course Name	Contact	Credit Hours	SWL	Prerequisites

			Hours			
	ENT425	Sustainable Development and SDGs interlinkages	6	4	180	
	ENT451	Fuel and Energy Transmission	4	3	120	
	ENT452	Selected Topics in Petroleum and Energy Engineering	4	3	120	
	ENT492	ENT Project IV	1	4	240	
	HUMUE2	University Elective II	2	2	60	
			17	16	720	

Total	Credit Hours: 137

- HUMUE2: University Elective II
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk

Energy Engineering Technology Industrial Track Renewable Energy Concentration

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EET111	Electrical Circuits I	3	3	
EET211	Electrical Circuits II	5	3	EET111

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	

Renewable Energy Technology

Code	Course Name	Semester	CH	Prerequisites
EPT431	Renewable Energy Technology	3	3	GEN123

Electrical Power Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT241	Industrial Control Engineering Technology I	5	3	GEN113

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN113	Applied Mathematics II	2	4	GEN111
GEN211	Probability & Statistics	4	3	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN123	Heat Transfer and Thermodynamics	2	3	
GEN121	Physics for Electrical Engineering	2	4	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	3	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites

HUMUE1	University Elective I	2	2	
HUM251	Safety and risk	4	2	
HUM431	Project Management	5	3	
HUMUE2	University Elective II	8	2	

Chemistry

Code	Course Name	Semester	CH	Prerequisites
GEN131	Principle of Chemistry & Material Science	1	4	

Mechanics

Code	Course Name	Semester	CH	Prerequisites
GEN241	Engineering Mechanics: Static and Dynamics	4	4	

Energy Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
ENT111	Energy, Development and Environment	2	4	
ENT211	Energy Systems I	3	3	
ENT212	Thermal Engineering	3	3	GEN123
ENT213	Energy Storage and Transmission	4	3	
ENT313	Fluid Machines	5	3	
ENT314	Principles of Ecology	5	4	
ENT311	Energy systems II	6	3	ENT211
ENT312	Innovative Energy Technologies	6	3	
ENT316	Measurements and diagnostics	6	4	
ENT315	Operation and maintenance	6	3	

Project and Training

Code	Course Name	Semester	CH	Prerequisites
ENT191	ENT Internship I	2	3	
ENT291	ENT Project I	3	2	
ENT292	ENT Project II	4	4	
ENT391	ENT Internship II	6	3	
ENT491	ENT Project III	7	4	
ENT492	ENT Project IV	8	4	

Industrial

Code	Course Name	Semester	CH	Prerequisites
ENT422	Energy Scenario and Modelling	7	4	
ENT421	Heat and Mass Transfer Equipment I	7	3	
ENT424	Industrial Plants I	7	3	
ENT423	Multiphase flow	7	3	
ENT425	Sustainable Development and SDGs interlinkages	8	4	

Renewable Energy

Code	Course Name	Semester	CH	Prerequisites
ENT441	Solar Energy Technology	8	3	
ENT442	Wind Energy Technology	8	3	

Study Plan

8	Code	Course Name	Contact	Credit Hours	SWL	Prerequisites

			Hours			
	ENT425	Sustainable Development and SDGs interlinkages	6	4	180	
	ENT441	Solar Energy Technology	4	3	120	
	ENT442	Wind Energy Technology	4	3	120	
	ENT492	ENT Project IV	1	4	240	
	HUMUE2	University Elective II	2	2	60	
			17	16	720	

Total	Credit Hours: 137

- HUMUE2: University Elective II
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk

Game Developments Technology Program

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	
CET112	Object Oriented Programming	2	4	CET111
CET211	Data Structures & Algorithms	3	4	CET112
CET212	Operating Systems	3	3	
CET213	Software Engineering	3	3	CET112
CET356	Advanced Data Structures and Algorithms	5	3	CET211
CET353	Advanced Object Oriented Programming	5	3	CET112
CET417	Advanced Software Engineering	6	3	CET213

Network and Cyber Security

Code	Course Name	Semester	CH	Prerequisites
CET231	Cyber & Information Security	5	3	CET161

Data Sciences

Code	Course Name	Semester	CH	Prerequisites
CET141	Database Management Systems	2	3	

Artificial Intelligence

Code	Course Name	Semester	CH	Prerequisites
CET251	Artificial Intelligence	4	3	CET111

Networks and Systems Administration

Code	Course Name	Semester	CH	Prerequisites
CET161	Network Basics	2	3	

Projects and Training

Code	Course Name	Semester	CH	Prerequisites
CET191	CET Internship I	2	3	
CET291	CET Project I	3	2	
CET292	CET Project II	4	4	CET291
CET392	CET Internship II	6	3	CET191
CET491	CET Project III	7	4	CET292
CET493	Thesis I	7	6	
CET492	CET Project IV	8	4	CET491
CET494	Thesis II	8	6	CET493

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011

GEN113	Applied Mathematics II	4	4	GEN111
GEN312	Game Mathematics	5	4	GEN113

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN122	Principles of Physics	2	3	
GEN321	Game Physics	5	4	GEN122

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	1	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites
CET151	Orientation to Field and Studies	1	2	
HUMUE1	University Elective I	2	2	
HUM231	Presentation Skills and Technical Writing	3	2	HUM111
HUMUE2	University Elective II	5	2	
HUM431	Project Management	6	3	

Game Development

Code	Course Name	Semester	CH	Prerequisites
CET153	Basics of Game Graphics	2	3	
CET411	Game Programming	3	3	CET112
CET253	Game Design	4	3	
CET244	Graphics Programming	4	3	CET153 AND CET112
CET354	Advanced Game Programming	6	3	CET411
CET358	Game Publishing and Analytics	6	3	
CET3E5	GD Major Elective I	6	3	
CET355	Game Industrial Business	7	2	
CET4E6	GD Major Elective II	8	3	CET3E5

Study Plan

1	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET111	Introduction to Computer and Programming	6	4	180	
	GEN111	Applied Mathematics I	5	4	150	GEN011
	EPT111	Computer Aided Engineering Drawing	4	3	120	
	HUM121	Principles of Law, Human Rights & Ethics	2	2	60	
	HUM111	English Language I	2	2	60	HUM011
	CET151	Orientation to Field and Studies	2	2	60	
			21	17	630	

2	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET112	Object Oriented Programming	6	4	180	CET111

	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET161	Network Basics	4	3	120	
	GEN122	Principles of Physics	4	3	120	
	CET153	Basics of Game Graphics	4	3	90	
	CET141	Database Management Systems	4	3	120	
	HUMUE1	University Elective I	2	2	60	
	CET191	CET Internship I	6	3	180	
			30	21	870	

3	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET213	Software Engineering	4	3	120	CET112
	CET212	Operating Systems	4	3	120	
	CET411	Game Programming	4	3	120	CET112
	CET211	Data Structures & Algorithms	6	4	180	CET112
	CET291	CET Project I	1	2	120	
	HUM231	Presentation Skills and Technical Writing	2	2	60	HUM111
			21	17	720	

4	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	GEN113	Applied Mathematics II	5	4	150	GEN111
	CET244	Graphics Programming	4	3	90	CET153 AND CET112
	CET253	Game Design	4	3	90	
	CET251	Artificial Intelligence	4	3	120	CET111
	CET292	CET Project II	1	4	240	CET291
			18	17	690	

5	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET353	Advanced Object Oriented Programming	6	3	90	CET112
	CET356	Advanced Data Structures and Algorithms	4	3	90	CET211
	GEN312	Game Mathematics	6	4	120	GEN113
	GEN321	Game Physics	6	4	120	GEN122
	CET231	Cyber & Information Security	4	3	120	CET161
	HUMUE2	University Elective II	2	2	60	
			28	19	600	

6	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET417	Advanced Software Engineering	4	3	120	CET213
	CET3E5	GD Major Elective I	8	3	90	
	CET358	Game Publishing and Analytics	4	3	90	
	CET354	Advanced Game Programming	4	3	90	CET411
	HUM431	Project Management	4	3	120	
	HUM311	English Language II	4	3	120	HUM111
	CET392	CET Internship II	6	3	180	CET191
			34	21	810	

7	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET355	Game Industrial Business	2	2	60	
	CET491	CET Project III	1	4	240	CET292
	CET493	Thesis I	8	6	180	
			11	12	480	

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET4E6	GD Major Elective II	8	3	90	CET3E5
	CET492	CET Project IV	1	4	240	CET491
	CET494	Thesis II	8	6	180	CET493
			17	13	510	

Total	Credit Hours: 137

- HUMUE1: University Elective I
    - HUM113: German Language
    - HUM114: Italian Language
    - HUM131: Innovation & Entrepreneurship
    - HUM132: Management and Leadership Skills
    - HUM133: Communication and Negotiation Skills
    - HUM141: Principles of Economics
    - HUM151: History of Engineering & Technology
    - HUM152: History of Art & Architecture
    - HUM153: The Character of Egypt
    - HUM154: Arabic Language
    - HUM161: Sustainability for Entrepreneurship
    - HUM162: Sustainability for Employment
    - HUM163: Health and Safety
    - HUM164: Social Responsibility
    - HUM171: Preparing Technical Reports
    - HUM172: Scientific Research & Critical Thinking
    - HUM251: Safety and risk
- HUMUE2: University Elective II
    - HUM113: German Language
    - HUM114: Italian Language
    - HUM131: Innovation & Entrepreneurship
    - HUM132: Management and Leadership Skills
    - HUM133: Communication and Negotiation Skills
    - HUM141: Principles of Economics
    - HUM151: History of Engineering & Technology
    - HUM152: History of Art & Architecture
    - HUM153: The Character of Egypt
    - HUM154: Arabic Language
    - HUM161: Sustainability for Entrepreneurship
    - HUM162: Sustainability for Employment
    - HUM163: Health and Safety
    - HUM164: Social Responsibility
    - HUM171: Preparing Technical Reports
    - HUM172: Scientific Research & Critical Thinking
    - HUM251: Safety and risk
- CET3E5: GD Major Elective I
    - CET214: Web Programming
    - CET215: Mobile Application Development
    - CET241: Cloud Databases
    - CET242: Data Analytics and Visualization
    - CET416: DevOps
    - CET5E1: Game UI/UX Design
    - CET5E3: Serious Games & Gamification
- CET4E6: GD Major Elective II
    - CET214: Web Programming
    - CET215: Mobile Application Development
    - CET218: Advanced Web Programming
    - CET241: Cloud Databases
    - CET242: Data Analytics and Visualization
    - CET416: DevOps
    - CET5E1: Game UI/UX Design
    - CET5E3: Serious Games & Gamification

Information Technology Program

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET212	Operating Systems	3	3	
CET314	Introduction to Web Technologies	5	3	CET123

Computer Engineering

Code	Course Name	Semester	CH	Prerequisites
CET122	Introduction to Computer and Programming for IT	1	4	
CET123	Foundation of Information Technology	2	4	CET122 OR CET111
CET223	Computer Architecture for IT	4	3	
CET322	Cloud Computing	5	3	CET212 AND CET161

Network and Cyber Security

Code	Course Name	Semester	CH	Prerequisites
CET231	Cyber & Information Security	3	3	CET161
CET435	Network and Mobile Security	7	3	CET161
CET436	Information Security Management	8	3	CET161

Data Sciences

Code	Course Name	Semester	CH	Prerequisites
CET142	Data Management Systems	2	3	
CET445	Information Analytics and Business Intelligence	8	3	

Networks and Systems Administration

Code	Course Name	Semester	CH	Prerequisites
CET161	Network Basics	2	3	
CET261	Advanced Computer Networks	3	4	CET161
CET265	Network Storage Systems	4	3	CET161
CET264	Software Systems Administration	4	3	CET212 AND CET161
CET263	Windows Server Administration	4	3	CET212 AND CET161
CET365	Virtualization Technologies	5	3	CET161
CET364	Cloud Systems Administration	6	3	CET212 AND CET161
CET363	Linux/Unix Server Administration	6	3	CET212 AND CET161
CET362	Network Analysis and Troubleshooting	6	3	CET261
CET366	Performance and Quality Management	6	3	CET264
CET3E4	IT Major Elective I	7	3	
CET4E4	IT Major Elective II	8	3	
CET262	Network Operation and Managment	8	3	CET261

Projects and Training

Code	Course Name	Semester	CH	Prerequisites
CET191	CET Internship I	2	3	
CET291	CET Project I	3	2	
CET292	CET Project II	4	4	CET291
CET392	CET Internship II	6	3	CET191
CET491	CET Project III	7	4	CET292

CET492	CET Project IV	8	4	CET491

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	1	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites
HUMUE1	University Elective I	2	2	
HUM231	Presentation Skills and Technical Writing	3	2	HUM111
HUMUE2	University Elective II	5	2	
HUM431	Project Management	7	3	

Information System

Code	Course Name	Semester	CH	Prerequisites
CET171	Business Foundation for IT	2	3	
CET371	Business Information Technology	5	3	CET171
CET471	Emerging IT Technologies	7	3	CET371

Study Plan

1	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET122	Introduction to Computer and Programming for IT	6	4	180	
	EPT111	Computer Aided Engineering Drawing	4	3	120	
	GEN111	Applied Mathematics I	5	4	150	GEN011
	HUM111	English Language I	2	2	60	HUM011
	HUM121	Principles of Law, Human Rights & Ethics	2	2	60	
			19	15	570	

2	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET123	Foundation of Information Technology	6	4	180	CET122 OR CET111
	CET161	Network Basics	4	3	120	
	CET142	Data Management Systems	4	3	120	
	CET171	Business Foundation for IT	4	3	120	
	HUMUE1	University Elective I	2	2	60	
	CET191	CET Internship I	6	3	180	

			26	18	780	

3	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET212	Operating Systems	4	3	120	
	CET231	Cyber & Information Security	4	3	120	CET161
	CET261	Advanced Computer Networks	6	4	180	CET161
	CET291	CET Project I	1	2	120	
	HUM231	Presentation Skills and Technical Writing	2	2	60	HUM111
			17	14	600	

4	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET263	Windows Server Administration	4	3	120	CET212 AND CET161
	CET223	Computer Architecture for IT	4	3	120	
	CET264	Software Systems Administration	4	3	120	CET212 AND CET161
	CET265	Network Storage Systems	4	3	120	CET161
	CET292	CET Project II	1	4	240	CET291
			17	16	720	

5	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET314	Introduction to Web Technologies	4	3	120	CET123
	CET371	Business Information Technology	4	3	120	CET171
	CET322	Cloud Computing	4	3	120	CET212 AND CET161
	CET365	Virtualization Technologies	4	3	120	CET161
	HUMUE2	University Elective II	2	2	60	
			18	14	540	

6	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET366	Performance and Quality Management	4	3	120	CET264
	CET362	Network Analysis and Troubleshooting	4	3	120	CET261
	CET363	Linux/Unix Server Administration	4	3	120	CET212 AND CET161
	CET364	Cloud Systems Administration	4	3	120	CET212 AND CET161
	HUM311	English Language II	4	3	120	HUM111
	CET392	CET Internship II	6	3	180	CET191
			26	18	780	

7	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET471	Emerging IT Technologies	4	3	120	CET371
	CET3E4	IT Major Elective I	4	3	120	
	CET491	CET Project III	1	4	240	CET292
	HUM431	Project Management	4	3	120	
	CET435	Network and Mobile Security	4	3	120	CET161
			17	16	720	

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET445	Information Analytics and Business Intelligence	4	3	120	
	CET262	Network Operation and Managment	4	3	120	CET261
	CET492	CET Project IV	1	4	240	CET491

	CET4E4	IT Major Elective II	4	3	120	
	CET436	Information Security Management	4	3	120	CET161
			17	16	720	

Total	Credit Hours: 127

- HUMUE1: University Elective I
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk
- HUMUE2: University Elective II
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk
- CET3E4: IT Major Elective I
  - CET331: Security Policy, Threats & Risk Management
  - CET361: Routing & Switching
  - CET462: Data Centers Fundamentals
  - CET463: Technical Support Fundamentals for IT Systems
  - CET472: Digital Transformation
- CET4E4: IT Major Elective II
  - CET331: Security Policy, Threats & Risk Management
  - CET361: Routing & Switching
  - CET462: Data Centers Fundamentals
  - CET463: Technical Support Fundamentals for IT Systems
  - CET472: Digital Transformation

Network and Cyber Security Technology Program

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	
CET112	Object Oriented Programming	2	4	CET111
CET212	Operating Systems	3	3	
CET214	Web Programming	3	3	CET112
CET216	Linux and Shell Programming	4	3	CET212
CET416	DevOps	8	3	CET214

Computer Engineering

Code	Course Name	Semester	CH	Prerequisites
CET322	Cloud Computing	5	3	CET212 AND CET161
CET321	Internet of Things	5	3	CET111
CET221	Computer Organization	7	3	CET121

Network and Cyber Security

Code	Course Name	Semester	CH	Prerequisites
CET231	Cyber & Information Security	3	3	CET161
CET233	Digital Forensics Fundamental	4	3	CET231
CET232	Web and Security Technologies	4	3	CET214 AND CET231
CET332	Penetration Testing & Ethical Hacking	5	3	CET232
CET331	Security Policy, Threats & Risk Management	5	3	CET231
CET333	Advanced Digital Forensics	6	3	CET233
CET334	Cryptographic Algorithms & Protocols	6	4	GEN111
CET3E3	NS Major Elective I	7	3	
CET431	Software Security	7	3	CET112
CET436	Information Security Management	8	3	CET161
CET435	Network and Mobile Security	8	3	CET161
CET4E3	NS Major Elective II	8	3	

Data Sciences

Code	Course Name	Semester	CH	Prerequisites
CET141	Database Management Systems	2	3	

Artificial Intelligence

Code	Course Name	Semester	CH	Prerequisites
CET251	Artificial Intelligence	6	3	CET111

Networks and Systems Administration

Code	Course Name	Semester	CH	Prerequisites
CET161	Network Basics	2	3	
CET261	Advanced Computer Networks	3	4	CET161
CET262	Network Operation and Managment	4	3	CET261
CET361	Routing & Switching	6	3	CET261

Projects and Training

Code	Course Name	Semester	CH	Prerequisites
CET191	CET Internship I	2	3	
CET291	CET Project I	3	2	
CET292	CET Project II	4	4	CET291
CET392	CET Internship II	6	3	CET191
CET491	CET Project III	7	4	CET292
CET492	CET Project IV	8	4	CET491

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN112	Applied Discrete Mathematics	2	3	
GEN211	Probability & Statistics	5	3	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN122	Principles of Physics	2	3	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	1	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites
HUMUE1	University Elective I	2	2	
HUM231	Presentation Skills and Technical Writing	3	2	HUM111
HUMUE2	University Elective II	5	2	
HUM431	Project Management	7	3	

Study Plan

1	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM111	English Language I	2	2	60	HUM011
	HUM121	Principles of Law, Human Rights & Ethics	2	2	60	
	GEN111	Applied Mathematics I	5	4	150	GEN011
	CET111	Introduction to Computer and Programming	6	4	180	
	EPT111	Computer Aided Engineering Drawing	4	3	120	
			19	15	570	

2	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUMUE1	University Elective I	2	2	60	

	GEN112	Applied Discrete Mathematics	5	3	150	
	GEN122	Principles of Physics	4	3	120	
	CET112	Object Oriented Programming	6	4	180	CET111
	CET161	Network Basics	4	3	120	
	CET141	Database Management Systems	4	3	120	
	CET191	CET Internship I	6	3	180	
			31	21	930	

3	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM231	Presentation Skills and Technical Writing	2	2	60	HUM111
	CET261	Advanced Computer Networks	6	4	180	CET161
	CET231	Cyber & Information Security	4	3	120	CET161
	CET212	Operating Systems	4	3	120	
	CET214	Web Programming	4	3	120	CET112
	CET291	CET Project I	1	2	120	
			21	17	720	

4	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET216	Linux and Shell Programming	4	3	120	CET212
	CET232	Web and Security Technologies	4	3	120	CET214 AND CET231
	CET262	Network Operation and Managment	4	3	120	CET261
	CET233	Digital Forensics Fundamental	4	3	120	CET231
	CET292	CET Project II	1	4	240	CET291
			17	16	720	

5	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUMUE2	University Elective II	2	2	60	
	GEN211	Probability & Statistics	5	3	150	GEN111
	CET321	Internet of Things	4	3	120	CET111
	CET331	Security Policy, Threats & Risk Management	4	3	120	CET231
	CET322	Cloud Computing	4	3	120	CET212 AND CET161
	CET332	Penetration Testing & Ethical Hacking	4	3	120	CET232
			23	17	690	

6	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM311	English Language II	4	3	120	HUM111
	CET251	Artificial Intelligence	4	3	120	CET111
	CET333	Advanced Digital Forensics	4	3	120	CET233
	CET334	Cryptographic Algorithms & Protocols	6	4	180	GEN111
	CET361	Routing & Switching	4	3	120	CET261
	CET392	CET Internship II	6	3	180	CET191
			28	19	840	

7	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	HUM431	Project Management	4	3	120	
	CET221	Computer Organization	4	3	120	CET121
	CET431	Software Security	4	3	120	CET112
	CET3E3	NS Major Elective I	4	3	120	
	CET491	CET Project III	1	4	240	CET292

			17	16	720	

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	CET4E3	NS Major Elective II	4	3	120	
	CET416	DevOps	4	3	120	CET214
	CET435	Network and Mobile Security	4	3	120	CET161
	CET436	Information Security Management	4	3	120	CET161
	CET492	CET Project IV	1	4	240	CET491
			17	16	720	

Total	Credit Hours: 137

- HUMUE1: University Elective I
    - HUM113: German Language
    - HUM114: Italian Language
    - HUM131: Innovation & Entrepreneurship
    - HUM132: Management and Leadership Skills
    - HUM133: Communication and Negotiation Skills
    - HUM141: Principles of Economics
    - HUM151: History of Engineering & Technology
    - HUM152: History of Art & Architecture
    - HUM153: The Character of Egypt
    - HUM154: Arabic Language
    - HUM161: Sustainability for Entrepreneurship
    - HUM162: Sustainability for Employment
    - HUM163: Health and Safety
    - HUM164: Social Responsibility
    - HUM171: Preparing Technical Reports
    - HUM172: Scientific Research & Critical Thinking
    - HUM251: Safety and risk
- HUMUE2: University Elective II
    - HUM113: German Language
    - HUM114: Italian Language
    - HUM131: Innovation & Entrepreneurship
    - HUM132: Management and Leadership Skills
    - HUM133: Communication and Negotiation Skills
    - HUM141: Principles of Economics
    - HUM151: History of Engineering & Technology
    - HUM152: History of Art & Architecture
    - HUM153: The Character of Egypt
    - HUM154: Arabic Language
    - HUM161: Sustainability for Entrepreneurship
    - HUM162: Sustainability for Employment
    - HUM163: Health and Safety
    - HUM164: Social Responsibility
    - HUM171: Preparing Technical Reports
    - HUM172: Scientific Research & Critical Thinking
    - HUM251: Safety and risk
- CET3E3: NS Major Elective I
    - CET413: Product Management
    - CET432: Database Security
    - CET433: Selected Topic in Network and Security I
    - CET438: Hardware Security Applications
- CET4E3: NS Major Elective II
    - CET434: Cloud and IoT Security
    - CET437: Adanced Cryptographic Algorithms & Protocols
    - CET439: Selected Topic in Network and Security II
    - CET461: Scaling and Connecting Networks

Water Engineering Technology Program

Study Plan

1	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	EPT111	Computer Aided Engineering Drawing	4	3	120	
	CET111	Introduction to Computer and Programming	6	4	180	
	GEN111	Applied Mathematics I	5	4	150	GEN011
	HUM111	English Language I	2	2	60	HUM011
	HUM121	Principles of Law, Human Rights & Ethics	2	2	60	
			19	15	570	

2	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WET102	Introduction to Water Resources Management	4	3	90	
	GEN122	Principles of Physics	4	3	120	
	GEN211	Probability & Statistics	5	3	150	GEN111
	GEN131	Principle of Chemistry & Material Science	5	4	150	
	HUMUE1	University Elective I	2	2	60	
	WET103	WET Internship I	4	4	90	
			24	19	660	

3	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WETC201	Introduction to Soil	4	3	90	
	WET203	Fundamental Surveying Techniques	4	3	90	
	WET204	Wells and Pumps	4	3	90	WET102
	WET205	WET Project I - Seminar I	1	3	90	
	EPT202	Foundation of Electrical Engineering	6	4	90	GEN111 AND GEN122
	HUM231	Presentation Skills and Technical Writing	2	2	60	HUM111
			21	18	510	

4	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WET206	Groundwater and Surface Water Hydrology	4	3	90	WET102
	WET207	Irrigation Instrumentation	6	4	120	EPT202
	WET208	Principles of Irrigation Systems	6	4	90	
	WET209	WET Project II	1	3	90	WET205
	CET123	Foundation of Information Technology	6	4	180	CET122 OR CET111
			23	18	570	

Total	Credit Hours: 70

- HUMUE1: University Elective I
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment

- HUM163: Health and Safety
- HUM164: Social Responsibility
- HUM171: Preparing Technical Reports
- HUM172: Scientific Research & Critical Thinking
- HUM251: Safety and risk

Irrigated Field Crops Track

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	

Computer Engineering

Code	Course Name	Semester	CH	Prerequisites
CET123	Foundation of Information Technology	4	4	CET122 OR CET111

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	
EPT202	Foundation of Electrical Engineering	3	4	GEN111 AND GEN122

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN211	Probability & Statistics	2	3	GEN111
GEN113	Applied Mathematics II	5	4	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN122	Principles of Physics	2	3	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	1	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites
HUMUE1	University Elective I	2	2	
HUM231	Presentation Skills and Technical Writing	3	2	HUM111
HUMUE2	University Elective II	5	2	
HUM431	Project Management	7	3	
HUMUE3	University Elective III	7	2	

Chemistry

Code	Course Name	Semester	CH	Prerequisites
GEN131	Principle of Chemistry & Material Science	2	4	

Agriculture Technology

Code	Course Name	Semester	CH	Prerequisites
WETC201	Introduction to Soil	3	3	
WETC301IFC	Drainage Engineering	5	3	WETC201
WET303	Agricultural Water Management	6	4	
WETC401IFC	Advanced Field Crop Irrigation Design	7	3	WETC302IFC
WETC402IFC	Cropping Systems	8	3	WETC401IFC

Irrigation Technology

Code	Course Name	Semester	CH	Prerequisites
WET203	Fundamental Surveying Techniques	3	3	
WET204	Wells and Pumps	3	3	WET102
WET207	Irrigation Instrumentation	4	4	EPT202
WET208	Principles of Irrigation Systems	4	4	
WET302	Water Treatment Reuse	5	3	GEN131
WETC302IFC	Field Crop Irrigation System Design Fundamentals	6	3	WETC301IFC
WET401	Design of On-Farm Irrigation Systems	7	4	WET206
WET407	Smart Irrigation Technologies	8	3	

Water Technology

Code	Course Name	Semester	CH	Prerequisites
WET102	Introduction to Water Resources Management	2	3	
WET206	Groundwater and Surface Water Hydrology	4	3	WET102
WET301	Soil and Water Conservation Engineering	5	3	WETC201
WET304	Modeling Soil and Water Processes	6	3	WET301
WET402	Irrigation Water Quality and Salinity Management	7	3	WET302
WET405	Remote Sensing for Water Management	8	4	

Study Plan

5	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WET301	Soil and Water Conservation Engineering	4	3	90	WETC201
	WETC301IFC	Drainage Engineering	4	3	90	WETC201
	WET302	Water Treatment Reuse	4	3	90	GEN131
	GEN113	Applied Mathematics II	5	4	150	GEN111
	HUMUE2	University Elective II	2	2	60	
			19	15	480	

6	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WETC302IFC	Field Crop Irrigation System Design Fundamentals	4	3	90	WETC301IFC
	WET303	Agricultural Water Management	6	4	120	
	WET304	Modeling Soil and Water Processes	4	3	120	WET301
	WET305	WET Internship II	4	4	90	WET103
	HUM311	English Language II	4	3	120	HUM111
			22	17	540	

7	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites

	WET401	Design of On-Farm Irrigation Systems	6	4	120	WET206
	WETC401IFC	Advanced Field Crop Irrigation Design	4	3	90	WETC302IFC
	WET402	Irrigation Water Quality and Salinity Management	4	3	90	WET302
	WET403	WET Project III + Seminar	1	3	90	WET209
	HUM431	Project Management	4	3	120	
	HUMUE3	University Elective III	2	2		
			21	18	510	

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WETC402IFC	Cropping Systems	4	3	90	WETC401IFC
	WET404	Water Delivery System	6	4	90	WET401
	WET405	Remote Sensing for Water Management	6	4	90	
	WET406	WET Project IV	1	3	90	WET403
	WET407	Smart Irrigation Technologies	4	3		
			21	17	360	

Total	Credit Hours: 137

- HUMUE2: University Elective II
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk
- HUMUE3: University Elective III
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk

Pivot Irrigation Technology Track

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	

Computer Engineering

Code	Course Name	Semester	CH	Prerequisites
CET123	Foundation of Information Technology	4	4	CET122 OR CET111

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	
EPT202	Foundation of Electrical Engineering	3	4	GEN111 AND GEN122

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN211	Probability & Statistics	2	3	GEN111
GEN113	Applied Mathematics II	5	4	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN122	Principles of Physics	2	3	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	1	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites
HUMUE1	University Elective I	2	2	
HUM231	Presentation Skills and Technical Writing	3	2	HUM111
HUMUE2	University Elective II	5	2	
HUM431	Project Management	7	3	
HUMUE3	University Elective III	7	2	

Chemistry

Code	Course Name	Semester	CH	Prerequisites
GEN131	Principle of Chemistry & Material Science	2	4	

Agriculture Technology

Code	Course Name	Semester	CH	Prerequisites
WETC201	Introduction to Soil	3	3	
WET303	Agricultural Water Management	6	4	

Irrigation Technology

Code	Course Name	Semester	CH	Prerequisites
WET203	Fundamental Surveying Techniques	3	3	
WET204	Wells and Pumps	3	3	WET102
WET207	Irrigation Instrumentation	4	4	EPT202
WET208	Principles of Irrigation Systems	4	4	
WETC301PIT	Advanced Irrigation System Design	5	3	WETC201
WET302	Water Treatment Reuse	5	3	GEN131
WETC302PIT	Center Pivot Irrigation System Design	6	3	WETC301PIT
WETC401PIT	Advanced Pivot Irrigation System Design	7	3	WETC302PIT
WET401	Design of On-Farm Irrigation Systems	7	4	WET206
WETC402PIT	Environmental Impact of Irrigation	8	3	WETC401PIT
WET407	Smart Irrigation Technologies	8	3	

Water Technology

Code	Course Name	Semester	CH	Prerequisites
WET102	Introduction to Water Resources Management	2	3	
WET206	Groundwater and Surface Water Hydrology	4	3	WET102
WET301	Soil and Water Conservation Engineering	5	3	WETC201
WET304	Modeling Soil and Water Processes	6	3	WET301
WET402	Irrigation Water Quality and Salinity Management	7	3	WET302
WET405	Remote Sensing for Water Management	8	4	

Study Plan

5	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WET301	Soil and Water Conservation Engineering	4	3	90	WETC201
	WETC301PIT	Advanced Irrigation System Design	4	3	90	WETC201
	WET302	Water Treatment Reuse	4	3	90	GEN131
	GEN113	Applied Mathematics II	5	4	150	GEN111
	HUMUE2	University Elective II	2	2	60	
			19	15	480	

6	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WETC302PIT	Center Pivot Irrigation System Design	4	3	90	WETC301PIT
	WET303	Agricultural Water Management	6	4	120	
	WET304	Modeling Soil and Water Processes	4	3	120	WET301
	WET305	WET Internship II	4	4	90	WET103
	HUM311	English Language II	4	3	120	HUM111
			22	17	540	

7	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites

	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WET401	Design of On-Farm Irrigation Systems	6	4	120	WET206
	WETC401PIT	Advanced Pivot Irrigation System Design	4	3	90	WETC302PIT
	WET402	Irrigation Water Quality and Salinity Management	4	3	90	WET302
	WET403	WET Project III + Seminar	1	3	90	WET209
	HUM431	Project Management	4	3	120	
	HUMUE3	University Elective III	2	2		
			21	18	510	

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WETC402PIT	Environmental Impact of Irrigation	4	3	90	WETC401PIT
	WET404	Water Delivery System	6	4	90	WET401
	WET405	Remote Sensing for Water Management	6	4	90	
	WET406	WET Project IV	1	3	90	WET403
	WET407	Smart Irrigation Technologies	4	3		
			21	17	360	

Total	Credit Hours: 137

- HUMUE2: University Elective II
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk
- HUMUE3: University Elective III
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
  - HUM154: Arabic Language
  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk

Smart Water Management Technology

Specializations

Computer Science

Code	Course Name	Semester	CH	Prerequisites
CET111	Introduction to Computer and Programming	1	4	

Computer Engineering

Code	Course Name	Semester	CH	Prerequisites
CET123	Foundation of Information Technology	4	4	CET122 OR CET111

Electrical Engineering Technology

Code	Course Name	Semester	CH	Prerequisites
EPT111	Computer Aided Engineering Drawing	1	3	
EPT202	Foundation of Electrical Engineering	3	4	GEN111 AND GEN122

Mathematics

Code	Course Name	Semester	CH	Prerequisites
GEN111	Applied Mathematics I	1	4	GEN011
GEN211	Probability & Statistics	2	3	GEN111
GEN113	Applied Mathematics II	5	4	GEN111

Physics

Code	Course Name	Semester	CH	Prerequisites
GEN122	Principles of Physics	2	3	

Language

Code	Course Name	Semester	CH	Prerequisites
HUM111	English Language I	1	2	HUM011
HUM311	English Language II	6	3	HUM111

Law

Code	Course Name	Semester	CH	Prerequisites
HUM121	Principles of Law, Human Rights & Ethics	1	2	

General Knowledge

Code	Course Name	Semester	CH	Prerequisites
HUMUE1	University Elective I	2	2	
HUM231	Presentation Skills and Technical Writing	3	2	HUM111
HUMUE2	University Elective II	5	2	
HUM431	Project Management	7	3	
HUMUE3	University Elective III	7	2	

Chemistry

Code	Course Name	Semester	CH	Prerequisites
GEN131	Principle of Chemistry & Material Science	2	4	

Agriculture Technology

Code	Course Name	Semester	CH	Prerequisites
WETC201	Introduction to Soil	3	3	
WET303	Agricultural Water Management	6	4	

Irrigation Technology

Code	Course Name	Semester	CH	Prerequisites
WET203	Fundamental Surveying Techniques	3	3	
WET204	Wells and Pumps	3	3	WET102
WET207	Irrigation Instrumentation	4	4	EPT202
WET208	Principles of Irrigation Systems	4	4	
WET302	Water Treatment Reuse	5	3	GEN131
WET401	Design of On-Farm Irrigation Systems	7	4	WET206
WET407	Smart Irrigation Technologies	8	3	

Water Technology

Code	Course Name	Semester	CH	Prerequisites
WET102	Introduction to Water Resources Management	2	3	
WET206	Groundwater and Surface Water Hydrology	4	3	WET102
WETC301WMT	Irrigation Hydraulics and Conveyance Systems	5	3	WETC201
WET301	Soil and Water Conservation Engineering	5	3	WETC201
WET304	Modeling Soil and Water Processes	6	3	WET301
WETC302WMT	Water Resource Management System Design	6	3	WETC301WMT
WETC401WMT	Integrated Water Management System Design	7	3	WETC302WMT
WET402	Irrigation Water Quality and Salinity Management	7	3	WET302
WET405	Remote Sensing for Water Management	8	4	
WETC402WMT	Water Policy	8	3	WETC401WMT

Study Plan

5	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WET301	Soil and Water Conservation Engineering	4	3	90	WETC201
	WETC301WMT	Irrigation Hydraulics and Conveyance Systems	4	3	90	WETC201
	WET302	Water Treatment Reuse	4	3	90	GEN131
	GEN113	Applied Mathematics II	5	4	150	GEN111
	HUMUE2	University Elective II	2	2	60	
			19	15	480	

6	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WETC302WMT	Water Resource Management System Design	4	3	90	WETC301WMT
	WET303	Agricultural Water Management	6	4	120	
	WET304	Modeling Soil and Water Processes	4	3	120	WET301
	WET305	WET Internship II	4	4	90	WET103
	HUM311	English Language II	4	3	120	HUM111
			22	17	540	

7	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites

	WET401	Design of On-Farm Irrigation Systems	6	4	120	WET206
	WETC401WMT	Integrated Water Management System Design	4	3	90	WETC302WMT
	WET402	Irrigation Water Quality and Salinity Management	4	3	90	WET302
	WET403	WET Project III + Seminar	1	3	90	WET209
	HUM431	Project Management	4	3	120	
	HUMUE3	University Elective III	2	2		
			21	18	510	

8	Code	Course Name	Contact Hours	Credit Hours	SWL	Prerequisites
	WETC402WMT	Water Policy	4	3	90	WETC401WMT
	WET404	Water Delivery System	6	4	90	WET401
	WET405	Remote Sensing for Water Management	6	4	90	
	WET406	WET Project IV	1	3	90	WET403
	WET407	Smart Irrigation Technologies	4	3		
			21	17	360	

Total	Credit Hours: 137

- HUMUE2: University Elective II
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
  - HUM132: Management and Leadership Skills
  - HUM133: Communication and Negotiation Skills
  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
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  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk
- HUMUE3: University Elective III
  - HUM113: German Language
  - HUM114: Italian Language
  - HUM131: Innovation & Entrepreneurship
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  - HUM141: Principles of Economics
  - HUM151: History of Engineering & Technology
  - HUM152: History of Art & Architecture
  - HUM153: The Character of Egypt
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  - HUM161: Sustainability for Entrepreneurship
  - HUM162: Sustainability for Employment
  - HUM163: Health and Safety
  - HUM164: Social Responsibility
  - HUM171: Preparing Technical Reports
  - HUM172: Scientific Research & Critical Thinking
  - HUM251: Safety and risk

Courses

Department of Electronic Engineering Technology

EET111: Electrical Circuits I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	120	300	3	150	90	120	60	15	25

Course Description

Electric circuits represent the foundation of electrical engineering studies and practices. All electrical systems can be modeled using the electric circuits approach. Therefore, learning how to build and analyze electric circuits constitute a milestone in building engineering career. This course will provide the students with strong understanding of electric circuits with emphasis on the techniques for analysing electric circuits in steady state and in transient state as well. The course contains an introduction to electric circuits, circuits elements and Ohm's law, Kirchhoff's' Laws & voltage and current division rules, the node-voltage method, the mesh-current method, superposition method and source transformation, Thevenin's and Norton's circuits, maximum power transfer theorem, inductors and capacitors, and first order transients.

References

Charles K. Alexander and Matthew Sadiku, "Fundamentals of Electric Circuits" Second Edition, McGrawHill, 2004.
W. Nilsson and S. A. Riedel, "Electric Circuits", Eights Edition or later. Upper Saddle River, NJ: Prentice Hall, 2011.

Learning Outcomes

CLO 1: To build an understanding of the basic concepts of electric circuits.
CLO 2: To apply the basic laws of electric circuits.
CLO 3: To learn the different analysis methods of electric circuits.
CLO 4: To analyze different configurations of resistive circuits using these methods.
CLO 5: To investigate the transient phenomena in electric circuits.
CLO 6: To develop the students' problem solving skills.

Tutorials

LAB 1: Electrical quantities, measuring instruments, resistor color code. LAB 2: Breadboard and wiring, power supply, Ohm's law, and series and parallel configurations. LAB 3: KVL, KCL, voltage divider rule, and current divider rule. LAB 4: An introduction to PsPice simulation. LAB 5: DC circuits with dependent sources. LAB 6: Nodal analysis and mesh analysis. LAB 7: Superposition principle. LAB 8: Thevenin's equivalent circuit. LAB 9: Maximum power transfer theorem.

EET121: Fundamental of Optics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

The course supports the students with the fundamentals of optics. The course includes the notion of the ray model of light. The course also contains the image formation by plane and spherical mirrors, the notion of refractive index of a material, Snell's law, total internal reflection in optical fibers, thin lenses, visible light spectrum, dispersion, light polarization, how the human eye works, usage of corrective lenses, magnifying glasses, and fifferent types of optical instruments (cameras, telescopes, and compound microscope).

References

D. C. Giancoli, Physics: Priciples with Applications, 6th ed. Pearson.

Learning Outcomes

CLO 1: Understand the ray model of light.
CLO 2: Learn the image formation by plane and spherical mirrors.
CLO 3: Learn the meaning of refracive index of a material.
CLO 4: Understand the meaning of the Snell's law of refraction and total internal reflection for optical fibers.
CLO 5: Learn the meaning of thin lenses.
CLO 6: Identify visible light spectrum and dispersion. CLO 7: Understand the concept of light polarization.
CLO 8: Recognize how the human eye works and the usage of corrective lenses. CLO 9: Understand the principle of operation of magnifying glasses. CLO 10: Identify different types of optical instruments: Cameras, telescopes, and compound microscope.

EET191: EET Internship I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
0	0	360	360	3	180			50	0	50

Course Description

Internship provides an opportunity to practice and/or apply knowledge and skills in professional environments and gain valuable work experience. Through the Internship students get exposure to the industrial environment which cannot be simulated in the classroom. During the internship, students understand and sharpen the real-time technical/managerial skills required at the job(s). Further, they understand the social, economic, and administrative considerations that influence the working environment of industrial organizations. Student learning includes overall professional development of students, required problem-solving, communication, human development, and relationship-building skills. Further, the students develop awareness of the organizational department structure and their roles, responsibilities, and function. Students select the internship field in consultation with an industry mentor and faculty guide in terms of the academic requirements. The student is expected to produce a joining letter and a successful completion certificate. once the internship is over. Internship evaluation can be based on the quality of projects completed as part of the internship activities. Faculty Member(s) evaluate(s) the performance of students once by visiting the industry/organization and submit the evaluation report of the students with the consent of Industry persons/ mentor. The students are exposed to the industry environment for 6 to 8 weeks duration to understand the operation of the industrial facility.

References

https://www.youtube.com/watch?v=jpf9J2TUJVg
https://www.youtube.com/watch?v=KqIshDsg494
https://www.youtube.com/watch?v=E1UcIHW5rSc
https://www.youtube.com/watch?v=EhnfOUrFgxM

Learning Outcomes

CLO 1: Understand the Electronic industrial standards and recognize the requirement of these standards with the industrial scenario.
CLO 2: Examine a specific project related to electrical engineering at an existing job.
CLO 3: Communicate effectively through the technical presentation.
CLO 4: Demonstrate individual confidence to handle various engineering assignments during the internship.
CLO 6: Expose themselves to acquire life skills to meet societal challenges
CLO 7: Relate the engineer’s responsibilities and ethics while handling various engineering assignments during the internship.
CLO 8: Read the engineering drawings and if necessary, modify the parts/unit/assembly drawing of the electrical product.

EET211: Electrical Circuits II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	120	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EET111

Course Description

This course is the second course in electric circuits for electrical engineering students. It aims to introduce the concepts of circuit analysis in three different domains namely; time domain, frequency domain, and in Laplace domain. It also provides the students with the techniques needed for the analysis of active circuits such as filter circuits and amplifiers. The course contains an introduction to AC circuits, circuit elements in th ephasor domain, analysis of AC circuits, power calculations in AC circuits, power factor correction, operational amplifiers and their applications, resonance circuits, filters, and S-domain analysis.

References

Charles K. Alexander and Matthew Sadiku. Fundamentals of Electric Circuits (11th edition). McGrawHill. ISBN-10: 0073048356. ISBN-13: 978-0073048352. J. W. Nilsson and S. A. Riedel. Electric Circuits (10th edition). Upper Saddle River, NJ: Prentice Hall. ISBN 0-13-146592-9.

Learning Outcomes

CLO 1: Recall the principles of operation, electrical characteristics and circuit models of active elements such as Operational amplifiers.
CLO 2: Identify different types of filters and amplifiers.
CLO 3: Recognize the principles of operation, electrical characteristics and circuit models of amplifiers, filters, AC circuits, S-domain circuits.
CLO 4: Distinguish between the different components of Power.
CLO 5: Formulate the transfer function of a circuit in frequency domain and in S- domain.
CLO 6: Analyze Filters, AC circuits, and amplifiers circuits.
CLO7: Calculate the apparent, active and reactive power of a circuit.
CLO 8: Calculate the power factor of the circuit and size the capacitor required for power factor improvement. CLO 9: Prepare reports and assignments and hand them before due dates.
CLO 10: Develop communication skills through interactive discussions within the lectures and tutorials.

Tutorials

LAB 1: Capacitors and oscilloscpes. LAB 2: R-L and R-C series connections. LAB 3: PsPice simulation - AC analysis. LAB 4: AC power triangle. LAB 5: Power factor correction. LAB 6: PsPice siluation - operational amplifier. LAB 7: Non-invderting operational amplifier. LAB 8: Operational amplifier applications: Differentiator and integrator. LAB 9: Filters.

EET212: Signals & Communication Systems Technology

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	120	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: GEN113

Course Description

Signals and systems are used in a wide range of engineering system like voice processing, image processing data processing, cellular networks which are an integral part of analog and digital communications. This course covers the classification of signals like continuous and discrete signals, analog and digital signals, deterministic and random signals, even and odd signals, periodic and aperiodic signals, and linear and nonlinear signal, and basic operations on signals like time shifting and time scaling. The topics include representation of basic signals like step, unit impulse, sinusoid, complex exponential. It also covers the impulse response and step response, convolution, and block diagram representations for interconnections of systems. The student learning includes Fourier analysis and properties of continuous-time periodic signals, discrete-time periodic signals, continuous-time aperiodic signals, and discrete-time aperiodic signals. The last part of the course covers the sampling theory, the need of modulation process, bandwidth requirement, amplitude modulation (AM), and spectrum of AM waves.

References

Oppenheim, V. Willsky, A. S., & Nawab, S. H. (2020). Signals and Systems, Prentice Hall,2nd Edition.
Taub, H. Schilling, D. L., & Saha, G. (2017). Principles of Communication Systems. 3rd Edition, TMH.
https://www.tutorialspoint.com/signals_and_systems/index.htm
http://www.dspguide.com/ch8/1.htm
https://electronicscoach.com/difference-between-analog-and-digital-communication.html
https://www.javatpoint.com/analog-communication

Learning Outcomes

CLO 1: Classify signals (continuous-time vs. discrete-time, real vs. complex, periodic vs. aperiodic, and deterministic vs. random). CLO 2: Calculate power and energy of signals and make transformations of the independent variable for signals. CLO 3: Illustrate systems based on their properties: in particular, to understand and exploit the implications of linearity, time-invariance, causality, memory, and bounded-input bounded-output (BIBO) stability for DSP applications.
CLO 4: Identify the different features of linear time-invariant (LTI) systems. CLO 5: Find the Fourier series for continuous-time periodic signals,

and identify its main properties. CLO 6: Find the Fourier series for discrete-time periodic signals, and identify its main properties. CLO 7: Find the Fourier transform for continuous-time aperiodic signals, and identify its main properties. CLO 8: Find the Fourier transform for continuous-time periodic signals, and identify its main properties. CLO 9: Find the Fourier transform for discrete-time aperiodic signals, and identify its main properties. CLO 10: Find the Fourier transform for discrete-time periodic signals, and identify its main properties. CLO 11: Understand the notion of the sampling theory.

Tutorials

LAB 1: An introduction to MATLAB. LAB 2: 1D arrays. LAB 3: Arrays and matrices. LAB 4: MATLAB representations of discrete-time signals. LAB 5: MATLAB representations of discrete-time signals (cont.). LAB 6: Discrete-time signals. LAB assignment: MATLAB code to generate discrete-time step, ramp, parabolic, sinusoidal, and impulse signals, find the sum and convolution of two discrete-time signals, and generate and plot the magnitude and phase for the Fourier transform of a given discrete-time aperiodic signal.

EET213: Electric Circuit Design & PCB Manufacturing

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	120	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EET211

Course Description

This is a basic course for designing PCB using software and hardware. The major objective is to select and use appropriate test equipment and procedures from a wide range of possibilities to analyze and interpret test results and measurements on electric circuits, in terms of theoretical models. The topics include predicting the performance of electric circuits from device characteristics and designing an electronic printed circuit board for a specific application using industry standard software. The student learning includes designing and fabricating PCB for prototyping for electronic circuits, single and multilayer PCB Technology, PCB plated through hole, surface mount, PCB Material, its mechanical and electrical properties, resins, and foils used, solder mask, electronic component packaging like hole packages, axial and radial lead, dual line package, transistor outline, pin grid array. The student also learns PCB designing, fabrication, production, electronic design automation tools like Eagle, Ultiboard, Orcad and Opensource tools like KiCad. In KiCad Schematic entry drawing, netlisting, layering, component footprint library selection & designing, design rules, component placing by manual and automatic, automatic & manual track routing, track length, angle, joint & size. It also covers the IPC standards for schematic, designing, material and documentation which includes the use of standard title blocks, page sequencing, readability, design rules, separate part list, assembly drawing, PWB drawing and flag notes. It covers the PCB prototyping using CNC machine, photo-lithography process, screen printing process and chemical etching. The course also covers the PCB mass manufacturing process like gerber generation, CAM, panelization, cleaning, drilling, plating, screen printing, etching, automated optical inspection, tinning, solder resist, legend printing, PCB testing.

References

Jon Varteresian, (2002) Fabricating Printed Circuit Boards, Newnes Publication.
https://reprap.org/wiki/MakePCBInstructions#Making_PCBs_yourself
https://www.youtube.com/watch?v=imQTCW1yWkg
https://www.circuitbasics.com/make-custom-pcb/

Learning Outcomes

CLO 1: Illustrate the concept of designing single and multi-layer PCB.
CLO 2: Design the layout for specific application of electrical circuit manually.
CLO 3: Analyze the fabrication process of printed circuit boards
CLO 4: Compare the various software available for PCB design
CLO 5: Use EDA software to select components, create library, design layout, and develop functional electronic circuit boards.
CLO 6: Demonstrate a mini-project from a lay out design using software to process of etching, drilling, and routing to get the final printed circuit board.

Tutorials

LAB 1: Study of transformer and winding step-down transformer winding of less than 5VA.
LAB 2: Study of crystal diode rectifier used in PCB.
LAB 3: Draw PCB layout for an electric circuit.
LAB 4: Etching and drilling of PCB, solder & soldering techniques of circuits in PCB, Wiring and fitting of power supply along with a meter in cabinet.

LAB 5: Testing of power supply fabricated and Building Schematic in ORCAD.
LAB 6: Creating parts, surface mount components and symbols in ORCAD library and Importing schematic to PCB machine.
LAB 7: Routing, glossing and copper pour for PCB.
LAB 8: PCB design and implementation of battery charger unit.
LAB 9: PCB design and Implementation of Motion detector circuit.
LAB 10: PCB design and implementation of uninterrupted supply circuit.
LAB 11: PCB design and implementation of solar charger circuit.

EET231: Electronics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: EET111 AND GEN113 AND GEN121

Course Description

Intrinsic Semiconductors (Crystal structure, Band diagram, Intrinsic carrier, concentration, and Influence of temperature). Exttrinsic Semiconductors (carrier concentarion, charge neutrality, majority and minority carriers, influence of temperature on carrier concentration, carrier transport mechanisms, generation and recombination). PN-junction at thermal equilibrium and I-V characteristics. Diode DC model, diode amall-signal model, diode circuits, and zener diode. BJT physical characteristics and as a circuit element. BJT circuit analysis. Structure of MOS diode (MOS = Metal Oxide Semiconductor) (Accumulation, Depletion, Inversion, Capacitance of MOS diode, Work function difference, Influence of built-in charge). MOS as a circuit element.

References

S. M. Sze, “Semiconductor Devices: Physics and Technology”, Wiley & So., ISBN 0471333727, 2001

Learning Outcomes

CLO 1: Intrinsic Semiconductors (Crystal structure, Band diagram, Intrinsic carrier, concentration, and Influence of temperature). CLO 2: Exttrinsic Semiconductors (carrier concentarion, charge neutrality, majority and minority carriers, influence of temperature on carrier concentration, carrier transport mechanisms, generation and recombination). CLO 3: PN-junction at thermal equilibrium and I-V characteristics. CLO 4: Diode DC model, diode amall-signal model, diode circuits, and zener diode. CLO 5: BJT physical characteristics and as a circuit element. BJT circuit analysis. CLO 6: Structure of MOS diode (MOS = Metal Oxide Semiconductor) (Accumulation, Depletion, Inversion, Capacitance of MOS diode, Work function difference, Influence of built-in charge). CLO 7: MOS as a circuit element.
CLO 8: Conduct lab experiments in electronic devices, write lab reports and present results.

EET291: EET Project I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	2	120			75	0	25

Course Description

This course enables the students to exercise some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. The student is expected to design a project that provides students with the experience of designing, building, and integrating modular software applications/ electronic system comprising analog, digital and computer subsystems. The student mostly implements design and tests the system. This course includes planning the tasks which are to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. By studying this course. The student develops creativity, initiative, and capacity to perform. Leadership development and supervision skills are also integrated into the learning objectives of this course. The project will have a detailed proposal, which must be executed or implemented within the time allocated while maintaining a logbook periodically monitored by the professor mentor. Projects should be chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is to be prepared as the project progresses, which has to be submitted after the project is over. The students acquire the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1: Define the tasks and scope of the project independently and/or collaboratively
CLO 2: Identify relevant information pertaining to project needs from a variety of resources.
CLO 3: Acquire knowledge on advanced topics in a chosen subject area
CLO 4: Summarize the information and draw a logical conclusion to the problem/task of the project
CLO 5: Outline the details of hardware and software required for the completion of the project
CLO 6: Prepare project proposals with an action plan and time duration scientifically.
CLO 7: Communicate project ideas and current work achievements clearly through technical report and presentations.

EET292: EET Project II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	4	240			75	0	25

Requisites

- Prerequisites: EET291

Course Description

This course enables the students to apply some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. Project II provides students with the experience of designing and building simple software and hardware applications. Further students can learn how to integrate it into a modular electronic system or computer subsystems. This course builds on the knowledge and skills built in Project I. The student mostly implements design and tests the system. This course includes planning the tasks which are to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. Through this course, the student develops creativity, initiative, and capacity to perform. The student develops interpersonal, teamwork, planning and organizing skills. The projects will have a detailed project proposal, which must be executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the teacher. Projects should be chosen so that they can be completed using students’ problem-solving capabilities and depth of learning. A detailed project report is to be prepared as the project progresses, which has to be submitted after the project is over. The students acquire the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1. Choose the relevant possible solutions from available alternatives
CLO 2. Conduct feasibility studies about hardware and software parts used in the project.
CLO 3. Design a simple software and hardware application taking into consideration various real-life constraints.
CLO 4. Investigate the important legal and ethical issues in the design project
CLO 5. Collaborate with team members, managers, and clients to design and prototype a product/service that meets user needs and expectations.
CLO 6. Conduct the theoretical study in detail and compare them on the basis of cost/ energy conservation/impact on environment/technology used etc.
CLO 7. Communicate project ideas and current work achievements clearly through technical report and presentations.

EET331: Digital System Design

Contact Time				CH	SWL	Exams Time		Marks		

LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET121

Course Description

Understanding the basic low-level background of digital circuits. Recognizing the different types of memories and programmable logic devices. Analysis and Design of Advanced Combinational and Sequential Circuits. Applying a complete design flow targeting FPGA platforms. Applying the concept of pipelining to boost the throughput of a digital system. Analysis and Design of Efficient Arithmetic Circuits

References

John Wakerly, “Digital Design,” Prentice Hall, ISBN: 0-13-176059-9
Neil Storey, “Electronics- A System Approach,” Prentice Hall, ISBN 0-13-129396-6
Stephen Brown, and Zvonko Vranesic, “Fundamentals of Digital Logic with VHDL Design,” Mc Graw Hill, ISBN 007-124482-4
Ercegovac and Lang, “Digital Arithmetic,”

Learning Outcomes

CLO 1: Understanding the basic low-level background of digital circuits.
CLO 2: Recognizing the different types of memories and programmable logic devices.
CLO 3: Analysis and Design of Advanced Combinational and Sequential Circuits.
CLO 4: Applying a complete design flow targeting FPGA platforms.
CLO 5: Applying the concept of pipelining to boost the throughput of a digital system.
CLO 6: Analysis and Design of Efficient Arithmetic Circuits.

EET332: Integrated Circuits Design

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: EET231

Course Description

Design and analyze digital circuits on transistor level.
Define different design alternatives in studying Dynamic Logic Circuits to build high performance digital integrated circuits. Discuss different types of digital memories. Notion of digital integrated circuits. Revision on semiconductor devices and their proerties.Identify the static and dynamic behavior of MOS inverter. Describe the delay induced by wiring interconnect. Consider static and dynamic MOS power consumption. Transistor-level implementation of NOR, NAND, and XOR gates. Transistor-level implementation of latches, flipflops, and registers. Transistor-level implementation of adders, multipliers, and shifters. Timing constraints consideration.

References

Weste, N. H. E. and Harris, D., CMOS VLSI Design: A Circuits and Systems Perspective.
Rabaey, J. et al, “Digital Integrated Circuits: A Design Perspective” 2nd Ed.
Kang, S-Mo. and Leblebici, Y., CMOS Digital Integrated Circuits.

Learning Outcomes

CLO 1: The notion of digital integrated circuits. CLO 2: Make an intensive revision on semiconductor devices and their proerties.
CLO 3: Identify the static and dynamic behavior of MOS inverter.
CLO 4: Describe the delay induced by wiring interconnect.
CLO 5: Consider static and dynamic MOS power consumption.
CLO 6: Transistor-level implementation of NOR, NAND, and XOR gates.
CLO 7: Transistor-level implementation of latches, flipflops, and registers. CLO 8: Transistor-level implementation of adders, multipliers, and

shifters. CLO 9: Consider timing constraints.

EET333: Electronic Circuits

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	120	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EET231

Course Description

Analog Circuit Design Basics. BJT DC and AC Analysis (Amplifiers). MOS-FET DC and AC Analysis (Amplifiers). Frequency Response of Amplifiers. Differential Amplifiers and Current Mirrors. Power Amplifiers. Feedback Amplifiers. Op-amp CMOS Circuit Design

References

“Microelectronic Circuit Design” , Jaeger
“Microelectronics Circuits” ,Sedra& Smith
“Analysis and Design of Analog Integrated Circuits”, Gray, Hurst, Lewis & Meyer
“ Fundamentals of Microelectronics”, Razavi
“Analog Integrated Circuit Design”, Johns & Martin
“Electronic Devices and Circuits”, Bogart, Beasley & Rico
“Microelectronic Circuits Analysis and Design”, Rashid
“Electronic Principles”, Malvino& Bates

Learning Outcomes

CLO 1: BJT DC and AC Analysis (Amplifiers)
CLO 2: MOS-FET DC and AC Analysis (Amplifiers)
CLO 3: Frequency Response of Amplifiers
CLO 4: Differential Amplifiers and Current Mirrors
CLO 5: Power Amplifiers
CLO 6: Feedback Amplifiers
CLO 7: Op-amp CMOS Circuit Design

EET341: Electronics Measurements & Instruments

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EET211

Course Description

Functional elements and generalized configuration of a measuring Instrument, characteristics of instruments, errors in measurements and their statistical analysis, it gives the introduction to display devices, character formats, segment displays, dot matrix displays, bar graph displays, cathode ray tubes, light emitting diodes, liquid crystal displays, nixes, incandescent, fluorescent, liquid vapor and visual displays. It also covers the introduction to oscilloscope, block diagram, cathode ray tube, delay line, multiple trace oscilloscope scope, digital storage oscilloscope. It also discusses the different signal generation techniques like sine wave generator, frequency synthesized signal generator, frequency divider generator, sweep frequency generator, pulse and square wave generator, function generator, wave analyzers, harmonic distortion analyzer, spectrum Analyzer. The second part of the course covers the instrumentation which includes the control of physical parameters using electronic P, I, and PID controllers, it covers the temperature measurement and control using RTD, thermistor, thermocouple, semiconductor junction thermometers, infrared Thermometers, pyro-electric thermometers, fiber optic temperature sensor, intelligent Temperature measuring instruments. It also covers the pressure measurement using primary sensing element like bellows, bourdon tube, manometers, diaphragm, resistive, inductive, and capacitive pressure sensor, and dead weight gauge. It also covers the flow measurement using differential meters, variable area flow meters, electromagnetic flow meters, ultrasonic Flow meters. It also discusses the level measurement using float level meters, capacitance probes, hydrostatic pressure system, ultrasonic and radar Methods. It also covers the basic measurement of light intensity using photovoltaic cell, phototransistor, photoconductive cells and also the introduction to viscosity, pH measurement and gas sensing analysis. Lectures, theoretical assignments, and presentations will be used in this course.

References

H.S. Kalsi (2010), Electronic Instrumentation,3rd Edition, Tata Mc Graw Hill
U.A. Bakshi, A.V. Bakshi, (2010), Electronics Measurements and Instrumentation, Technical Publication
Klaas B. Klaassen, (2002),Electronic Measurement and Instrumentation, Cambridge University Press.
https://www.omega.com/en-us/resources/flow-meters
https://www.smar.com/en/technical-article/pressure-measurement-characteristics-technologies-and-trends
https://cfdflowengineering.com/basic-of-flow-measurement-techniques

Learning Outcomes

CLO 1: Determine the function elements of measurement system like data measurement, data manipulation and data presentation
CLO 2: Identify the different signal generators used and their applications.
CLO 3: Illustrate the working of oscilloscope, digital storage oscilloscope, working principle and the block diagram representation.
CLO 4: Classify the various types of display devices used like LED, LCD and Dot Matrix.
CLO 5: Interpret the various pressure measurement devices, wave form analyzers like spectral analyzer used in industry
CLO 6: Demonstrate experiment using temperature, pressure sensors, PID controllers and flow meters used in industry.

Tutorials

LAB 1: Study of electronic-proportional controller and verify the output.
LAB 2: Study of electronic-PI controller and verify the output.
LAB 3: Study of electronic PID Integral controller and verify the output and application of PID to control the temperature.
LAB 4: Pressure measurement using dead-weight gauge and Bourdon tube.
LAB 5: Flow measurement using differential-flow meters, variable-area flow meters, electromagnetic-flow meters, and ultrasonic-flow meters.
LAB 6: Study of phototransistor.
LAB 7: Study of photoconductive cell.
LAB 8:Study of light-detecting resistor.
LAB 9: Study of PH measurement and control.
LAB 10: Study of rotameter to measure flow.

EET351: Digital Signal Processing

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: EET212

Course Description

Digital programmable system allows flexibility in reconfiguring the digital signal processing operations simply by changing the program. Reconfiguration of an analog system usually implies a redesign of the hardware. In addition, digital systems provide much better control of accuracy than analog systems by specifying the accuracy requirements in A/D converter (number of levels). In analog systems, it is difficult to control the accuracy because it is affected by other factors, for example, the circuit components (resistors and capacitors) are affected by temperature. The course recalls the basic concepts in digital signal processing and for linear time-invariant (LTI) systems, aims to find the z-transform and recognize its application for LTI systems, targets to find and identify the discrete Fourier transform and fast Fourier transform, and identify each of infinite impulse response (IIR) digital filter and finite impulse response (FIR) digital filter and recognize their design.

References

J. Proakis, Digital Signal Processing: Principles, Algorithms, and Applications", Communication Systems, 4th edition, Prentice-Hall, 1996.

Learning Outcomes

CLO 1: Recall the basic concepts in digital signal processing. CLO 2: Recall the basic concepts for linear time-invariant (LTI) systems. CLO 3: Find the z-transform and recognize its application for LTI systems. CLO 4: Find and identify the discrete Fourier transform. CLO 5: Find and identify the fast Fourier transform CLO 6: Identify infinite impulse response (IIR) digital filter and recognize its design. CLO 7: Identify finite impulse response (FIR) digital filter and recognize its design.

EET352: Random Signals & Noise

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: GEN211

Course Description

Random signals and noise course is a basic course aiming to introduce stochastic processes, probability and statistics information and queuing theory. A Prerequisite for this course is probability and statistics. The course offers an overview on basic stochastic processes and queuing systems which are highly important in modeling any desired system. Among its' basic topics are: Discrete and continuous distributions, Poisson and exponential processes and Markovian queues. The course is beneficial for students who will continue in the research field as well as those targeting a job in the networking or communication fields.

References

“Probability and Random Processes with Applications to Signal Processing and Communications”, S. L. Miller, and D. G. Childers, Elsevier Academic Press, 2004. “Analysis of Computer and Communication Networks ”, F. Gebali, Springer, 2008

Learning Outcomes

CLO 1: Solve challenging problems on stochastic processes.
CLO 2: Analyze real-life systems using probability distributions.
CLO 3: Differentiate between continuous and discrete models.
CLO 4: Setup queuing models for real applications.
CLO 5: Measure performance metrics for modeled systems.
CLO 6: Experiment modeling of a simple queuing model with the aid of simulators such as MATLAB.
CLO 7: Acquire excellent skills in programming queuing models.
CLO 8: Develop good understanding for probability theory concepts and their applications to practical fields.

EET391: EET Internship II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
0	0	360	360	3	180			50	0	50

Course Description

Internship provides an opportunity to practice and/or apply knowledge and skills in professional environments and gain valuable work experience. Through the Internship students get exposure to the industrial environment which cannot be simulated in the classroom. During the internship, students have to understand and sharpen the real-time technical/managerial skills required at the job(s). Further, they have to Understand the social, economic, and administrative considerations that influence the working environment of industrial organizations. Overall professional development of students required problem-solving, communication, human development, and relationship-building skills. Students select the internship field in consultation with an industry mentor and faculty guide in terms of the academic requirements. The student is supposed to produce a joining letter and a successful completion certificate. once the internship is over. Internship evaluation can be based on the quality of projects completed as part of the internship activities. Faculty Member(s) has to evaluate(s) the performance of students once by visiting the Industry/Organization and the Evaluation Report of the students' needs to submit in the department office with the consent of Industry persons/ mentor. The students will be exposed to the industry environment for a minimum period of 08 weeks duration to understand the operation of the industrial facility.

References

https://www.youtube.com/watch?v=jpf9J2TUJVg
https://www.youtube.com/watch?v=KqIshDsg494
https://www.youtube.com/watch?v=E1UcIHW5rSc

https://www.youtube.com/watch?v=EhnfOUrFgxM

Learning Outcomes

CLO 1: Analyze the assigned task and solve it by applying critical thinking and problem-solving skills.
CLO 2: Collaborate and communicate effectively with different professionals in the work environment.
CLO 3: Communicate effectively through the technical presentation.
CLO 4: Design solutions with contextual constraints, acquiring and applying new knowledge.
CLO 5: Recommend solutions for improved processes and optimal use of resources.
CLO 6: Evaluate career options by considering opportunities in industry and higher education and sharpen the real-time technical/managerial skills required at the job(s) during the internship.
CLO 7: Demonstrate ethical and professional behavior in the work environment.

EET411: Microelectronics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: EET231

Course Description

After finishing this course, students will be to analyze and design advanced analog circuits. Build the fundamental circuits for design of integrated circuits. Be able to determine the parameters, characteristics and specifications of analog circuits.

References

“Analysis and Design of Analog Integrated Circuits”, Gray, Hurst, Lewis & Meyer
"Fundamentals of Microelectronics”, Razavi
“Design of Analog CMOS Integrated Circuits”, Razavi
“Analog Integrated Circuit Design”, Johns & Martin

Learning Outcomes

CLO 1: Students should be to analyze and design advanced analog circuits. CLO 2: Students should be to build the fundamental circuits for design of integrated circuits. CLO 3: Students should be tobe able to determine the parameters, characteristics and specifications of analog circuits.

EET412: Detection & Estimation

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

Classical estimation, where the parameter to be estimated is deterministic, [minimum variance unbiased estimation (MVU), Cramer-Rao lower bound (CRLB), best linear unbiased estimator (BLUE), and least squares estimator)]. Bayesian estimation, where the parameter to be estimated is random [minimum mean square error estimator (MMSE), maximum a posteriori estimator (MAP), and linear MMSE estimator].

References

H.L. Van Trees, Detection, Estimation, and Linear Modulation Th+F164eory, vol. I. John Wiley& sons, New York, 2001.
Don. H. Johnson, Statistical Signal Processing: Detection Theory, Houston, TX, 2013.
S. Kay, Fundamentals of Statistical Signal Processing: Estimation Theory, Prentice Hall, 1993.
S. Kay, Fundamentals of Statistical Signal Processing: Detection Theory, Prentice Hall, 1993.

Learning Outcomes

CLO 1: The student should be familiar with classical estimation, where the parameter to be estimated is deterministic, [minimum variance unbiased estimation (MVU), Cramer-Rao lower bound (CRLB), best linear unbiased estimator (BLUE), and least squares estimator)]. CLO 2: The student should be familiar with Bayesian estimation, where the parameter to be estimated is random [minimum mean square error estimator (MMSE), maximum a posteriori estimator (MAP), and linear MMSE estimator].

EET421: Optoelectronics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

The course covers the Gaussian beam, which is the mode of propagation in free-space, optical communication. Topics include Bessel beams characterized by an unusually long focal length, optical tweezers useful for manipulating microbiological objects like DNA, and laser cooling leading to noise-free spectroscopy. In addition, the course comprehensively treats external field effects on crystals, such as the photorefractive effect. Moreover, the course deals with the state of polarization of light. Further, basic optical phenomena such as reflection and refraction, which depend on the state of polarization of the light, are discussed.

Learning Outcomes

CLO 1: Understating the notion of Fabry–Perot resonators, beams, and radiation pressure.
CLO 2: Discussing the optical properties of crystals under various external fields.
CLO 3: Understanding polarization of light.

EET422: Integrated Optics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

The course explains how a light wave propagates through a planar optical guide, which is the foundation of integrated optics. The concept of propagation modes is fully explored. Cases for multilayer optical guides are also included. The course also presents optical fibers, which are the key components in optical communication systems. Important considerations in the choice of optical fibers are attenuation during transmission and dispersion causing distortion of the light pulse. Such special purpose optical fibers as the dispersion-shifted fiber, polarization-preserving fiber, diffraction grating imprinted fiber, and dual-mode fiber are described. In addition, the course contains a description of light detectors for laboratory as well as communication uses. Mechanisms for converting the information conveyed by photons into their electronic counterparts are introduced. Various detectors, such as the photomultiplier tube, the photodiode, and the avalanche photodiode, and various detection methods, such as direct detection, coherent detection, homodyne detection, and detection by stimulated Brillouin scattering, are described and their performance is compared for the proper choice in a given situation. Furthermore, the course briefly reviews of relevant topics in quantum electronics, followed by an in-depth look at optical amplifiers. The optical amplifier has revolutionized the process of pulse regeneration in fiber-optic communication systems. Moreover, the course overviews different types of lasers, followed by an in-depth treatment of semiconductor lasers, which are the preferred light sources for most fiber-optic communication systems. The basic relationship among the laser structure, materials, and operational characteristics are clarified. The ability to tune the laser wavelength, which is indispensable to the wavelength division multiplexing of the communication system, is addressed. The quantum well, quantum wire, and quantum dot laser diodes that have low threshold current and hence a high upper limit on the modulation frequency are also included. The design skills developed throughout the course are interweaved with realistic problems in fiber-optic communication systems.

Learning Outcomes

CLO 1: identifying the notion of planar optical guides for integrated optics, modes, and dispersion in optical fibers.
CLO 2: Understating essential elements in integrated optics such as detection of light, optical amplifiers, transmitters, communication by fiber optics.

EET431: VLSI Design

Contact Time				CH	SWL	Exams Time		Marks		

LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: EET332

Course Description

Overview of VLSI. Technologies for Micro and Nanostructures. Low Voltage and power design. Synchronous and Asynchronous Circuit Design. Architectures for VLSI Applications. Test and Measurement Techniques for VLSI Circuits.

References

Anantha Chandrakasan, William J. Bowhill, Frank Fox, “Deign of high performance microprocessor circuits”
John P. Uyemura, “Introduction to VLSI circuits and systems”

Learning Outcomes

CLO 1: Performing an overview of VLSI.
CLO 2: Understanding technologies for Micro and Nanostructures.
CLO 3: Considering Low Voltage and power design.
CLO 4: Identifying Synchronous and Asynchronous Circuit Design.
CLO 5: Identifying Architectures for VLSI Applications.
CLO 6: Addressing Test and Measurement Techniques for VLSI Circuits.

EET432: Communication Electronics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

Give an introduction to the basic concepts of electronic communication systems. Address the design of communication systems building blocks: multipliers, Oscillators, Frequency synthesizers and power amplifiers.Describe communications systems, such as amplitude modulation (AM), frequency modulation (FM), phase modulation (PM). Discuss some significant systems, such as television systems, satellite communications systems

References

Wayne Tomasi, “Electronic Communication Systems,” Prentice Hall, ISBN: 0-13-049492-5
Frank R. Dungan, “Electronic communications systems,” PWS Publishers, ISBN 0-534-07698-x
William schweber, “Electronic Communications systems: Acomplete Course,” Prentice Hall, ISBN 0-13-590092-1
Behzad Razavi, “RF Microelectronics,” Prentice Hall PTR, ISBN 0-13-887571-5

Learning Outcomes

CLO 1: Give an introduction to the basic concepts of electronic communication systems
CLO 2: Address the design of communication systems building blocks: multipliers, Oscillators, Frequency synthesizers and power amplifiers
CLO 3: Describe communications systems, such as amplitude modulation (AM), frequency modulation (FM), phase modulation (PM)
CLO 4: Discuss some significant systems, such as television systems, satellite communications systems

EET433: Selected Topic in Electronics I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

EET434: Selected Topic in Electronics II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

EET451: Information Theory

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

Fundamentals of Information Theory (Information measures, Shannon’s theorems on source coding and channel coding, and the rate distortion theorem). Source Coding (Huffman Tunstall coding, Lempel-Ziv-Welch coding, Elias-Willems coding). Channel Coding (Channel coding theorems, Tree and trellis codes, Channel models, Band-limited Gaussian channels, Channel capacity, error probabilities). Cryptology (Classical methods of encryption and decryption, Symmetrical encryption techniques, Data encryption standard (DES), The RSA encryption technique, Private and public key systems, Key management, Electronic signatures).

References

T. Cover and J. Thomas, “Elements of Information Theory”, 2nd Edition, John Wiley & Sons, 2006, ISBN-13: 978-0471241959
R. W. Yeung, “Information Theory and Network Coding”, Springer, 2008, ISBN-13: 978-0387792330
S. Lin and D. J. Costello, “Error Control Coding: Fundamentals and Applications”, Prentice-Hall, Inc., ISBN: 0-13-283796-4
David J. C. MacKay, “Information Theory, Inference and Learning Algorithms”, Cambridge University Press, 2003, ISBN-13: 978-0521642989
B. Schneider, “Applied Cryptography”, John Wiley & Sons, 2015, ISBN-13: 978-1119096726

Learning Outcomes

CLO 1: Understand the fundamentals of Information Theory (Information measures, Shannon’s theorems on source coding and channel coding, and the rate distortion theorem). CLO 2: Understand Source Coding (Huffman Tunstall coding, Lempel-Ziv-Welch coding, Elias-Willems coding). CLO 3: Understand Channel Coding (Channel coding theorems, Tree and trellis codes, Channel models, Band-limited Gaussian channels, Channel capacity, error probabilities). CLO 4: Understand the meaning of Cryptology (Classical methods of encryption and decryption, Symmetrical encryption techniques, Data encryption standard (DES), The RSA encryption technique, Private and public key systems, Key management, Electronic signatures).

EET452: Modulation & Coding

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

Communications: Modulation and Coding constitute two thirds of the soul of digital communications. Networks: In order to design a communication network, a good understanding of the
physical layer capabilities of such a network is of significant importance.

References

B. Sklar, “Digital Communication: Fundamentals and Applications”, 2nd Edition, Prentice-Hall, 2001, ISBN 0-13-084788-7
J. G. Proakis, “Digital Communications”, 4th Edition, McGraw-Hill, 2001, ISBN 0-07-118183-0
S. Haykin, “Communication Systems”, 4th Edition, Wiley, 2000, ISBN 0-471-17869-1
R. D. J. van Nee, “OFDM for Wireless Multimedia Communications”, Artech House Publishers, 1999, ISBN 978-0890065303

Learning Outcomes

CLO 1: Review the basics of modulation and coding.

CLO 2: Address the trade-offs of modulation and coding.
CLO 3: Address the state-of-the-art digital modulation techniques.
CLO 4: Address the state-of-the-art coding techniques.
CLO 5: Identify how modulation and coding complement each other in the latest generations of digital communications.

EET453: Source Coding & Compression

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

Introduction to digital communication system. Definitions of source and data compression. The basics mathematical knowledge needed for source modeling (Probability, Random variables, and random processes). Brief review of the basics of information theory and source modeling. Efficient Source Coding and Prefix Code. Lossless Compression Techniques, Shannon Fano Code, Huffman Code, Conditional Huffman Code, Adaptive Huffman Code, Tunstall Code, Tunstall Code. Arithmetic codes and Dictionary codes.

References

Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann, 3rd. Ed., 2006

Learning Outcomes

CLO 1: Revise the basic concepts in a digital communication system. CLO 2: Define source and data compression. CLO 3: Review the basics mathematical knowledge needed for source modeling (Probability, Random variables, and random processes). CLO 4: Review the basics of information theory and source modeling. CLO 5: Understand efficient Source Coding and Prefix Code. CLO 6: Identify Lossless Compression Techniques, Shannon Fano Code, Huffman Code, Conditional Huffman Code, Adaptive Huffman Code, Tunstall Code, and Tunstall Code. CLO 7: Identify Arithmetic codes and Dictionary codes.

EET454: Adaptive Antennas

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

Generally our objective is to understand the relationship between smart antennas and modern communication systems concerning [the reason for adaptive antenna system, adaptive antenna capability, NB vs. WB traditional BF, distinguish between BF and beam steering, and different algorithms for adaptive antennas]. Temporal reference BF.[Steepest descent method, Least Mean square (LMS),.Direct Matrix Inversion (DMI), Recursive Least Square (RLS)]. Blind Algorithm [Constant Modulus Algorithm (CMA)]. Spatial reference BF (DoA) [Fourier Method,.Capon’s minimum variance,.MUltiple SIgnal Classification (MUSIC), Estimation of Signal Parameters via Rotational Invariance Technique (ESPRIT)].

References

Simon Haykin, “Adaptive Filter Theory”, 3rd edition, Prentice□Hall Inc 1996
B. Allen and M. Ghavami, “Adaptive Array Systems", John Wiley & Sons 2005
J. Proakis and D. Manolakis, “Digital Signal Processing” ,Pearson 2007

Learning Outcomes

CLO 1: Understand the relationship between smart antennas and modern communication systems concerning [the reason for adaptive antenna system, adaptive antenna capability, NB vs. WB traditional BF, distinguish between BF and beam steering, and different algorithms for adaptive antennas].
CLO 2: Identify temporal reference BF.[Steepest descent method, Least Mean square (LMS),.Direct Matrix Inversion (DMI), Recursive Least Square (RLS)]. CLO 3: Identify blind algorithm [Constant Modulus Algorithm (CMA)]. CLO 4: Identify spatial reference BF (DoA) [Fourier Method,.Capon’s minimum variance,.MUltiple SIgnal Classification (MUSIC), Estimation of Signal Parameters via Rotational Invariance Technique (ESPRIT)].

EET455: Radar Technology

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

Basic functions of wave propagation. Introduction to radar systems. Pulse radars. Continuous wave radars. Coherent and noncoherent radars. Milimetric wave radars. Radar antennas. Synthetic aperture radar. Search and tracking radars. GPS,ILS,MLS.

References

M. I. Skolnik “Introduction to Radar Systems”, McGraw-Hill Book Company
L. Warren et al. “Antenna Theory and Design”, John Wiley & Sons ISBN 0-471-02590-9
D. Pozar “Microwave and RF Wireless Systems”, John Wiley & Sons

Learning Outcomes

CLO 1: Introduce various schemes of radar wave propagation and MW transmission
CLO 2: Understand the radar concept
CLO 3: Study some types of radars and antennas
CLO 4: Understand the navigation support systems
(ILS, MLS and GPS)

EET491: EET Project III

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	4	240			75	0	25

Requisites

- Prerequisites: EET292

Course Description

- This course enables the students to exercise some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. Further, they do market surveys about raw materials, components or finished products and identify the ethical societal and environmental issues related to the project (if there are any). The student also develops the ability to design, implement and test systems, hardware, or software. This course includes planning the tasks to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. Through this course, the student develops creativity, initiative, and capacity to perform. The leadership, supervisory, planning, and organizational skills are integrated into the learning objectives of this course. The projects has a detailed project proposal, which is executed or implemented within the time allocated, simultaneously maintaining a logbook, periodically monitored by the professor mentor. Projects are chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is to be prepared as the project progresses, which is to be submitted after the project is over. The student acquires the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1: Assess the impact of the project on society (if there is any)
CLO 2: Conduct Feasibility studies, Design projects, and Market surveys about raw materials, components or finished products

CLO 3: Design, plan and propose a project according to user requirements.
CLO 4: Apply project development methodologies appropriate to the project
CLO 5: Collaborate with team members to develop the prototype of the Application
CLO 6: Identify the ethical societal and environmental issues related to the project (if there are any)
CLO 7: Communicate project ideas and current work achievements clearly through technical report and presentations.

EET492: EET Project IV

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	4	240			75	0	25

Requisites

- Prerequisites: EET491

Course Description

This course enables the students to exercise some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. In this course, the students apply the knowledge gained during the program to design and prototype a software application that meets user needs and expectations. Further, they evaluate the impact of the product or system or process on society and draw conclusions. This course includes planning the tasks which are to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. Through this course, the student develops creativity, initiative, and capacity to perform. The student develops leadership and supervision skills which are integrated into the learning objectives of this course. The projects have a detailed project proposal, which is executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the professor mentor. Projects are chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is prepared as the project progresses, which is submitted after the project is over. The students acquire the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1: Demonstrate the ability to apply the knowledge to design and prototype a software/hardware application that meets user needs and expectations.
CLO 2: Design the project acquiring and applying new knowledge through literature review.
CLO 3: Design computing/hardware solutions considering economical, environmental, cultural, global impact and technical aspects.
CLO 4: Assess the impact of technical and system constraints to select optimal solutions.
CLO 5: Evaluate the impact of the product or system or process on society and draw conclusions.
CLO 6: Demonstrate teamwork through regular formal team meetings, project management, class presentations, and a final design presentation.
CLO 7: Assess the ethical and legal impact of the implemented product or system or process.
CLO 8: Write a technical report in a standard format and give an oral presentation.
CLO 9: Design and implement the project with modern engineering tools and software.

Department of Computer Engineering Technology

CET011: Computer 0

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	0	120	90	120	40	20	40

Course Description

Provide basic computer knowledge and skills: computer components, computer typing, computer graphics and painting, using word, excel and power point, printing and scanning, understand files and network, using internet and email, using windows system, using windows basic applications, understand flowcharts.

CET111: Introduction to Computer and Programming

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	0	180	360	4	180	90	120	60	15	25

Course Description

Computer programming performs a particular computation by designing and building an executable computer program. Students learn programming languages, software projects, organizing code, working with data, variables and strings, control constructs, constructors, destructors, functions, recursion, arrays, and programming tools. At the first stage, the student learns to identify the requirements for creating a computer program using various programming development paradigms commonly used and then identify the differences between compiled and interpreted programming languages. They learn various components used in constructing computer programs by identifying the differences between input and output data, simple/primitive data types, the advantages of modular programming using subroutines/procedures, different types of control structures, various types of operators used in programming. In order to generate a computer program, students are made aware of differences between compiled programs that use languages such as C, C++, or VB to generate applications though the course can focus on C++ programs. The knowledge and skills set of each stage in programming includes displaying syntax and semantics, algorithms, data structures, and program constructs. The system provides an opportunity for students to learn how programs are created in the abstract before applying that knowledge and the fact that such programs are usually developed through different stages of software development. Program testing is conducted for each program developed by the students. Students further learn about user-defined types, classes, references, pointers, memory management, object-oriented programming characteristics, exception handling, and input/output streams. Lectures, lab sessions, assignments and projects will be used to deliver the course.

References

Wassberg, J. (2020). Computer Programming for Absolute Beginners: Learn essential computer science concepts and coding techniques to kick-start your programming career. Packt Publishing Ltd.
Forouzan, B. A., & Gilberg, R. F. (2020). C++ Programming: An Object-Oriented Approach. McGraw-Hill Education.
https://www.learncpp.com (Retrieved from the Internet 10/11/2022)
https://researchcomputing.princeton.edu/education/external-online-resources/cplusplus(Retrieved from the Internet 10/11/2022)
https://www.w3schools.com/cpp/(Retrieved from the Internet 10/11/2022)
https://www.tutorialspoint.com/cplusplus/index.htm(Retrieved from the Internet 10/11/2022)

Learning Outcomes

CLO 1: Define a programming environment for program writing.
CLO 2: Describe the principles of data, variable and strings related to given problem.
CLO 3: Explain how programming can be useful in day-to-day life.
CLO 4: Identify, and solve problems using programming techniques to provide good solutions.
CLO 5: Demonstrate the basic concepts of control and structured programming using functions, arrays and pointers for implementation of program.
CLO 6: Execute, debug and test application programs to validate the outcome.
CLO 7: Write lab programs and present the results.

Tutorials

WEEK 1: Induction to Lab policies, reports
WEEK 2: Introduction to TURBO C++ IDE and Programming Environment
WEEK 3: C Building Blocks
WEEK 4: Decision making the if and if-else structure
WEEK 5: Decision making the Switch case and conditional operator.
WEEK 6: Loop Constructs in C++ Language.
WEEK 7: Nested looping
WEEK 8: Arrays in C++ (single dimensional).
WEEK 9: Arrays in C++ (Multidimensional).
WEEK 10: Structures and Unions.
WEEK 11: Pointers in C++
WEEK 12: Pointers with arrays and function.
WEEK 13: File Handling in C++
WEEK 14: Error Handling in C++
WEEK 15: Lab Final Exam.

CET112: Object Oriented Programming

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	0	180	360	4	180	90	120	60	15	25

Requisites

- Prerequisites: CET111

Course Description

Software industry uses the object-oriented programming (OOP) model to organize software design around data or objects rather than functions and logic. Object oriented programming concepts are important in building the foundation for any application program. In the first phase of the course, students are introduced to the principles and practices of system analysis and design. Students learn object□oriented programming design, decision statements, control statements, loops, arrays, class and objects, inheritance (single, multilevel, and hierarchical) and polymorphism. Other topics in the course are abstraction, encapsulation, information hiding, association, aggregation, and collection, coupling and cohesion, use of standard object libraries, interfaces, exception handling, object-oriented design, recursions, database connectivity and design of user interface in the Java programming environment. Thus, knowledge and skills of the course cover visibility of attributes and operations (private, public, protected) with object-oriented life cycles pattern. Students further learn to implement a solution from an object-oriented design using techniques with operators and control structures, defining, accessing, and manipulating data structures, creating constructor methods and method overloading etc. A final test of the entire course will be to assess how students have achieved the skills to write programs constructed from objects and classes, hide internal workings of objects by encapsulation, create new classes by inheriting properties and methods from existing classes and create a single interface to entities of different types by means of polymorphism. The teaching approach include lectures, learning by doing sessions, assignments, and project.

References

Dean, J., & Dean, R. (2021). Introduction to programming with Java: a problem-solving approach. McGraw-Hill.
https://docs.oracle.com/en/java/ (Retrieved from the Internet 06/11/2022)
https://www.tutorialspoint.com/java/java_documentation.htm (Retrieved from the Internet 06/11/2022)
https://www.geeksforgeeks.org/introduction-object-oriented-programming-javascript/ (Retrieved from the Internet 06/11/2022)
https://www.javatpoint.com/java-oops-concepts (Retrieved from the Internet 06/11/2022)

Learning Outcomes

CLO 1: Identify the object-oriented programming concepts to provide solutions to complex computing problems.
CLO 2: Articulate a small-scale object-oriented application and present experimental results.
CLO 3: Demonstrate and implement the concept of inheritance and abstractions for different contexts in teams.
CLO 4: Examine and communicate the concept of polymorphism, pointers and virtual function for programming level administration in team.
CLO 5: Recognize concepts of strings, files and exception handling for given set of computing requirements.
CLO 6: Compile good programming practices in object-oriented programming to make informed judgements.
CLO 7: Write lab experiments to implement object oriented programming concepts and present lab report.

Tutorials

WEEK 1: Induction of lab policies, rules, and record writing
WEEK 2: Introduction to Object Oriented Programming Concepts.
WEEK 3: Implementing Data Type.
WEEK 4: Functions for natural numbers/grid pattern
WEEK 5: Program with Decisions, control statements and Loops
WEEK 6: Program with Arrays and Array Lists
WEEK 7: Class and objects.
WEEK 8: Program with Inheritance and Interfaces.
WEEK 9: Program with Exception Handling.
WEEK 10: Use of Built-in functions.
WEEK 11: Programs with Recursion.
WEEK 12: Programs with Database
WEEK 13: Programs with Web connectivity
WEEK 14: Programs with GUI
WEEK 15: Lab Final Exam.

CET121: Digital Logic Design

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Course Description

Digital design is used in digital electronics circuits and computers architecture, combine digital components to create circuits that perform fundamental computing tasks such as arithmetic and storage of information. Topics covered include number conversion like Binary to Octal, Binary to Hexadecimal, Binary to Gray code, Binary to BCD and vice versa. It also covers the 1s complement and 2s complement addition and subtractions. The student learns the realization of digital circuits using AND, OR, NOT, XOR Gates, representation of logical functions in Sum of Products, Products of Sum form, concept of minterms and maxterms, minimizing the digital circuits using Boolean algebra, three variable, four variable and five variable Kaurnaugh Map. The student learning also includes the 2x1, 4x1, 8x1 multiplexer, demultiplexers, encoders and decoders, parallel and series adders and subtractors. The course topics include the sequential circuits using SR, JK, T and D flip flops, synchronous and asynchronous counters, shift registers, state diagram and reduction. Students extend their knowledge to practice by way of hands-on laboratory exercises where various hardware tools are used to design and test solutions for real-world applications. Students understand the design of digital computing systems at their most fundamental level and are able to design such systems using modern tools and techniques. Design problems and assignments will be used in delivering the course.

References

Roger L. Tokheim, Patrick E. Hoppe (2021), Digital Electronics: Principles and Application, 9th Edition (Mc Graw Hilll)
https://www.tutorialspoint.com/digital-electronics-flip-flops-and-their-types
https://www.javatpoint.com/number-system-in-digital-electronics
https://www.electrically4u.com/types-of-counter-in-digital-circuit

Learning Outcomes

CLO 1: Describe the binary, octal, hexadecimal number system and calculate the conversions.
CLO 2: Illustrate logic of various logic gates and express as sum of product and product of sum form.
CLO 3: Make Combinational Circuit using minimization techniques, Boolean algebra, Karnaugh Map to develop digital logic circuits.
CLO 4: Use of sequential logic SR, JK, D, T Flip flops to design digital circuits.
CLO 5: Draw and explain multiplexer, De-multiplexer, decoder and encoder circuits.
CLO 6: Apply different method to design asynchronous and synchronous counters using state diagram to understand different logic families.
CLO 7: Demonstrate experiment in combinational, sequential circuits to learn the logic design and prototyping process in order to acquire requisite hands-on skills and report the results in formatted written document.

Tutorials

WEEK 1: To verify truth table of logic gates using IC’s
WEEK 2: To verify half adder, full adder, half subtractor, full subtractor using gates.
WEEK 3: To design a 4-bit BCD to Excess-3 code converter and verify truth table.
WEEK 4: To design circuit for binary to grey code converter and verify truth table.
WEEK 5: To perform experiment in multiplexer and De-multiplexer and verify the truth table.
WEEK 6: To verify the truth table of R-S, J-K flip flops
WEEK 7: To verify the truth table of D , T-flip flops
WEEK 8: To design a 4-bit serial in serial out shift register
WEEK 9: To design a 4-bit serial in parallel out shift register
WEEK 10: To design a 4-bit parallel in serial out shift register
WEEK 11: To design a 3-bit asynchronous UP-counter using J-K flip flops.
WEEK 12; To design a 3-bit synchronous Down counter using J-K flip flops
WEEK 13: To design binary to grey code converter and verify truth table
WEEK 14: To design BCD to Seven segment display
WEEK 15: Lab Final Exam

Laboratories

WEEK 1: Numerical on Binary to Decimal, Binary to Hexadecimal and Octal and vice versa
WEEK 2: Numerical on BCD to Gray, Decimal to BCD and vice versa
WEEK 3: Numerical on 1s complement subtraction
WEEK 4: Numerical on 2s complement subtraction
WEEK 5: Numerical on simplifying the Boolean expressions
WEEK 6: Numerical on 2 and 3 variable K Map
WEEK 7: Numerical on 4 Variable and 5 variable K Map
WEEK 8: Drawing 8x1 Multiplexer and 1x8 Demultiplexer
WEEK 9: Drawing encoders and decoders
WEEK 10: Designing UP counter using Flip Flop

WEEK 11: Designing Down counter using Flip Flop
WEEK 12: Designing serial to parallel converter using shift registers
WEEK 13: Designing parallel to serial converter using shift register.
WEEK 14: Implementing Boolean expression using PAL
WEEK 15: Implementing Boolean expression using PROM

CET122: Introduction to Computer and Programming for IT

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	0	180	360	4	180	90	120	60	15	25

Course Description

This course is your gateway to the digital world! We'll embark on a journey to understand the fundamental building blocks of computers, from the physical components you can see to the software programs that make them tick. You'll delve into the inner workings of hardware, like the CPU, memory, and storage devices, gaining a clear picture of how they work together to process information. We'll also explore basic software concepts like operating systems and common application software, equipping you with the skills to navigate your computer with confidence.
The course won't stop there! We'll introduce you to the fascinating world of programming, providing a glimpse into how computers understand and execute instructions. You'll learn basic programming concepts like variables, data types, and simple algorithms, giving you a taste of the logic behind creating software. By the end, you'll have a solid foundation in computer hardware and software, empowering you to use computers effectively and explore the vast possibilities of technology.

References

Computers & Technology by Floyd P. Hassel (Latest Edition)
Absolute Beginner's Guide to Computer Basics by Greg Perry (Latest Edition)
How Computers Work by Ron White (Latest Edition)
Illustrated Guide to PC Hardware & Upgrades by Roger A. Grimes (Latest Edition)
Python Crash Course by Eric Matthes (Latest Edition)

Learning Outcomes

Identify and explain the functions of major computer hardware components.
Understand the role of software, including operating systems and application software.
Navigate a computer operating system effectively.
Grasp basic programming concepts like variables, data types, and algorithms.
Apply basic troubleshooting techniques for common computer issues.
Communicate effectively about computer technology using appropriate terminology.

CET123: Foundation of Information Technology

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	0	180	360	4	180	90	120	60	15	35

Requisites

- Prerequisites: CET122 OR CET111

Course Description

This course provides a foundational understanding of key concepts in information technology (IT). It covers essential topics such as computer hardware, software, networking, databases, and the internet. The course is designed to give students a broad overview of IT, equipping them with the basic knowledge necessary for more advanced study and practical application in the field. Emphasis is placed on understanding how IT supports and enhances various business and organizational functions.

References

"Introduction to Information Technology" by Chris B. Roe
"Computer Concepts: Illustrated Introductory" by Gary B. Shelly and Misty E. Vermaat
"Fundamentals of Information Systems" by Ralph M. Stair and George W. Reynolds

"Networking All-in-One For Dummies" by Doug Lowe

Learning Outcomes

Understand basic IT concepts, including hardware, software, and networking.
Explain the components and functions of computer systems.
Describe the role of databases and data management in IT.
Identify key internet technologies and their applications.
Apply basic IT knowledge to solve practical problems and support business functions.
Recognize the impact of IT on various industries and organizational operations

CET141: Database Management Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Course Description

Database management system provides the foundation needed for a career in database development or data warehousing for business intelligence specialization. Students will learn to create relational databases, write MySQL statements to create tables with relationships in a database, extract information to satisfy business reporting requests, create entity relationship diagrams (ERDs) to design databases, and analyze table designs using database querying, optimization techniques, database tuning, normalization techniques, transaction processing, concurrency control and recovery and new application developments. The course helps students understand the fundamentals of database design with knowledge and skills of concepts and terminology of the entity-relationship model, primary and foreign keys, the process of normalization while creating a database structure with integrity constraints and table subsets. Students further learn to develop SQL commands to manage database information through building basic queries, using expressions in a select clause, retrieving specific rows from tables, grouping data records, sorting data records, and joining data in related tables. The course expects students to gain thorough knowledge of entity, relationship, attribute, domain, Associations: 1:1, 1:M, M:N, table; column, row, field, rules for relational data model (for example, unique identifier (atomic)) and the purpose and uniqueness of keys in a database system and all the normalization forms such as UNF, 1NF, 2NF and 3NF and the purpose of each stage of normalization. Lectures, practical lab sessions, and assignments will be used to deliver the course.

References

Ramez Elmasri, Shamkant B. Navathe (2022). Fundamentals of Database Systems Seventh Edition, 7th Edition. PEARSON.
Abraham Silberschatz , Henry Korth, S. Sudarshan (2022), Database System Concepts 7th Edition, McGraw-Hill
https://dev.mysql.com/doc/(Retrieved from the Internet 04/11/2022)
https://dev.mysql.com/doc/workbench/en/(Retrieved from the Internet 04/11/2022)
https://www.oracle.com/technetwork/mysql-hands-on-lab-403032.pdf(Retrieved from the Internet 04/11/2022)

Learning Outcomes

CLO 1: Associate a conceptual schema from real-world problems, restate program-data independence, data models for database systems, and database schema and database instances as per user requirements.
CLO 2: Make relational models to create and implement the database using SQL.
CLO 3: Examine relational algebra and tuple calculus in DBMS to determine and restate a database, with free from anomalies.
CLO 4: Define and administer query processing techniques for database optimization and tuning.
CLO 5: Distinguish various concurrency control techniques, security and recovery methods for regaining the database in critical circumstance.
CLO 6: Execute, debug and test SQL queries to validate the outcome.
CLO 7: Write lab reports and present results.

Tutorials

WEEK 1: Familiarize lab policies, rules and lab record writing / Understand the MySQL Workbench environment.
WEEK 2: Understand Database/ Structures / tables.
WEEK 3: Database Key(s) and relationships.
WEEK 4: Use of Primary Key and relationships.
WEEK 5: Querying Using various SQL statements.
WEEK 6: Use of Foreign Key in tables.
WEEK 7: Use functions in SQL statements.
WEEK 8: Complicated relational DB creations with constraints.
WEEK 9: Complex Queries.
WEEK 10: Triggers and Views.
WEEK 11: Table modifications, DML Commands.

WEEK 12: Update statements
WEEK 13: Use of Joins.
WEEK 14: Use of PL/SQL.
WEEK 15: Lab Final Exam.

CET142: Data Management Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Course Description

This course focuses on the implementation aspects of data management systems, starting with relational database engines to introduce the fundamental concepts of efficient data processing. The course then expands these concepts to modern implementations used in data centers and cloud environments. Students will explore key topics such as storage, data access, indexing, consistency, concurrency, and transactions from a systems implementation perspective.
It also covers key topics such as data modeling, database design, data storage, retrieval, security, and governance. The course also addresses the role of data management in decision-making processes, emphasizing the importance of data quality and integrity. Students will gain hands-on experience with data management tools and techniques used in the industry.

References

"Data Management for Researchers" by Kristin Briney
"Data Warehousing Fundamentals" by Paulraj Ponniah
"The Data Warehouse Toolkit" by Ralph Kimball and Margy Ross
Ramez Elmasri, Shamkant B. Navathe (2022). Fundamentals of Database Systems Seventh Edition, 7th Edition. PEARSON.
Abraham Silberschatz , Henry Korth, S. Sudarshan (2022), Database System Concepts 7th Edition, McGraw-Hill
https://dev.mysql.com/doc/(Retrieved from the Internet 04/11/2022)
https://dev.mysql.com/doc/workbench/en/(Retrieved from the Internet 04/11/2022)
https://www.oracle.com/technetwork/mysql-hands-on-lab-403032.pdf(Retrieved from the Internet 04/11/2022)

Learning Outcomes

Understand the fundamental concepts of data management systems, including storage, indexing, concurrency, and transactions.
Analyze the implementation of these concepts in relational database engines.
Evaluate the effectiveness of various data management strategies in different system environments.
Implement and optimize data management techniques in both traditional and cloud-based systems.
Apply knowledge of modern data management technologies to solve real-world problems in data centers and cloud environments.

CET153: Basics of Game Graphics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Course Description

This course provides a foundational understanding of graphics for game development, bridging theory and practice. Students explore the principles of 2D and 3D graphics, including coordinate systems, pixel manipulation, and the basics of rasterization. The course introduces rendering concepts like sprites, basic shading (flat vs. gradient), and perspective projection, with examples from classic and modern games. Tools like Photoshop or GIMP are used to create 2D assets (e.g., character sprites, tilesets), while Blender introduces 3D modeling basics (e.g., creating simple objects like cubes or spheres). Labs focus on integrating these assets into a game engine (e.g., Unity), building a small scene with animated 2D sprites and a static 3D model. Students also learn about color theory, resolution optimization, and file formats (e.g., PNG, OBJ) to ensure compatibility and performance in games.

References

Akenine-Möller, T., et al. (2018). *Real-Time Rendering* (4th ed.). CRC Press.
Blender Foundation. *Blender Tutorials*. https://www.blender.org

Learning Outcomes

LO1: Students will be able to describe the basic concepts, terminology, and roles of graphics in digital games, including differences between 2D and 3D graphics.
LO2: Students will understand image resolution, color models, file formats, and the processes involved in creating and manipulating digital images for games.
LO3: Students will comprehend the workflow for producing 2D and 3D assets and integrating them into game engines.
LO4: Students will understand the principles of texture mapping, material assignment, and their impact on visual quality and realism.
LO5: Students will be able to explain the basics of lighting and shading models and their application in game environments.
LO6: Students will recognize and differentiate between various visual styles (e.g., pixel art, realism, stylized) and their suitability for different game genres.
LO7: Create and edit 2D graphics (sprites, backgrounds, textures) using industry-standard software.
LO8: Construct and manipulate simple 3D models, applying textures and materials.
LO9: Import, configure, and optimize 2D and 3D assets within a modern game engine.
LO10: Apply basic lighting and shading to game scenes to enhance visual impact.
LO11: Adapt and implement different art styles to suit specific game design goals.
LO12: Collaborate effectively in asset production teams, provide and incorporate feedback, and document asset creation processes.
LO13: Critically analyze the suitability of different graphic techniques and styles for various game projects.
LO14: Address and resolve technical and creative challenges in asset creation and integration.
LO15: Clearly communicate design choices, production processes, and technical requirements related to game graphics.
LO16: Independently learn and apply new tools, techniques, and trends in game graphics.
LO17: Demonstrate awareness of ethical, cultural, and sustainability considerations when creating and selecting graphic content for games.

Lectures

Week 1: Course overview, history of game graphics, introduction to digital imaging, and the role of graphics in games.
Week 2: Image resolution, color models (RGB, CMYK), bit depth, and file formats (PNG, JPEG, BMP).
Week 3: Principles of 2D graphics, sprite sheets, transparency, and animation basics.
Week 4: Textures in games, seamless tiling, and UV mapping basics.
Week 5: 3D coordinate systems, meshes, vertices, edges, and faces; overview of 3D modeling software.
Week 6: Basic lighting models, material properties, and shading techniques.
Week 7: Rendering pipelines, rasterization vs. ray tracing, and real-time rendering in games.
Week 8: Importing graphics into game engines (e.g., Unity, Unreal); asset management and optimization.
Week 9: Principles of UI design, HUD elements, icons, and menus in games.
Week 10: Keyframes, timelines, and basic animation principles for both 2D and 3D assets.
Week 11: Particle systems, special effects, and shaders for visual impact in games.
Week 12: Optimizing graphics for performance (polygon count, texture size, LOD); mobile vs. desktop considerations.
Week 13: Overview of popular art styles (pixel art, cel-shading, realism, stylized); adapting graphics to game genres.
Week 14: Best practices for asset presentation, portfolio development, and industry expectations.

Laboratories

Week 1: Setting up graphics software (e.g., Photoshop, GIMP, or Krita); exploring the user interface.
Week 2: Creating and saving images in different formats; experimenting with color modes.
Week 3: Drawing and animating simple sprites; exporting sprite sheets for use in game engines.
Week 4: Creating seamless textures; applying textures to simple 3D models.
Week 5: Navigating 3D modeling software (e.g., Blender); creating basic 3D shapes.
Week 6: Applying materials and simple lighting to 3D objects; experimenting with shaders.
Week 7: Rendering scenes with different settings; comparing real-time and offline rendering.
Week 8: Importing and using custom graphics assets in a game engine; troubleshooting common issues.
Week 9: Designing and implementing UI elements; creating interactive menus.
Week 10: Creating simple animations for characters or objects; exporting animations for use in games.
Week 11: Designing basic particle effects; experimenting with shader parameters.
Week 12: Profiling and optimizing game assets; reducing file sizes without significant quality loss.
Week 13: Creating assets in different styles; group critique and feedback session.
Week 14: Final project presentations; peer and instructor feedback; course wrap-up and reflection.

CET161: Network Basics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Course Description

The industry needs professionals who understand the basics of networks, which are the backbone for exchanging data/resources. Students learn how data is sent and received in a computer network and how small computer networks are created. The student learns about device configuration, protocols, and models, layering concepts, security fundamentals, and wireless networks. IP addressing within the context of the internet and intranet are discussed in various practical's along with network components, like, switches, routers, and hubs. The student learning also includes building simple and complex networks, visualize how a network works, integrate devices, or automate the network using packet tracer (a simulation tool by CISCO Systems). The topics include Dynamic Host Configuration Protocol (DHCP) related to static and dynamic addresses, public and private, and Network Address Translation (NAT). The course includes implementation, design principles and goals of a computer network and touches upon the various routing algorithms. The student explores the principles of IP addressing and fundamentals of Ethernet concepts, media, and related operations. The topics also include basic networking concepts, various networking devices such as the hub, switches, routers etc., configuring various networking scenarios using packet tracer simulation and how to apply IP addressing schemes. Lectures, Practical lab sessions, simulations, and assignments, will be used to deliver the course.

References

Press, C. (2020). Introduction to networks: companion guide (CCNAv7).
Stallings, W. (2015). Data and Computer Communications, International Edition. Pearson Education UK.
Alin, G. (2022). Practical assignments for CCNA7 COURSE, part 2: Switching Routing Wireless Essentials. Southeast Europe Journal of Soft Computing, 11(1), 13-18.
Udemy, "Introduction to networking for complete beginners", https://www.udemy.com/course/introduction-to-networking-for-complete-beginners/, Accessed on 15.10.2022
CISCO, "Networking Essentials", https://www.netacad.com/courses/networking/networking-essentials, Accessed on 15.10.2022
UDACITY, Computer Networking, https://www.udacity.com/course/computer-networking--ud436 Accessed on 15.11.2022

Learning Outcomes

CLO 1: Classify the different types of network devices to solve computing problems as per given requirement.
CLO 2: Examine home and small business networks to connect with the Internet.
CLO 3: Demonstrate the basic configuration process to accomplish group tasks related to IP services.
CLO 4: Relate reference models and layered architectures in networking to apply, integrate and administer secure computing technologies as per user requirement.
CLO 5: Analyze the principles of networking protocols and standards.
CLO 6: Diagnose the process of troubleshooting in team for a small-scale computer network.
CLO 7: Simulate, configure, and troubleshoot, network-based activity and prepare lab record for presentation.

Tutorials

WEEK 1: Researching Network Collaboration Tools and Converged Network Services.
WEEK 2: Packet Tracer - Network Representation Instructions and Navigating the IOS Instructions
WEEK 3: Establishing a Console Session with Tera Term and Configuring Initial Switch Settings Instructions.
WEEK 4: Building a Simple Network and Implementing Basic Connectivity Instructions.
WEEK 5: Configuring a Switch Management Address and researching Networking Standards.
WEEK 6: Investigating the TCP/IP and OSI Models in Action Instructions and using Wireshark to View Network Traffic.
WEEK 7: Observing DNS Resolution and exploring FTP.
WEEK 8: Using Wireshark to Observe the TCP 3-Way Handshake and to Examine a UDP DNS Capture.
WEEK 9: Viewing Host Routing Tables and to configure Initial Router Settings Instructions.
WEEK 10: Connect a Router to a LAN Instructions.
WEEK 11: Identifying IPv4 Addresses and configuring IPv6 Addresses on Network Devices.
WEEK 12: Troubleshooting IPv4 and IPv6 Addressing Instructions.
WEEK 13: Implementing a Submitted IPv6 Addressing Scheme Instructions.
WEEK 14: Connecting a Wired and Wireless LAN Instructions and managing Device Configuration Files Using TFTP, Flash, and USB.
WEEK 15: Lab Final Exam.

CET171: Business Foundation for IT

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	35

Course Description

This course provides a comprehensive introduction to fundamental business concepts and practices essential for professionals in the IT industry. The course covers key areas such as business strategy, financial management, marketing, operations, and human resources, all within the context of IT. Students will learn how to apply business principles to IT projects and how IT can drive business success. The course aims to bridge the gap between technical expertise and business acumen, preparing students to effectively contribute to the strategic goals of their organizations.

References

"Essentials of Business Processes and Information Systems" by Simha R. Magal and Jeffrey Word
"Financial Intelligence for IT Professionals" by Karen Berman, Joe Knight, and John Case
"Business Strategy: Managing Uncertainty, Opportunity, and Enterprise" by J.C. Spender
"The Art of Strategy: A Game Theorist's Guide to Success in Business and Life" by Avinash K. Dixit and Barry J. Nalebuff

Learning Outcomes

Understand key business concepts, including strategy, finance, marketing, operations, and human resources.
Analyze the role of IT in supporting business processes and achieving organizational goals.
Apply business principles to the planning, execution, and management of IT projects.
Evaluate business environments and identify opportunities for IT to create value.
Communicate effectively with both technical and non-technical stakeholders about business and IT issues.
Integrate IT strategies with broader business strategies to drive competitive advantage.

CET191: CET Internship I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
0	0	360	360	3	180			50	0	50

Course Description

Internship provides an opportunity to practice and/or apply knowledge and skills in professional environments and gain valuable work experience. Through the Internship students get exposure to the industrial environment which cannot be simulated in the classroom. During the internship, students understand and sharpen the real-time technical/managerial skills required at the job(s). Further, they understand the social, economic, and administrative considerations that influence the working environment of industrial organizations. Student learning includes overall professional development of students, required problem-solving, communication, human development, and relationship-building skills. Further, the students develop awareness of the organizational department structure and their roles, responsibilities, and function. Students select the internship field in consultation with an industry mentor and faculty guide in terms of the academic requirements. The student is expected to produce a joining letter and a successful completion certificate. once the internship is over. Internship evaluation can be based on the quality of projects completed as part of the internship activities. Faculty Member(s) evaluate(s) the performance of students once by visiting the industry/organization and submit the evaluation report of the students with the consent of Industry persons/ mentor. The students are exposed to the industry environment for 6 to 8 weeks duration to understand the operation of the industrial facility.

References

https://www.youtube.com/watch?v=jpf9J2TUJVg
https://www.youtube.com/watch?v=KqIshDsg494
https://www.youtube.com/watch?v=E1UcIHW5rSc
https://www.youtube.com/watch?v=EhnfOUrFgxM

Learning Outcomes

CLO 1: Understand the Electronic industrial standards and recognize the requirement of these standards with the industrial scenario.
CLO 2: Examine a specific project related to electrical engineering at an existing job.
CLO 3: Communicate effectively through the technical presentation.
CLO 4: Demonstrate individual confidence to handle various engineering assignments during the internship.
CLO 6: Expose themselves to acquire life skills to meet societal challenges
CLO 7: Relate the engineer’s responsibilities and ethics while handling various engineering assignments during the internship.
CLO 8: Read the engineering drawings and if necessary, modify the parts/unit/assembly drawing of the electrical product.

CET211: Data Structures & Algorithms

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	0	180	360	4	180	90	120	60	15	25

Requisites

- Prerequisites: CET112

Course Description

Data structure and algorithms are used for efficient data persistence. Students learn the concepts of functions, pointers, structures, linear and nonlinear data structure like arrays, array representation of stacks, operations associated with stacks- push & pop, polish expressions, conversion of infix to postfix, infix to prefix (and vice versa),application of stacks recursion, polish expression and their compilation, conversion of infix expression to prefix and postfix expression, tower of hanoi problem. The topics include queue: definition, representation of queues, operations of queues- insert, delete, priority queues, circular queue, deque. linked list, linked list-based implementation of stacks and queues, trees: basic terminology, binary trees and their representation, expression evaluation, complete binary trees, extended binary trees, traversing binary trees, searching, insertion and deletion in binary search trees, general trees, avl trees, threaded trees, b trees, graphs, spanning tree. The course covers traversing in a graph, various sorting and search techniques like insertion sort, bubble sort, selection sort, quick sort, merge sort, heap sort, partition exchange sort, shell sort, sorting on different keys, external sorting. linear search, binary search, hashing: hash functions. The student learning also includes collision resolution techniques and the use of basic algorithm analysis including both theoretical and empirical methods. Lab sessions include the implementation of stack, quest, linked list, tree, graphs, sorting and searching discussed during the course.

References

Balagurusamy, E. (2017). Data Structures using C., MC GRAW HILL. ISBN-10: 1259029549, ISBN-13: 978-1259029547
Seymour, L. (2010). Data Structures with C., MC GRAW HILL INDIA, ISBN-10: 0070701989, ISBN-13: 978-0070701984
https://nptel.ac.in/courses/106102064
https://www.geeksforgeeks.org/data-structures/
https://www.programiz.com/dsa/data-structure-types
https://www.tutorialspoint.com/data_structures_algorithms/index.htm
https://www.javatpoint.com/data-structure-tutorial

Learning Outcomes

CLO 1: Apply advance programming techniques such as pointers, dynamic memory allocation, structures to solve the computing problems.
CLO 2: Use abstract data types such as lists, stacks, queues, and trees to develop a computational model.
CLO 3: Demonstrate the ability to work in a team to design the solution using linear and nonlinear data structure algorithms for computing problems and present it.
CLO 4: Examine the sorting and searching algorithms to select the suitable algorithm for optimum solution.
CLO 5: Classify the graph algorithms to model engineering problems, when appropriate.
CLO 6: Use the concepts of data structure to write the program for a given problem in the lab.
CLO 7: Write the lab report and present output results.

Tutorials

WEEK 1: Lab Induction, Course Policies and, program on arrays.
WEEK 2: Implement the arrays and pointer concepts.
WEEK 3: Stack implementation.
WEEK 4: Queue implementation.
WEEK 5: Linear and Binary Search implementation.
WEEK 6: Implementation of sorting algorithms.
WEEK 7: Implementation of sorting algorithms.
WEEK 8: Implement singly linked lists
WEEK 9: Implement doubly linked list
WEEK 10: Implement tree concepts
WEEK 11: Implement tree concepts
WEEK 12: Implement graph algorithms
WEEK 13: Implement graph algorithms
WEEK 14: Open End Problems/Projects
WEEK 15: Lab Final Exam

Laboratories

WEEK 1: Arrays
WEEK 2: Stacks and Queue
WEEK 3: Recursion and Tower of Hanoi
WEEK 4: Binary and Linear Search
WEEK 5: Quick and Merge Sort
WEEK 6: Selection, Insertion and Bubble Sort.
WEEK 7: Linked Lists
WEEK 8: Binary Search Tree, Inorder, preorder and post order traversal.
WEEK 9: AVL Tree
WEEK 10: B Tree
WEEK 11: Heap Sort, Max and Min Heap.

WEEK 12: BFS and DFS.
WEEK 13: Graphs: Adjacency matrix and adjacency lists.
WEEK 14: Spanning Tree problems and algorithms.
WEEK 15: Shortest path problems and algorithms.

CET212: Operating Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Course Description

The course is designed to introduce candidates to the issues involved in installing and administering a client operating system. It manages memory, processes, processor, software, and hardware. The primary purpose of this course is to understand processes of the operating systems and improve students' skills to install and troubleshoot the network. Students learn to install a client operating system, administer resources, implement, manage, and troubleshoot hardware devices and drivers, monitor, and optimize system performance and reliability, configure, and troubleshoot the desktop environment, implement network protocols and services, implement, monitor, and troubleshoot security, connect to resources using web browser, manage and troubleshoot firewall. Students understand stages in a setup process such as preparation of hard drive and copying files, product key information, regional information, adapter cards and post-installation requirements, familiarize themselves with the use of automated deployment techniques, processes, and software, distinguish between express and custom upgrades and be able to roll back an unsuccessful upgrade. Students learn to be aware of common errors and their possible causes, for example, inability to contact domain controller, error loading OS, failure of a service to start, lack of disk space, media errors, incompatible optical drive, etc. They also get to be familiarized with the log files created during installation and their use in troubleshooting. Lecture, Laboratory sessions, Assignment, projects, and presentations are used to deliver the course.

References

ABRAHAM SILBERSCHATZ, PETER BAER GALVIN, GREG GAGNE, Operating system concepts, Tenth Edition, John Wiley & Sons, 2018
https://learn.microsoft.com/en-us/windows-(Retrieved from the Internet 02/11/2022)
hardware/manufacture/desktop/install-windows-from-a-usb-flash-drive?view=windows-11
https://www.tutorialspoint.com/operating_system/operating_system_tutorial.pdf
https://www.academia.edu/31599334/operating_system_tutorial_for_biginers

Learning Outcomes

CLO 1: Install a client operating system.
CLO 2: Implement, manage and troubleshoot hardware devices and drivers.
CLO 3: Practice installation of windows operating system.
CLO 4: Analyze and optimize system performance and reliability.
CLO 5: Create a model of LAN system to learn the client-server architecture.
CLO 6: Review and implement network protocols and services.
CLO 7: Use the concepts of LAN networking to write the program for a given problem and write the lab report.

Tutorials

WEEK 1: Introduction to Lab policies/ Lab Rules and reports
WEEK 2: Perform manual and automated installations
WEEK 3: Upgrade from an older version and apply post-installation updates
WEEK 4: Troubleshoot installation problems.
WEEK 5: Monitor, manage, and troubleshoot access to files, folders and share folders.
WEEK 6: Connect to local or network print devices/ Configure and manage file systems.
WEEK 7: Implement, manage, and troubleshoot disk devices and display devices.
WEEK 8: Implement, manage, and troubleshoot input/output devices and update devices.
WEEK 9: Monitor, optimize and troubleshoot system performance.
WEEK 10: Manage and troubleshoot the use of offline files, recover system files and user data.
WEEK 11: Configure and manage user profiles, desktop settings and accessibility services.
WEEK 12: Configure and troubleshoot the TCP/IP protocol, firewall, connect to resources using a web browser.
WEEK 13: Configure, manage, and troubleshoot file encryption, security configuration and local security policy.
WEEK 14: Configure, manage, and troubleshoot local user and group accounts
Week 15: Lab Final Exam.

CET213: Software Engineering

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET112

Course Description

Software Engineering is used for a systematic, disciplined and quantifiable approach for the development, operation, and maintenance of software. The knowledge and skills covered in the course are identification of attributes, identification of operations, visibility of attributes and operations (private, public, protected), and specification of appropriate association, aggregation, and inheritance relationships between classes. Students learn how robust software systems are built most economically to assure the best quality and maintenance techniques in the software industry through different lifecycle models, system analysis and design, agile methodologies, software reengineering techniques such as Lines of Codes (LOCs) and metric analysis, software test methods, reverse engineering models, association, aggregation, collaboration, coupling, cohesion, COCOMO models to calculate the time taken to develop and deliver a software economically and validate requirements using use case scenarios and user interface walkthroughs. Critical UML diagrams used here are the use case, state machine, activity, object, class diagrams etc. to learn how the engineering team can communicate requirements. Students also learn how to create use case scenarios which include pre and post conditions trigger event and the best-case scenario flow of events. Alternative or exceptional behavior must be included in one or more use case scenarios. The course will be delivered using lectures, lab sessions, projects, and case studies.

References

David Farley (2022). Modern Software Engineering, 1st Edition. PEARSON.
https://www.lucidchart.com/pages/uml-class-diagram(Retrieved from the Internet 01/11/2022)
https://www.youtube.com/watch?v=w4gCAyvFFFo(Retrieved from the Internet 01/11/2022)
https://www.geeksforgeeks.org/software-engineering-cocomo-model/(Retrieved from the Internet 02/11/2022)
https://www.tutorialspoint.com/uml/index.htm(Retrieved from the Internet 01/11/2022)

Learning Outcomes

CLO 1: Analyze the importance of software development life cycle process and agile systems for effective software development.
CLO 2: Compare and use different cost-effective models to develop software products economically.
CLO 3: Demonstrate Software Reengineering practices for software reuse.
CLO 4: Determine and evaluate test methods for best software release practices.
CLO 5: Design and develop software models for robust real time software products.
CLO 6: Create UML (Unified Modelling Language) diagrams needed for the software development in the lab and present the output in lab records.

Tutorials

WEEK 1: Use of Lucid Chart Tools
WEEK 2: Introduction to Rational Rose
WEEK 3: Use Case Diagrams
WEEK 4: Activity Diagram in UML
WEEK 5: State Diagram.
WEEK 6: Sequence Diagram in UML
WEEK 7: Object Diagram in UML
WEEK 8: Object Diagram in UML.
WEEK 9: Class Diagram in UML.
WEEK 10: Class Diagram in UML.
WEEK 11: Collaboration Diagram in UML.
WEEK 12: Component Diagram in UML.
WEEK 13: Deployment Diagram in UML.
WEEK 14: Deployment Diagram in UML
WEEK 15: Lab Final Exam.

Laboratories

WEEK 1: Software engineering worldwide practices.
WEEK 2: Software Life Cycle Models.
WEEK 3: Quality Standards like ISO 9001, SEI-CMM
WEEK 4: Design Metrics, Data Structure Metrics, Information Flow Metrics
WEEK 5: Cost estimation, static, Single, and multivariate models, COCOMO model, Putnam Resource Allocation Model
WEEK 6: Problem analysis, software requirement and specifications, behavioral and non-behavioral requirements, coupling and cohesion.

WEEK 7: Function oriented design, object-oriented design, user interface design, top-down and bottom-up structured programming and information hiding.
WEEK 8: Reliability Models: Basic Model, Logarithmic Poisson Model
WEEK 9: Functional testing: Boundary value analysis, Equivalence class testing
WEEK 10: Data flow and mutation testing, unit testing, integration, and system testing, Debugging, Testing Tools, & Standards.
WEEK 11: Decision table testing, Cause effect graphing
WEEK 12: Management of maintenance, Maintenance Process, Maintenance Models
WEEK 13: Reverse Engineering, Software Reengineering
WEEK 14: Software Risk Management.
WEEK 15: Case studies on general software production companies.

CET214: Web Programming

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET112

Course Description

The integration of Web technologies has an essential role in accomplishing companies' objectives to raise competitiveness in the market. The students learn fundamental concepts of web technologies, develop basic skills in creating web pages, and explain the coding behind designing websites. The course starts with the underlying technologies of the web: URI, HTTP, HTML, CSS and XML, along with a strong focus on web services and web programming technologies with their practical application. Students will also be able to learn the key considerations while using Django and Ruby on Rail for an Open source Web Application Framework. Ruby is a prevalent programming language that is highly in demand in the marketplace: it is commonly used in Rails applications, an open-source web application framework. While at the same time, students also apply built-in login functionality in Django, and define sessions, cookies, and one-to-many models. Students will gain competencies such as create a secure professional website embedded with suitable information using HTML, CSS, and JavaScript, Install and integrate web technologies to build applications. The students will also be ready to move to the subsequent course and to proceed successfully in the remaining part of the program.

References

Akshi Kumar (2018) Web Technology: Theory and Practice, Chapman, and Hall/CRC Press
M., Dai, W., & Gai, K. (2016). Mobile Applications Development with Android: Technologies and Algorithms. Chapman and Hall/CRC.
Caya, A. (2018). Mastering The Faster Web with PHP, MySQL, and JavaScript: Develop state-of-the-art web applications using the latest web technologies. Packt Publishing Ltd.
UDACITY, "Intro to HTML and CSS", https://www.udacity.com/course/intro-to-html-and-css—ud001, Accessed on 14.10.2022
Udemy, "Android Development from Scratch to Create Cool Apps!", https://www.udemy.com/course/sisoft-android-basic-to-create-cool-apps/, Accessed on 15.10.2022
Udacity, "Intro to JavaScript", https://www.udacity.com/course/intro-to-javascript--ud803, Accessed on 15.10.2022
Udemy, The Complete Ruby on Rails Developer Course, https://www.udemy.com/course/the-complete-ruby-on-rails-developer-course/ Accessed on 15.11.2022
Courseera, Django for Everybody Specialization, https://www.coursera.org/specializations/django, Accessed on 15.11.2022

Learning Outcomes

CLO 1: Utilize the principles of web technologies for better decision-making.
CLO 2: Analyze coding practice examples using well-defined characteristics for building professional websites.
CLO 3: Relate the use of HTML, CSS, and JavaScript to build websites.
CLO 4: Demonstrate design skills to create a secure professional website embedded with suitable information.
CLO 5: Select mobile applications in a team or as individuals to solve realworld problems in varying contexts.
CLO 6: Apply the concepts of web technologies and develop applications to solve problems.
CLO 7: Install and integrate web technologies to build applications and present the results as lab record.

Tutorials

WEEK 1: Explore internet technology and applications.
WEEK 2: Implementing the mail carrier tool for API development.
WEEK 3: Implementing the curl tool for transferring data.
WEEK 4: Static website with HTML.
WEEK 5: Modifying and building static website with CSS and HTML.
WEEK 6: Advance version of HTML and CSS tags.
WEEK 7: Implementing JavaScript for website development.
WEEK 8: Install and build node.js application.
WEEK 9: Build an app using Django and Ruby on Rail.
WEEK 10: Installing and implementing MYSQL.
WEEK 11: Integrate MySQL database with front end.
WEEK 12: Getting started with Android (installation and various android app development platforms)
WEEK 13: Build an android application with various android components
WEEK 14: Build an Android app that has multimedia and 2-D graphics.
WEEK 15: Lab Final Exam.

CET215: Mobile Application Development

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET112

Course Description

The number of users of mobile devices (smartphones, smartwatches, and tablets) is exponentially increasing, which has fostered the market demand for mobile application development. Mobile application development involves the development of applications that run on mobile devices but access remote computer resources over the network. The course enables students to apply Java programming languages features and software patterns needed to develop maintainable mobile apps comprised of core Android components. This course introduces students to programming technologies, design and development related to mobile applications. The student learns about developing mobile applications, building campaigns for the customer, and different ways to manage this with Search Engine Optimization - (SEO). The student learning includes storing unlimited files in a low-cost object store, utilizing CloudSearch and Elasticsearch, and automating API deployment in stages effortlessly. The student also explores the role of a cross-platform mobile developer, using HTML, and CSS, in Mobile app development. The topics include the key concepts of Android, 2-D graphics and multimedia in Android, mobile embedded system architecture, data storage and SQLite operations, mobile applications optimization, mobile cloud computing, and best practices in mobile development. The student learns application deployment in the cloud platform and its related techniques. Lectures on mobile application development, Lab sessions, projects, structured laboratory, and assignments are used to deliver the course.

References

Qiu, M., Dai, W., & Gai, K. (2016). Mobile Applications Development with Android: Technologies and Algorithms. Chapman and Hall/CRC.
UDACITY, "Developing Android Apps", https://www.udacity.com/course/new-android-fundamentals--ud851, Accessed on 14.10.2022
UDEMY, "Become an Android Developer from Scratch", https://www.udemy.com/course/become-an-android-developer-from-scratch/, Accessed on 14.10.2022
Meta, Introduction to Mobile Development, https://www.coursera.org/learn/intro-to-mobile-development, Accessed on 14.11.2022

Learning Outcomes

CLO 1: Identify software/hardware tools to develop, test and debug mobile applications.
CLO 2: Analyze and develop mobile applications to solve real-world problems.
CLO 3: Evaluate various mobile frameworks to make an accurate technological choice in a given scenario.
CLO 4: Apply a range of methods for mobile application development.
CLO 5: Develop enterprise-level mobile solutions by taking full advantage of the capabilities of adopted platform/framework.
CLO 6: Apply Mobile Application development concepts in the labs to provide solutions as per user requirements.
CLO 7: Write the lab report and present the output result as a lab record.

Tutorials

WEEK 1: Lab Induction, and getting started with Android
WEEK 2: Installation of Android studio and building the first application
WEEK 3: To determine the density of material of the given wire with the help of Sonometer.

WEEK 4: Build an android application with various android components.
WEEK 5: Build an Android app that has multimedia and 2-D graphics.
WEEK 6: Implementing advanced concepts for android with scheduling algorithms and memory technology.
WEEK 7: Implementing advanced concepts for android with messaging.
WEEK 8: Apply the main operations on files management (Retrieval/modification/storage).
WEEK 9: Apply the SQLite operations.
WEEK 10: Implementing Mobile app optimization (Mobile/App SEO and Metrics & KPIs, Creating an SEO Campaign).
WEEK 11: Implement Mobile app optimization (Testing Methodologies and Tools for Analytics).
WEEK 12: Mobile app and cloud deployment (with various platform such as Amazon Elastic Cloud, Microsoft’s Azure, Google App Engine)
WEEK 13: Mobile app and cloud deployment (techniques for building, deploying, and maintaining machine images and applications).
WEEK 14: Implementing advanced exploration of cloud computing for mobile deployment.
WEEK 15: Lab Final Exam.

CET216: Linux and Shell Programming

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET212

Course Description

Operating systems are main components of recent computer technology. It is software that bridges users and hardware. It manages memory, processes, processor, software, and hardware. The primary purpose of this course is to understand processes of operating systems and improve students' skills to develop applications on the subsystems of operating systems. Students learn virtual environments and use of virtual disk spaces using VMware. They get a thorough knowledge of Linux systems and directories management, shell programming, system calls, shell programming, threads management and scheduling algorithms for deadlock managements. Students also learn the features of Linux as a multiuser operating system and their hardware and software components of a multiuser operating system environment. Other knowledge and skill set of the course requires to navigate filesystem(s), manipulate files and directories, follow given file naming conventions, controlling process management, use and monitor printing facilities, terminal types, on-line help systems, device and file systems status, use of mail facilities, use of redirection facilities, creating regular expressions and selecting and using filters. Students get hands on to compose scripts to carry out routine tasks like use editor(s), passing arguments, using environment variables, selecting, and using control structure(s) etc. Lecture, Laboratory sessions, Assignment, projects, and presentations are used to deliver the course.

References

William E. Jr. Shotts, The Linux Command Line, 5th Edition: A Complete Introduction Paperback – Illustrated, 7 March 2019
ABRAHAM SILBERSCHATZ, PETER BAER GALVIN, GREG GAGNE, Operating system concepts, Tenth Edition, John Wiley & Sons, 2018
https://www.tutorialspoint.com/unix/index.htm(Retrieved from the Internet 03/11/2022)
https://www.javatpoint.com/linux-tutorial(Retrieved from the Internet 03/11/2022)
https://www.tutorialspoint.com/operating_system/index.htm(Retrieved from the Internet 04/11/2022)

Learning Outcomes

CLO 1: Analyze operating system used in computing world to recommend for efficient resource management.
CLO 2: Use OS as a resource manager to supports multiprogramming.
CLO 3: Select the suitable process scheduling algorithm to solve computing problem.
CLO 4: Work in a team to review memory management issues including advance techniques of paging, segmentation and virtual memory for operating system.
CLO 5: Assess the system model to produce solutions for deadlocks problems.
CLO 6: Review the open source operating systems for integration in given context.
CLO 7: Use the concepts of shell programing to write the program for a given problem and write the lab report.

Tutorials

WEEK 1: Induction to Lab policies, reports
WEEK 2: Introduction to Virtual environments and Vmware installations.
WEEK 3: Understanding Basic Linux commands and use of Directories.
WEEK 4: Basics of shell programming.
WEEK 5: Sample shell programming.
WEEK 6: Use of Grep, AWK and sed commands
WEEK 7: Decision making & loop control in shell programming

WEEK 8: Function using shell programming.
WEEK 9: System calls in C and their implementation in Linux.
WEEK 10: Thread basics and Client-Server architecture.
WEEK 11: Thread management in C.
WEEK 12: FCFS Scheduling Algorithms.
WEEK 13: SJF Scheduling Algorithms.
WEEK 14: File system calls in C and their implementation in Linux.
Week 15: Lab Final Exam.

CET217: Software Testing and Quality Assurance

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET213

Course Description

This course offers an in-depth exploration of the methodologies and processes essential for the development and continuous maintenance of high-caliber software systems. It extensively delves into software testing, encompassing testing strategies spanning unit, module, subsystem, and systems levels. Topics include test data generation, both automated and manual, dynamic and static analysis, functional testing, rigorous inspections, and robust reliability assessment. Furthermore, this course introduces the foundational concepts, metrics, and models integral to the realm of software quality assurance. It comprehensively examines the components of software quality assurance systems throughout the software development lifecycle, elucidating aspects such as meticulous planning, rigorous reviews, meticulous testing, and robust configuration management. The curriculum additionally delves into metrics and models to gauge software quality objectively. Real-world case studies and hands-on experiences enrich the learning journey, equipping students with practical insights into the domain of software quality assurance within the context of computer science and engineering.

Learning Outcomes

CLO 1: Develop expertise in software testing, encompassing various testing levels and strategy selection.
CLO 2: Acquire skills in test data generation and dynamic/static analysis techniques for effective defect identification.
CLO 3: Master functional testing and engage in rigorous defect inspections to ensure software functionality.
CLO 4: Perform systematic reliability assessments to mitigate software risks.
CLO 5: Understand foundational QA concepts, metrics, and models to ensure software quality.
CLO 6: Apply QA components throughout the software development lifecycle, including planning, reviews, testing, and configuration management.
CLO 7: Utilize metrics and models for objective software quality assessment.
CLO 8: Apply course concepts through hands-on experiences and case studies in real-world scenarios, enhancing practical problem-solving skills in software quality assurance.

Tutorials

WEEK 1: Lab Induction, course policies and format of lab reports.
WEEK 2: Levels of Testing and Test Strategy.
WEEK 3: Test Data Generation Techniques.
WEEK 4: Dynamic and Static Analysis for Defect Identification.
WEEK 5: Functional Testing Principles.
WEEK 6: Defect Inspections and Ensuring Software Functionality.
WEEK 7: Systematic Reliability Assessments and Risk Mitigation.
WEEK 8: Foundational QA Concepts and Metrics.
WEEK 9: Software Quality Models.
WEEK 10: Integrating QA Components in Software Development.
WEEK 11: QA in Planning and Reviews.
WEEK 12: Hands-on Testing.
WEEK 13: Configuration Management.
WEEK 14: Metrics and Models for Quality Assessment.
WEEK 15: Lab Final Exam.

CET218: Advanced Web Programming

Contact Time	CH	SWL	Exams Time	Marks

LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET214

Course Description

Open-source technology is used widely in multiple enterprises. Open source enables technology agility, typically offering multiple ways to solve problems. Students learn how robust software is developed using open-source technologies using PHP and MySQL. This course provides the knowledge necessary to design and develop dynamic, database-driven web pages using PHP, which powers many websites. The student use MySQL, a popular relational database management system. The student learns how to create an interactive Web site, allowing visitors to post and retrieve information, along with the understanding of a complete content management system Web application. The student learning includes downloading and installing PHP and MySQL tools and frameworks onto a server and home machine, configuring relevant settings to match the project's needs, and developing a user interface and a database back-end that stores critical information. This enables the student to plan and apply PHP and MySQL in real-world projects. The course topics include allowing site visitors to add new information to an online database, search through posted data, and create meaningful reports. The course is delivered in theory and practice using PHP, MySQL, other related frameworks, and Content Management Systems. Lectures, assignments, structured laboratory, and projects based on open-source technologies are used to deliver the course.

References

Larry Ullman (2017). PHP and MySQL for Dynamic Web Sites: Visual QuickPro Guide (5th ed.).Peachpit Press.
Luke Welling, Laura Thomson (2017) PHP and MySQL Web Development (Developer's Library) (5th ed.). Addison-Wesley Professional.
Adam Omelak (2018) Zend Framework 3. Developer's Guide.
Gordon, H. (2021). How Source Ate Software: Understand the Open-Source Movement and So Much More. S.I .:A press.
Udemy, "PHP & MySQL course for absolute beginners | Become a PHP pro", https://www.udemy.com/course/php-mysql-course-for-absolute-beginners/, Accessed on 14.10.2022
Class Central, Beginner PHP and MySQL Tutorial, https://www.classcentral.com/course/udemy-php-mysql-tutorial-26598, Accessed on 14.11.2022

Learning Outcomes

CLO 1: Analyze the concepts of different operators and functions related to PHP in various computing problem.
CLO 2: Apply the DDL and DML commands related to MySQL for given set of development context.
CLO 3: Demonstrate the ability to accomplish group tasks related to open source technologies.
CLO 4: Organize the application development process in varying context of information technology industry.
CLO 5: Compare the dynamic websites handling and server-side scripts for application management.
CLO 6: Summarize the need of open source software for the computational task.
CLO 7: Write of lab based task and reports to present the results.

Tutorials

WEEK 1: Installation of framework such as LAMP/WAMP and starting with PHP script.
WEEK 2: To implement PHP script with concepts of Numbers/Constants/ operators/ Strings
WEEK 3: Program related to Statements / selection-based PHP scripts /Arrays/Loops
WEEK 4: To implement PHP script for Dynamic website.
WEEK 5: To implement Database / Database elements/ Coolum type and datatype.
WEEK 6: Program related to PHP script with database connection, DML and DDL queries.
WEEK 7: To implement Database design /Primary Key /Foreign key.
WEEK 8: To implement PHP script for file handling. Script related to advanced SQL and MySQL.
WEEK 9: To implement PHP script for exception handling/ upload a file/ Error handling techniques / debugging the errors.
WEEK 10: To implement PHP script to create database and populate the database. Develop frontend to interact with this database.
WEEK 11: To implement PHP script to for exchanging values. Use of Hidden from input / Edit existing records. /Use to date and time function.
WEEK 12: To implement PHP script to create login page/ Create a blog using open-source framework such as WordPress. / Sending email
WEEK 13: To implement PHP script for using session / cookies / Session security
WEEK 14: To implement PHP script for Preventing Spam / XSS attacks / SQL Injection Attack
WEEK 15: Lab Final Exam.

CET219: UI/UX Principles

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Course Description

This technical User Experience (UX) course offers an in-depth exploration of the dynamic fields of UX research and design. Students will acquire a profound understanding of UX research methodologies, encompassing advanced techniques such as user interviews, system assessments, and the systematic application of design principles to analyze systems. Furthermore, participants will delve into the intricacies of UX Design, including the systematic generation of innovative design solutions and the meticulous creation of prototypes across various levels of fidelity. Through the systematic interleaving of successive UX Research and Design phases, students will develop the expertise to extract valuable insights from inevitable errors, enabling iterative enhancements toward the creation of high-impact UX-optimized products within the realm of computer science and technology.

References

Lean UX: Designing Great Products with Agile Teams - Jeff Gothelf
A Project Guide to UX Design: For User Experience Designers in the Field Or in the Making - Russ Unger, Carolyn Chandler

Learning Outcomes

CLO 1: Master advanced UX research techniques.
CLO 2: Apply design principles to analyze systems.
CLO 3: Create innovative design solutions.
CLO 4: Develop prototypes at varying fidelity levels.
CLO 5: Integrate UX Research and Design phases effectively.
CLO 6: Learn from and leverage mistakes for iterative improvement.
CLO 7: Optimize user experiences within the realm of technology.

Tutorials

WEEK 1: Introduction to Advanced UX Research Techniques.
WEEK 2: Applying Design Principles for System Analysis.
WEEK 3: Generating Innovative Design Solutions.
WEEK 4: Prototyping at Varying Fidelity Levels.
WEEK 5: Effective Integration of UX Research and Design Phases.
WEEK 6: Embracing Iterative Improvement through Mistakes.
WEEK 7: Optimizing User Experiences in the Context of Technology.
WEEK 8: Review and Consolidation of Advanced UX Research.
WEEK 9: Analyzing Systems with a Design-Centric Approach.
WEEK 10: Practical Application of Innovative Design Solutions.
WEEK 11: Prototyping Strategies for Real-World Scenarios.
WEEK 12: Seamless Integration of UX Research and Design.
WEEK 13: Iterative Improvement and Feedback Loops.
WEEK 14: Comprehensive User Experience Optimization Assessment and Recap.
WEEK 15: Lab Final Exam

CET221: Computer Organization

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET121

Course Description

The course covers the evolution of 8085, 8086 microprocessor, functional block diagrams, organization chart for the microprocessor, architecture, and the pin configuration of the microprocessor. This course also includes the instruction set, machine cycles, timing diagram for the instruction set and the addressing modes of the processor. The topics include the types of instructions like arithmetic instructions, logic instructions, branching instructions, machine control instructions and the timing diagrams. The student analyzes 8086 processor instruction execution times, instruction affecting flags. This instruction set covered is used to develop coding in assembly language to perform simple experiments in 8085 processor, in addition the programming using Keil C is also covered to perform the experiment. This course also introduces memory and IO interfacings. The student learning includes types of memory like ROM, PROM, Static RAM, and DRAM, Even and odd memory banks, memory organization in 8085 and 8086, the need for the interrupts, interrupt classification, ICs used, enabling software-hardware interrupts in both 8085 and 8086. Along with the interrupts, experiments pertaining to the peripheral device IC 8255 used in interfacing with keyboards, display devices, DAC are done. The student is exposed to some basic introduction to pin configuration, architecture, addressing modes and registers available in 80X86 family processors like 80186, 80286, 80386.

References

Pablo Mary and Panda Jeebanan, (2016), Microprocessor and Microcontrollers. 1st Edition, PHI Publication.
https://www.tutorialspoint.com/microprocessor/microprocessor_overview.htm
https://www.electronicshub.org/microprocessors
https://electronicsdesk.com/8085-microprocessor.html

Learning Outcomes

CLO 1: Explain the architecture of 8085 and 8086 processor.
CLO 2: Use instruction set to write the assembly level programming.
CLO 3: Diagnose the memory and memory organization and memory interfacing.
CLO 4: Compare the various software, hardware interrupts and application.
CLO 5: Perform input output device programming using PPI and assembly language programming
CLO 5: Execute programs in 8085 and 8086 using serial and parallel interface.
CLO 5: Demonstrate interface experiments with A/D. D/A converters, sensors and motors.

Tutorials

WEEK 1: Write a program in assembly language in 8085 to add two 8 bit and 16-bit numbers.
WEEK 2: Write a program in assembly language in 8085 to subtract two 8 bit and 16-bit numbers.
WEEK 3: Write a program in assembly language in 8085 to multiply two 8-bit numbers.
WEEK 4: Write a program in assembly language in 8085 to Divide two 8-bit numbers.
WEEK 5: Write a program in assembly language in 8086 to multiply two16 bit numbers.
WEEK 6: Write a program in assembly language in 8086 to divide 16-bit numbers by 8-bit number.
WEEK 7: Write program in assembly language in 8085 & 8086 to find the largest number in array
WEEK 8: Write program in assembly language in 8085 & 8086 to sort number in ascending order.
WEEK 9: Write
WEEK 10: Write assembly language program in 8085 &8086 to run stepper motor.
WEEK 11: Write assembly language program in 8085 &8086 to run servo motor.
WEEK 12: Write assembly language program in 8085 &8086 to run DC motor.
WEEK 13: Write assembly language program in 8085 &8086 to control the traffic light.
WEEK 14; Write assembly language program in 8085 &8086 to read sensor data using A/D Converter.
WEEK 15: Lab Final Exam.

CET222: Embedded Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET221

Course Description

The objective of this course is to provide a knowledge of Smart Electronics Systems, with a basic understanding of programming skills and interfacing with different sensors for the smart and automatic system development. The course introduces the Arduino Hardware, ATMEGA328 P16, its architecture, clock speed, memory, pin configuration, Arduino IDE Platform, Arduino Syntax, Arduino Board Layout, types of Arduino Board, the structure of programming, setup (), loop (), functions. The topics include variable declaration and definition, datatypes, arithmetic Expressions, constants, flow Control, logical operators, libraries declaration, digital input output, analog Input Output, time intervals, mathematical functions, random functions, serial communication with computer. The second half of the course covers software programs like blinking of LED, fading of LED, circling of LED, graphics creation on LED matrix, LED advertisement display using LED Matrix, traffic light system, LED control using switches, LED control from keyboards, LED blinking using user command. The student learning includes the interfacing of input devices like microphones, bar code scanner, buttons, encoders, keypad capacitive sensors, distance sensors, electromagnetic fields, humidity sensors, temperature sensors, gas sensors, anemometer, and IR sensors. The student also learns EEG, EMG sensors, motion sensors, magnetic sensors, touch pad, light sensors, Joysticks, keyboards and GPS Interfacing, SD card interfacing, load cell interfacing, camera control, 7 segment displays, LCD, OLED, Graphical LCD. It also includes the programming and controlling of stepper motor, servo motors, DC Motors. The course also covers controlling with Joystick, indexing, direction control, synchronization of two motors solenoids, relays, and PWM. Lectures, theoretical assignments, presentations will be used in this course.

References

Richard Blum, (2015), Arduino Programming, 1st Edition, Pearson Education.
Matthew Mackinnon(2016), Arduino: Complete Beginners Guide for Arduino, 1st Edition Create Space Independent Publishing Platform
https://create.arduino.cc/projecthub
https://all3dp.com/2/most-useful-arduino-projects/
https://circuitdigest.com/arduino-projects

Learning Outcomes

CLO 1: Describe the architecture, memory, and hardware of ATMEGA328 P 16 microcontroller
CLO 2: Illustrate the structure of program and platform used
CLO 3: Categorize the instruction set used in developing the program.
CLO 4: Use instructions to write program in platform and verify the results
CLO 5: Design the circuit for a specific application using Arduino
CLO 6: Draw the complete circuit diagram in software like Tinkercad and simulate the results
CLO 7: Demonstrate mini project by interfacing Arduino with sensors and control the output devices.

Tutorials

WEEK 1. To perform LED blinking using Arduino Mega with digital pins.
WEEK 2. To perform LED fading and Circling using Arduino Mega with digital and analog pins.
WEEK 3. To perform interfacing of LED dice with Computer Keyboard using Arduino Mega.
WEEK 4. Interface Gas sensors with Arduino Mega and operate LED and show four critical levels.
WEEK 5. Interfacing of Proximity sensors and note the response on Serial Monitor and connect buzzer for Minimum distance using Arduino Mega.
WEEK 6. Interfacing of 7 Segment display and start automatic counter from 0 to 9 using Arduino Mega.
WEEK 7. Interfacing of LCD and display text on the LCD with four different fonts using Arduino Mega.
WEEK 8. Interfacing of GLCD and display your own picture on the display using Arduino Mega.
WEEK 9. Interfacing of Stepper motor and Servo Motor and vary the speed with a PWM signal.
WEEK 10. Controlling of Solenoid using Electronics/Electrical Relays with the help of Arduino Mega.
WEEK 11. Direction control of Servo Motor using Arduino Mega.
WEEK 12: Interfacing of DC motor and vary the speed.
WEEK 13: Interfacing temperature and humidity sensor with Arduino and display the values in LCD or OLED.
WEEK 14: Interface motion sensor to detect the motion and generates alarm.
WEEK 15: Interface level sensor to detect the set point of level in water tank and stop the flow using solenoid valve.

CET223: Computer Architecture for IT

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Course Description

This course provides a comprehensive introduction to computer architecture, focusing on the structure, function, and performance of computer systems from an IT perspective. This course covers an introduction to computer architecture, along with topics such as data representation, CPU organization, memory architecture, system us and Interfacing, Parallelism and Performance, Storage Systems, Emerging Technologies in Computer Architecture, and input/output mechanisms. Students will gain a solid understanding of how computers process information and how different architectural choices impact system performance, reliability, and scalability.

References

"Computer Organization and Design: The Hardware/Software Interface" by David Patterson and John Hennessy
"Software Architecture in Practice" by Len Bass, Paul Clements, and Rick Kazman
"Design Patterns: Elements of Reusable Object-Oriented Software" by Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides
"Distributed Systems: Principles and Paradigms" by Andrew S. Tanenbaum and Maarten Van Steen

Learning Outcomes

Understand the fundamental concepts and terminology of computer architecture.
Describe the organization and functioning of the CPU, memory, and I/O subsystems.
Analyze the performance implications of different architectural designs.
Apply knowledge of computer architecture to optimize IT systems.

Troubleshoot basic architectural issues in computer systems.

CET231: Cyber & Information Security

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET161

Course Description

In today's digital age, information and cyber security is more important than ever. Protecting online information and identity is crucial to keeping personal and financial data safe from theft or fraud. This is an introductory level information security course which provides students basic understanding about cyber and information security and its need in current digital world. This course covers the introduction to information, computer and network security, security risks and cyber-attacks, security concepts, kinds of security breaches, threats, and risks, point of vulnerability, attacks- passive and active, security services, confidentiality, authentication, non-repudiation, integrity. The topics include access control, availability, model for internetwork security, internet standards and RFCs, sources of security threats, motives, target assets , consequence of threats, e-mail threats, web threats, hacking, intruders, insider threats, cybersquatting, cyber stalking, crime of deception, content oriented online crime, malicious software use and detection. The student learning includes cyber terrorism, information warfare and surveillance, virtual crime, online frauds, identity theft and intellectual property theft, network threats-worms, virus, spams, ad-ware, spy ware, trojans and convert channels, backdoors, bots, IP spoofing, ARP spoofing, session hijacking, sabotage, phishing, zombie/zombie drone. The course also includes legal ethical and professional issues in information security and intellectual property rights. It also covers firewalls, basic concepts of intrusion detection and prevention system, basic cryptographic techniques, risk assessment and risk control strategies, information security blueprint, honeypots, honey nets and padded cell systems, scanning and analysis tool, biometric access control and case study related to information security. The laboratory work consists of experiments illustrating the principles, algorithms and concepts discussed in the course.

References

Michael E. Whitman Herbert J. Mofford. (2017). Principles of Information Security, 6th Edition. Cengage Learning, Inc
https://www.ftc.gov/system/files/attachments/cybersecurity-small-business/cybersecuirty_sb_factsheets_all.pdf
https://www.cynet.com/network-attacks/network-attacks-and-network-security-threats/
https://www.cisco.com/c/en_ae/products/security/common-cyberattacks.html#~types-of-cyber-attacks
https://umbrella.cisco.com/trends-threats

Learning Outcomes

CLO 1: Discuss the cyber and information security issues, attacks and ethics for internet users.
CLO 2: Analyze the legal and ethical issues of IT infrastructure for the organization.
CLO 3: Illustrate information security risks and requirement of security services to secure the network.
CLO 4: Work in a team to assess the intrusions detection systems, cryptographic algorithms and others tools used in organizational network to secure the network and present it in professional context.
CLO 5: Apply the basic concepts of cyber security methods, write programs in lab to solve the given problem.
CLO 6: Write the lab report and present the output result in lab record.

Tutorials

WEEK 1: Lab Induction, course policies and format of lab reports.
WEEK 2: Download and install the Linux operating system.
WEEK 3: Study and practice Linux commands.
WEEK 4: Study and practice networking commands.
WEEK 5: Study of packet sniffer tools like Wireshark, ethereal, tcpdump etc. Use the tools to do the following: Observer performance in promiscuous as well as non-promiscuous mode. Show that packets can be traced based on different filters
WEEK 6: Install IDS (e.g., SNORT) and study the logs.
WEEK 7: Write a program to perform Encryption / Decryption using Caesar cipher.
WEEK 8: Write a program to perform Encryption / Decryption using Mono Alphabetic techniques
WEEK 9: Write a program to perform Encryption / Decryption using Playfair
WEEK 10: Write a program to perform Encryption / Decryption using Hill cipher
WEEK 11: Write a program to perform Encryption / Decryption using
WEEK 12: Use the Nessus tool to scan the network for vulnerabilities
WEEK 13: Open Ended Project
WEEK 14: Open Ended Project
WEEK 15: Lab Final Exam

CET232: Web and Security Technologies

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET214 AND CET231

Course Description

The integration of Web technologies has an essential role in accomplishing companies' objectives to raise competitiveness in the market. The students learn fundamental concepts of web technologies, develop basic skills in creating web pages, and explain the coding behind designing websites. The course starts with the underlying technologies of the web: URI, HTTP, HTML, CSS, and XML, along with a strong focus on web services and web programming technologies with their practical application. The course also discusses the key considerations while using Django and Ruby on Rail for an Open-source Web Application Framework. Ruby is a prevalent programming language that is highly in demand in the marketplace: it is commonly used in Rails applications, an open-source web application framework. While at the same time, students also apply built-in login functionality in Django, and define sessions, cookies, and one-to-many models. The student learning includes describing and building a data model in Django, applying model query and template tags/code of Django Template Language. The topics include Hyper Text Markup Language (HTML), Cascading Style Sheets (CSS), JavaScript, database integration, and concepts of mobile development. The lectures focus on web application development fundamentals. Lab sessions, projects, and assignments are used to deliver the course.

References

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M., Dai, W., & Gai, K. (2016). Mobile Applications Development with Android: Technologies and Algorithms. Chapman and Hall/CRC.
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Udemy, "Android Development from Scratch to Create Cool Apps!", https://www.udemy.com/course/sisoft-android-basic-to-create-cool-apps/, Accessed on 15.10.2022
Udacity, "Intro to JavaScript", https://www.udacity.com/course/intro-to-javascript--ud803, Accessed on 15.10.2022
Udemy, The Complete Ruby on Rails Developer Course, https://www.udemy.com/course/the-complete-ruby-on-rails-developer-course/ Accessed on 15.11.2022
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Learning Outcomes

CLO 1: Utilize the principles of web technologies for better decision-making.
CLO 2: Analyze coding practice examples using well-defined characteristics for building professional websites.
CLO 3: Relate the use of HTML, CSS, and JavaScript to build websites.
CLO 4: Demonstrate design skills to create a secure professional website embedded with suitable information.
CLO 5: Select mobile applications in a team or as individuals to solve real-world problems in varying contexts.
CLO 6: Apply the concepts of web technologies and develop applications to solve problems.
CLO 7: Install and integrate web technologies to build applications and present the results as lab record.

Tutorials

WEEK 1: Explore internet technology and applications.
WEEK 2: Implementing the mail carrier tool for API development.
WEEK 3: Implementing the curl tool for transferring data.
WEEK 4: Static website with HTML.
WEEK 5: Modifying and building static website with CSS and HTML.
WEEK 6: Advance version of HTML and CSS tags.
WEEK 7: Implementing JavaScript for website development.
WEEK 8: Install and build node.js application.
WEEK 9: Build an app using Django and Ruby on Rail.
WEEK 10: Installing and implementing MYSQL.
WEEK 11: Integrate MySQL database with front end.
WEEK 12: Getting started with Android (installation and various android app development platforms)
WEEK 13: Build an android application with various android components
WEEK 14: Build an Android app that has multimedia and 2-D graphics.
WEEK 15: Lab Final Exam.

CET233: Digital Forensics Fundamental

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET231

Course Description

Digital Crime and Security Course Is essential for Computer Science field as it provides students a basic understanding about issues, trends and categories of cyber-attacks and digital crime in the current digital world. This course covers the understanding of essential computer concepts and information processing, introduction and overview of cybercrime and cyber terrorism , hackers , sophisticated cyber-criminal organizations, white collar crimes - identity theft, internet fraud schemes, money laundering, corporate espionage, viruses, and malicious code (history and development, viruses, worms, Trojan horses, adware, and spyware). The course includes Denial-Of-Service attacks, blended threats, extent of viruses and malicious code; sex crimes, victimization, and obscenity on the World Wide Web, nature of exploitation on the internet, cyberstalking, cybercrime in a data-driven and techno-centric society - cybercrime and the cybercriminal, the origin and definition of cybercrime. The topics include data, evolution of cybercrime, cybercrime categories, the future of cybercrime, cybercrime, and the Internet of Things (IoT), cybercrime: Machine Learning and Artificial Intelligence, online child sexual abuse and exploitation (CSAE), cost of cybercrime, understanding the legal system and cyber laws, networking environment, types of cyberattacks, prevention mechanisms and encryption methodology. Students are exposed to cellular networks, and the main components of network architecture, along with security threats and vulnerabilities, Internet of Things (IoTs), applications, security vulnerabilities, investigation of digital evidence, computer forensics, and the prevention of cybercrime. The laboratory work Consists of experiments illustrating the principles, algorithms and concepts discussed in the course.

References

Taylor, Robert W., Eric J. Fritsch, John Liederbach, Michael R. Saylor, and William L. Tafoya. Cybercrime and cyber terrorism. New York, NY: Pearson, 2019.
Alexandrou, Alex. Cybercrime and Information Technology: Theory and Practice: The Computer Network Infrastructure and Computer Security, Cybersecurity Laws, Internet of Things (IoT), and Mobile Devices. CRC Press, 2021.
https://www.simplilearn.com/tutorials/cyber-security-tutorial/what-is-cyber-security
https://www.youtube.com/watch?v=pM8yX-cr6S8
https://www.im-c.com/cyber-crime-time-learning-journey/
https://www.researchgate.net/publication/331914032_On_Cyber_Crimes_and_Cyber_Security

Learning Outcomes

CLO 1: Explain the current problems, trends, and issues in the area of digital crime.
CLO 2: Examine the processes, best practices, and techniques to manage and prevent cybercrime.
CLO 3: Evaluate the technical, social, financial, and legal impact of cybercrime on global commerce
CLO 4: Compare and contrast the differences between digital evidence and traditional evidence.
CLO 5: Review and recommend the strategies and steps to investigate digital evidence in cybercrime
CLO 6: Write the lab report and present the output result in lab record.

Tutorials

WEEK 1: Lab Induction, course policies and format of lab reports.
WEEK 2: Installation & Demonstration of N-Map tool.
WEEK 3: Perform an experiment to demonstrate use of nmap tool for Port Scanning.
WEEK 4: A) Installation and demonstration of Jscript tool. B) Using Jscript tool (or any other equivalent) to demonstrate asymmetric, symmetric crypto algorithm.
WEEK 5: Study of packet sniffer tools like wireshark, ethereal, tcpdump etc. Use the tools to do the following. i. Observer performance in promiscuous as well as non-promiscuous mode. Ii. Show that packets can be traced based on different filters
WEEK 6: Perform an experiment to demonstrate the use of Wireshark network analyzer to sniff for router traffic.
WEEK 7: Install and configure Virtual Environment- VirtualBox , Select Intrusion Dataset and understand the functioning of virtual box.
WEEK 8: A) Network Scanning (nmap), Web Server Vulnerability Scanning (Nikto) and Host scanning (fping). B) Network Sniffing (TCPDUMP/Wireshark/tshark/Ettercap), Vulnerability Scanning (nmap ad CVE) and Security Visualization (Etherape).
WEEK 9: a) Infosec Coding using Python Network Socket Programming (Build the port scanner). b) Network Scanning, Packet manipulation, Network Attacks using Scapy.
WEEK 10: Backdoor- Network Socket/ File Transfer and Reverse Shell using Netcat
WEEK 11: Vulnerability Assessment and System Hacking (VAPT) VA-Nessus/OpenVAS and Penetration Testing using Metasploit.

WEEK 12: a) Cyber Security and Machine Learning-Intrusion Detection KDDCUP99/NSL-KDD/CIC-IDS2017 dataset. b) Anomaly detection-network traffic analysis using tshark.
WEEK 13: a) Network Forensics using Xplico and tshark. b) Digital Forensics (Host/Disk) with TCT/Sleuthkit.
WEEK 14: a) Memory Forensics using Volatility. b) Email Forensics using Online utilities
WEEK 15: Lab Final Exam

CET241: Cloud Databases

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET141

Course Description

Today’s internet has brought various emerging challenges for data storage and management. The amount of generated data has grown exponentially. Cloud databases are at the heart of where software-as-a-service, or SaaS, companies like Microsoft, Salesforce and Google are shifting their business models. There are more open-source cloud databases available now than ever before. This explosive growth shows that cloud databases are a thriving market with a lot of innovation. With a cloud database, the data is uploaded to a remote storage location that is connected to a network of external servers. The data may be replicated across multiple data centers. The students will learn concepts related to database systems management and cloud computing. The course covers an introduction to Database Systems and Cloud Computing, Database Design and Windows Azure Data Storage, Table Normalization and Windows Azure SQL Database, Database Development and Management with SQL—Importing and Exporting Database Objects—Querying Information in Windows Azure SQL Database, Windows Azure SQL Database Procedures, and Functions, Database Application Development. The course explores Windows Azure and Deployment of Applications to the Cloud, Windows Azure Storage, Windows Azure Management, tricks, and best practices. Lectures focusing on cloud databases fundamentals, Lab sessions, projects, and assignments are used to deliver the course.

References

Chao, L. (2013). Cloud database development and management. CRC Press.
https://learn.microsoft.com/en-us/azure/azure-sql/database/design-first-database-tutorial?view=azuresql
https://www.tutorialspoint.com/Cloud-Databases
https://www.techtarget.com/searchcloudcomputing/definition/cloud-database

Learning Outcomes

CLO 1: Explain and apply the principles of Database Systems and Cloud Computing.
CLO 2: Solve problems related to Data Storage using Windows Azure Data Storage.
CLO 3: Design Databases and Table Normalization.
CLO 4: Apply SQL queries on Windows Azure SQL Database.
CLO 5: Deploy applications to the cloud.
CLO 6: Apply concepts of windows Azure management and Storage.
CLO 7: Write lab reports and present results.

Tutorials

Week 1: Introduction to Database Systems and Cloud Computing.
Week 2: Database Design and Windows Azure Data Storage.
Week 3: Table Normalization and Windows Azure SQL Database.
Week 4: Database Development and Management with SQL.
Week 5: Importing and Exporting Database Objects.
Week 6: Querying Information in Windows Azure SQL Database.
Week 7: Windows Azure SQL Database Procedures and Functions.
Week 8: Database Application Development.
Week 9: Windows Azure and Deployment of Applications to the Cloud
Week 10: Windows Azure Storage (part 1)
Week 11: Windows Azure Storage (part 2)
Week 12: Windows Azure Management (part 1)
Week 13: Windows Azure Management (part 2)
Week 14: Tricks and best practices
Week 15: Lab Final Exam

CET242: Data Analytics and Visualization

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: GEN211

Course Description

Data Analytics and Visualization is an integrated course that explores a wide array of data-related concepts and tools. Beginning with data science fundamentals, students learn Python, Anaconda, and iPython/Jupyter environments, gaining proficiency in key Python Data Science packages like Numpy, Pandas, Scikit, and Matplotlib. The course covers data acquisition, cleaning, exploration, and preprocessing, and delves into statistical data analysis techniques. Additionally, it introduces R/Python programming for systematic data analysis, addressing data architecture, acquisition, and complex analysis using regression models. Students also explore the principles of data visualization through Tableau, mastering the creation of various charts, maps, dashboards, and interactive data displays. The course emphasizes hands-on experience, including lab sessions, projects, and assignments, ensuring students acquire a comprehensive understanding of data analytics and visualization within the context of computer science and technology.

References

Klosterman, S. (2021). Data Science Projects with Python: A case study approach to gaining valuable insights from real data with machine learning. Packt Publishing Ltd.
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https://www.r-project.org/other-docs.html (Retrieved from the Internet 06/11/2022)
http://www.r-tutor.com/r-introduction (Retrieved from the Internet 06/11/2022)
https://medium.com/codex/stock-market-analysis-with-r-programming-language-c3ab502eb3e7 (Retrieved from the Internet 06/11/2022)
https://www.guru99.com/r-tutorial.html (Retrieved from the Internet 06/11/2022)
Ryan, L. (2018). Visual data storytelling with tableau: story points, telling compelling data narratives. Addison-Wesley Professional.
Murray, D. G. (2013). Tableau your data: fast and easy visual analysis with tableau software. John Wiley & Sons.
Few, S. (2013). Information dashboard design: Displaying data for at-a-glance monitoring (Vol. 5). Burlingame, CA: Analytics Press.
https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm
https://www.analyticsvidhya.com/blog/2017/07/data-visualisation-made-easy/
https://www.datacamp.com/tutorial/data-visualisation-tableau

Learning Outcomes

CLO 1: Master Python and essential data science tools.
CLO 2: Proficiently use Python Data Science packages.
CLO 3: Acquire data manipulation and preprocessing skills.
CLO 4: Explore statistical data analysis techniques.
CLO 5: Learn systematic data analysis using R programming.
CLO 6: Create diverse data visualizations with Tableau.
CLO 7: Apply knowledge through practical tasks and projects.

Tutorials

Week 1: Introduction to Python and Data Science Tools.
Week 2: Python Data Science Packages Proficiency.
Week 3: Data Manipulation and Preprocessing Techniques.
Week 4: Exploring Statistical Data Analysis.
Week 5: Introduction to R Programming for Systematic Data Analysis.
Week 6: Diverse Data Visualizations with Tableau.
Week 7: Hands-On Data Analysis Projects.
Week 8: Advanced Python and Data Science Tools.
Week 9: Utilizing Python Data Science Packages Effectively.
Week 10: Mastering Data Manipulation and Preprocessing.
Week 11: In-Depth Statistical Data Analysis.
Week 12: Advanced Systematic Data Analysis with R.
Week 13: Advanced Data Visualization with Tableau.
Week 14: Comprehensive Data Analysis Projects and Application.

Week 15: Lab Final Exam

CET244: Graphics Programming

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: CET153 AND CET112

Learning Outcomes

LO1: Students will be able to describe the architecture and workflow of modern graphics pipelines, including the roles of hardware and software in rendering.
LO2: Students will understand and apply key mathematical concepts (vectors, matrices, transformations) essential for 2D and 3D graphics programming.
LO3: Students will be able to explain and implement fundamental rendering techniques, including rasterization, shading models, and the use of shaders.
LO4: Students will demonstrate understanding of major graphics programming interfaces (e.g., OpenGL, DirectX, or Vulkan) and their application in real-time rendering.
LO5: Students will understand advanced topics such as lighting models, texturing, animation, and optimization for performance in graphics applications.
LO6: Implement the stages of a graphics pipeline, from object modeling and transformation to rasterization and fragment processing.
LO7: Write and integrate vertex and fragment shaders to achieve various visual effects in real-time applications.
LO8: Develop programs that create, transform, and render 2D and 3D objects using appropriate mathematical operations and graphics APIs.
LO9: Apply textures and materials to objects, adjusting parameters for realistic or stylized visual outcomes.
LO10: Analyze and optimize graphics code for efficiency, addressing bottlenecks and improving rendering performance.
LO11: Critically analyze and solve technical challenges in graphics programming, selecting appropriate algorithms and techniques.
LO12: Document and communicate graphics programming processes, code structure, and design decisions clearly and effectively.
LO13: Work effectively in teams to design, implement, and test graphics programming projects, incorporating feedback and industry best practices.
LO14: Independently learn and apply new graphics programming tools, APIs, and emerging technologies.
LO15: Demonstrate awareness of ethical, cultural, and sustainability considerations in the development and application of computer graphics.

Lectures

Week 1: Course overview; history and applications of computer graphics; graphics hardware and software pipeline.
Week 2: Overview of major graphics APIs; rendering pipeline stages; drawing primitives.
Week 3: Vectors, matrices, and transformations; coordinate systems; homogeneous coordinates.
Week 4: 3D space representation; 3D transformations; camera models and view matrices.
Week 5: Perspective and orthographic projection; viewport transformation; clipping.
Week 6: Rasterization process; color, depth, and stencil buffers; double buffering.
Week 7: Lighting theory; Phong and Gouraud shading; ambient, diffuse, and specular components.
Week 8: Texture mapping; UV coordinates; material properties and texture filtering.
Week 9: Introduction to shaders; vertex and fragment shaders; GLSL/HLSL basics.
Week 10: Transparency, blending, and anti-aliasing; rendering pipelines for special effects.
Week 11: Keyframe and skeletal animation; scene graph structures for hierarchical modeling.
Week 12: Performance bottlenecks in graphics; culling, LOD, and batching; profiling tools.
Week 13: Physically-based rendering (PBR); real-time ray tracing; graphics in VR/AR.
Week 14: Industry trends and career opportunities in graphics programming; course review.

Laboratories

Week 1: Setting up a graphics programming environment (e.g., OpenGL, DirectX, or Vulkan); first window and rendering context.
Week 2: Drawing basic 2D shapes (points, lines, triangles) using a graphics API.
Week 3: Implementing 2D transformations (translation, rotation, scaling) in code.
Week 4: Rendering and transforming simple 3D objects; implementing a virtual camera.
Week 5: Coding perspective and orthographic projections; switching between views.
Week 6: Implementing double buffering and depth testing; visualizing buffer effects.
Week 7: Implementing basic lighting and shading models in shaders.
Week 8: Applying textures to 3D models; experimenting with different material settings.
Week 9: Writing custom vertex and fragment shaders; implementing color and lighting effects.
Week 10: Implementing transparency and blending; exploring anti-aliasing techniques.
Week 11: Creating simple animations; building and traversing a scene graph.
Week 12: Profiling a graphics application; optimizing rendering for performance.

Week 13: Experimenting with PBR materials; introduction to real-time ray tracing APIs.
Week 14: Final project presentations; peer feedback; course reflection and wrap-up.

CET251: Artificial Intelligence

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET111

Course Description

Artificial Intelligence aims to mimic the cognitive efforts of humans to equip machines with automated problem-solving capabilities. Artificial Intelligence improves the speed, precision, and effectiveness of human efforts. Artificial intelligence technology provides several essential benefits that make it an excellent tool for any modern organization. In practical terms, AI applications can be deployed in a number of domains such as healthcare, finance, manufacturing, logistics, and so on. Healthcare is one domain where AI has been widely adopted and is being used for tasks such as diagnosis, treatment recommendations, disease prediction, and so on. Finance is another domain where AI is being used for tasks such as fraud detection, credit scoring, stock market prediction, and so on. Students learn concepts and strategies that form the core of artificial intelligence, including fundamental concepts like AI-based problem solving, knowledge representation, understanding of natural language, expert systems, and learning. This course covers an introduction to Python and libraries. It discusses and presents the implementation of DFS, BFS, and A* Algorithms in Python. A Knowledge representation problem is solved. This course also presents a semantic network with Python and design and implement an intelligent agent. The course applies Word Tokenization using the NLTK package and implements NER and parsing using Spacy. An expert system for a given use case is presented and implemented with Python. It explores the design of an XOR truth table using Python. Experiments with robotics and computer vision are provided. Lectures focusing on AI fundamentals, Lab sessions, projects, and assignments are used to deliver the course.

References

Stuart Russell & Peter Norvig (2018) Artificial Intelligence: A Modern Approach, Third Global Edition, Pearson Education
https://www.javatpoint.com/artificial-intelligence-tutorial
https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial
https://www.w3schools.com/ai/
https://www.mygreatlearning.com/blog/artificial-intelligence-tutorial/

Learning Outcomes

CLO 1: Formulate the computing requirements for a given AI based problem.
CLO 2: Design AI systems to meet given organizational requirement, considering ethical implications.
CLO 3: Evaluate and recommend AI algorithms for a given problem.
CLO 4: Select suitable AI techniques and write programs for a given problem.
CLO 5: Write lab reports and present results.

Tutorials

WEEK 1: Introduction to Python and libraries
WEEK 2: Implement DFS and BFS using Python
WEEK 3: Implement A* Algorithm in Python
WEEK 4: Implementation of a Knowledge representation problem
WEEK 5: Implement a semantic network with Python
WEEK 6: Implement an intelligent agent (1)
WEEK 7: Implement an intelligent agent (2)
WEEK 8: Word Tokenization using NLTK package
WEEK 9: Implement NER and parsing using Spacy
WEEK 10: Write an expert system for a given use case with Python
WEEK 11: Design an XOR truth table using Python.
WEEK 12: Experiment with robotic exercise
WEEK 13: Experiment with a computer vision exercise
WEEK 14: Advanced example implementation for robotics
WEEK 15: Lab Final Exam.

Laboratories

WEEK 1: What is Artificial Intelligence, Applications of Artificial Intelligence
WEEK 2: AI techniques, search knowledge, State space search
WEEK 3: Search in complex environments
WEEK 4: Knowledge Representation issues, first order predicate calculus
WEEK 5: Horn Clauses, Resolution, Semantic Nets, Frames, Partitioned Nets
WEEK 6: Logical Agents
WEEK 7: Forward Vs Backward Reasoning
WEEK 8: Introduction to NLP, Syntactic Processing, Semantic Analysis, Parsing techniques
WEEK 9: Conceptual Dependency, Grammar free analyzers, Sentence generation and translation
WEEK 10: Expert System, Knowledge acquisition, Case studies: MYCIN, RI, Learning: Learning automation, Learning by inductions
WEEK 11: Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning, Use of certainty factors, Fuzzy logic
WEEK 12: Robotics Architectures and control
WEEK 13: Trajectory Planning, Sensors, and vision system
WEEK 14: Applications of Robotics
WEEK 15: Features of Robotics

CET253: Game Design

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Course Description

This elective explores the theory and analysis of game design. Students study design frameworks, like MDA (Mechanics, Dynamics, Aesthetics), to understand player engagement. The course covers genres (e.g., RPG, FPS), dissecting their core loops (e.g., exploration, combat) and emotional impacts. Narrative design, progression systems (e.g., XP curves), and player psychology (e.g., flow state) are analyzed through games like “Dark Souls” or “Stardew Valley.” Labs involve prototyping mechanics—e.g., a reward system or puzzle—and critiquing existing titles with written analyses. Students also explore iterative design, refining ideas based on feedback.

References

Schell, J. (2014). *The Art of Game Design: A Book of Lenses* (2nd ed.). CRC Press.
Salen, K., & Zimmerman, E. (2003). *Rules of Play*. MIT Press.

Learning Outcomes

LO1: Students will be able to describe and explain the core principles and terminology of game design, including game mechanics, dynamics, aesthetics, and player experience.
LO2: Students will recognize and differentiate between major game genres and structural elements, understanding how these influence design choices.
LO3: Students will understand the purpose and structure of key game design documents, such as concept documents, game design documents (GDD), and storyboards.
LO4: Students will be able to explain the role of narrative, world-building, and character development in enhancing player engagement.
LO5: Students will understand the importance of prototyping, playtesting, feedback collection, and iterative refinement in the game design process.
LO6: Students will recognize ethical, cultural, and social issues relevant to game design, including inclusivity, representation, and responsible content creation.
LO7: Generate, evaluate, and refine original game concepts, applying creative thinking and design methodologies.
LO8: Design and implement engaging game mechanics, rules, and systems that support intended player experiences.
LO9: Develop physical or digital prototypes to test and communicate design ideas.
L10: Conduct structured playtests, collect and analyze player feedback, and iterate on designs for improvement.
L11: Prepare clear, comprehensive design documents and effectively communicate design ideas to team members and stakeholders.
L12: Work productively in multidisciplinary teams, contributing to group discussions, critiques, and collaborative projects.
L13: Critically analyze games and design decisions, identifying strengths and areas for improvement.
L14: Address design challenges by applying systematic design processes and creative solutions.
L15: Apply basic project management skills, such as planning, scheduling, and resource allocation, within the context of game development.
L16: Independently seek out and apply new game design theories, tools, and industry trends.
L17: Clearly articulate design concepts, rationales, and feedback in both oral and written forms, adapting communication style to different audiences.
L18: Demonstrate awareness of ethical and social responsibilities in game design, including respect for diversity and the impact of games on society.

Lectures

Week 1: Overview of game design; history and genres of games; the role of the game designer.

Week 2: Core components of games—rules, mechanics, dynamics, and aesthetics.
Week 3: Techniques for brainstorming and evaluating game ideas; concept documentation.
Week 4: Importance of prototyping; iterative design process; rapid prototyping techniques.
Week 5: Types of game mechanics; balancing gameplay for challenge and fairness.
Week 6: Role of narrative; interactive storytelling; integrating story with gameplay.
Week 7: Principles of level design; pacing, flow, and player guidance.
Week 8: UX principles in games; designing clear and engaging interfaces.
Week 9: Methods for effective playtesting; collecting and analyzing player feedback.
Week 10: Designing for multiplayer experiences; social mechanics and community building.
Week 11: In-game economies; reward structures; motivating player engagement.
Week 12: Visual and audio design principles; aligning art and sound with gameplay.
Week 13: Creating professional game design documents (GDD); pitching game ideas to stakeholders.
Week 14: Best practices for presenting and critiquing game projects; industry expectations.

Laboratories

Week 1: Analyzing classic and modern games; group discussion on favorite games and their mechanics.
Week 2: Deconstructing a simple game to identify its core elements; hands-on with board or digital games.
Week 3: Group brainstorming session; drafting a game concept document.
Week 4: Creating paper or digital prototypes; playtesting and feedback collection.
Week 5: Modifying prototypes to adjust mechanics and balance; documenting changes.
Week 6: Writing a short narrative for a game concept; designing branching story paths.
Week 7: Designing a simple game level (paper or digital); peer review and critique.
Week 8: Sketching wireframes for HUDs and menus; usability testing.
Week 9: Conducting structured playtests of student prototypes; revising designs based on feedback.
Week 10: Prototyping a simple multiplayer or social game mechanic; group playtest.
Week 11: Designing a basic in-game economy and reward loop; simulation exercises.
Week 12: Creating or sourcing basic art and audio assets; integrating them into prototypes.
Week 13: Preparing a GDD for the final project; practicing game pitches in groups.
Week 14: Final project presentations; peer and instructor feedback; course wrap-up and reflection.

CET261: Advanced Computer Networks

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	0	180	360	4	180	90	120	60	15	25

Requisites

- Prerequisites: CET161

Course Description

- The objective is to acquaint the students with the application of networking. Detail description of the various TCP/IP protocols and the working of ATM and its performance and introduction to network management system, cryptography, security and authentication, and various algorithms related to it has been dealt, to get a practical approach. This course covers TCP/IP Protocol, internet addressing and mapping to physical address, advanced computer network protocols, layered protocols, internet addressing, mapping internet address to physical address, internet protocol, OSPF, RIP, RARP, BOOTP, DHCP, BGP, ARP, IP, Ipv6. The topics include ICMP transport protocols: UDP, TCP and SNMP, frame relay, B-ISDN, ATM protocol stack, ATM switching, internetworking with ATM networks, traffic management in ATM, subnet, super net, classless and class full addresses, Connection oriented networks, LAN ethernet, fast-ethernet, gigabit Ethernet, FDDI, DSL, ADSL, switching and socket programming. This course also covers wireless communication, mobile networks, Bluetooth, DNS and Active Directory, XML-based web services, socket programming, peer-to-peer (P2P) networks and applications, virtual LAN, class of service, and multilayer networks, network analysis and modeling, queuing theory, modelling network as a graph, network management system and standard, introduction to cryptography and basics of network security. The laboratory work consists of simulation and implementation of advanced networking concepts, socket programming discussed during the course.

References

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https://www.javatpoint.com/computer-network-tutorial

Learning Outcomes

CLO 1: Analyze virtual network using appropriate methodologies, techniques, tools and transmission medium for the integration of concepts from varying fields.
CLO 2: Formulate and communicate the mechanism to evaluate the role of wireless mobile network layer for all stakeholders in the network.
CLO 3: Review the network security issues to identify solutions using appropriate skills for complex network.
CLO 4: Analyze ad-hoc networks and quality of service in various networks.
CLO 5: Simulate, configure and troubleshoot networking activities and perform experiments, interpret results and conclusions.
CLO 6: Write lab reports and present results.

Tutorials

WEEK 1: Lab Induction, Introduction to tools, Course Policies, and format for lab reports
WEEK 2: Implement the following forms of Inter process communication(IPC): a) Pipes. b) FIFO.
WEEK 3: Implement file transfer using Message Queue form of IPC.
WEEK 4: Design, implement and test TCP iterative Client and Server application to reverse the given input sentence.
WEEK 5: Design, implement and test TCP concurrent Client and Server application to reverse the given input Sentence.
WEEK 6: Design, implement and test TCP Client and Server application to transfer file.
WEEK 7: Design, implement and test a TCP concurrent Server to convert a given text into upper case using Multiplexing system call “select”
WEEK 8: Design, implement and test a TCP concurrent Server to echo given set of sentences using Poll functions.
WEEK 9: Design, implement and test UDP Client and Server application to reverse the given input sentence. Week 10: Design UDP Client Server to transfer a file.
WEEK 11: Design, implement and test using Poll Client Server application to multiplex TCP and UDP requests for converting a given text into upper case.
WEEK 12: Design, implement and test an RPC application to add and subtract a given pair of integers.
WEEK 13: Open Ended Practical’s/Mini Project
WEEK 14: Open Ended Practical’s/Mini Project
WEEK 15: Lab Final Exam

CET262: Network Operation and Managment

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET261

Course Description

Enterprise networks include Local Area Networks, Wide Area Networks and Cloud Networks. This course covers wide area network (WAN) technologies and quality of service (QoS) mechanisms used for secure remote access, along with the introduction of software-defined networking, virtualization, and automation concepts that support the digitalization of networks. The course provides students with the network industry knowledge required to obtain IT employment. The student learning includes networking theory that explains practical applications and learning to configure Cisco routers and switches at a basic level. Students gain skills to configure and troubleshoot enterprise networks and learn to identify and protect against cybersecurity threats. The student learns about the concepts of a home network as a starting point to describe how big businesses deliver data network connections to thousands of devices, along with the variety of network hardware. The student also explores the different cabling types, how fibre optics are categorized for data network use, and the different types of 802.11 wireless networks and their uses. They are introduced to network management tools and learn key software-defined networking concepts, including controller-based architectures. The course covers how application programming interfaces (APIs) enable network automation. Lectures, assignments, structured lab sessions and projects based on Enterprise Network Service are used to deliver the course.

References

Cisco Networking Academy. (2020). Enterprise Networking, Security, and Automation Companion Guide (Ccnav7). Pearson Education (US).
Shin, B. (2017). A Practical Introduction to Enterprise Network and Security Management. Auerbach Publications.
Pluralsight, "Introduction to Enterprise Network Infrastructure", https://www.pluralsight.com/courses/enterprise-network-infrastructure-introduction, Accessed on 15.10.2022

Learning Outcomes

CLO 1: Apply best practices when designing and implementing security zones in an enterprise network.
CLO 2: Analyze the limitations inherent in networking technology as they affect network quality of service (QoS) metrics.
CLO 3: Explain best practices when assigning IPv4 and IPv6 addresses in an enterprise network.
CLO 4: Compare routing protocols (including the Enhanced Interior Gateway Routing Protocol (EIGRP) and the Open Shortest Path First (OSPF) protocol) as used in an enterprise network.
CLO 5: Categorize Local Area Network (LAN) and Virtual LAN (VLAN) technologies as used in an enterprise network.
CLO 6: Interpret enterprise applications for their network service requirements.
CLO 7: Organize an enterprise network design for efficiency and effectiveness in supporting multiple locations, user device security, user content security, 24x7 availability, QoS, and congestion management.

Tutorials

WEEK 1: Lab Induction, understanding packet tracer /simulator, Course Policies, and reports.
WEEK 2: Design and configure Single-Area OSPF-I Link Costs and Interface Priorities.
WEEK 3: Design and configure Multi-Area OSPF-I with Stub Areas and Authentication.
WEEK 4: Design and configure OSPF-II Virtual Links and Area Summarization and OSPF over Frame Relay.
WEEK 5: Configure Redistribution and Administrative Distances Between RIP and OSPF and Manipulating Administrative Distances.
WEEK 6: Configuring Border Gateway Protocol (BGP) with Default Routing Using the AS_PATH Attribute.
WEEK 7: Configure Border Gateway Protocol (BGP) Route Reflectors and Route Filters.
WEEK 8: Configuring Open Shortest Path First (OSPF) for IPv6.
WEEK 9: Configuring VLANs and Ether Channel Static VLANS, VLAN Trunking, and VTP Domains and Modes.
WEEK 10: Configuring Spanning Tree Protocol (STP) Default Behavior and Modifying Default Spanning Tree Behavior.
WEEK 11: Configuring Per-VLAN Spanning Tree and Multiple Spanning Tree Behavior.
WEEK 12: Configure Inter-VLAN Routing with an External Router.
WEEK 13: Configure Inter-VLAN Routing with an Internal Route Processor.
WEEK 14: Configure Network address translation-NAT Services.
WEEK 15: Lab Final Exam.

CET263: Windows Server Administration

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Requisites

- Prerequisites: CET212 AND CET161

Course Description

The Windows Server Administration course equips IT professionals with the essential skills to manage and deploy Windows Server environments within organizations. Through a combination of lectures, hands-on labs, and practical exercises, you'll gain a comprehensive understanding of core server administration tasks. This course covers a wide range of topics, including user and group management with Active Directory, network infrastructure configuration, file and storage services, virtualization with Hyper-V, and security best practices. By the course's end, you'll be confident in your ability to manage and optimize Windows Server environments for efficient and secure operation.

References

"Microsoft Windows Server Administration Fundamentals" by William Pearson (Covers Microsoft MTA exam 98-365 objectives)
"Windows Server 2022 Administration Comprehensive Guide" by Microsoft Press (Focuses on the latest Windows Server version)
"Learning Active Directory" by Chris Russel (In-depth guide to Active Directory services)
"Hyper-V and Virtualization: Microsoft Client to Datacenter" by Patrick Dougherty and Edilson Canales (Covers Hyper-V virtualization concepts)
"Security for Windows Server and Active Directory" by Edilson Canales (Focuses on security best practices)
Microsoft Docs: Windows Server https://learn.microsoft.com/en-us/windows-server/ (Official documentation from Microsoft)
Microsoft Virtual Academy: Windows Server Courses
Windows Server Administration Tutorials https://www.acilearning.com/catalog/microsoft/ (Video tutorials on various Windows Server topics)
CBT Nuggets: Windows Server Training https://www.cbtnuggets.com/it-training/microsoft-windows-server (In-depth video training with labs)
Professor Messer: Windows Server Lessons https://www.professormesser.com/discounted-comptia-server-plus-voucher/ (Free video lectures on Windows Server administration)

Learning Outcomes

Install, configure, and manage Windows Server environments.
Implement Active Directory for user and group management.
Configure network infrastructure services like DHCP and DNS.

Manage file and storage services for efficient data access.
Utilize Hyper-V for server virtualization and containerization.
Implement high availability and disaster recovery solutions.
Apply security best practices to protect Windows Server environments.
Troubleshoot common Windows Server issues.

CET264: Software Systems Administration

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Requisites

- Prerequisites: CET212 AND CET161

Course Description

This course equips you with the foundational skills to manage essential software systems within an enterprise environment. You'll gain a comprehensive understanding of widely used software, including anti-virus programs, office suites like Microsoft Office, printing and scanning utilities, and communication and video conferencing tools. Through a combination of lectures, hands-on labs, and case studies, you'll learn how to install, configure, troubleshoot, and maintain these critical systems.
The course emphasizes best practices for user administration, security protocols, and system optimization. You'll develop the ability to identify and resolve common issues, ensuring smooth operation and user productivity. This basic level prepares you for a career in IT support or as a stepping stone towards more advanced system administration roles.

References

MCTS Microsoft Windows Server 2019 Administration Fundamentals (Exam 70-410) by William R. Schultz (Latest Edition)
The Complete Guide to Microsoft Office 365 & Office 2019 by Jason R. Maas (Latest Edition)
Enterprise Antivirus: Practical Security Solutions by Syngress (Latest Edition)
Linux Administration: A Beginner's Guide by Evi Nemeth, Garth Snyder, Trent R. Hein (Latest Edition) (While this focuses on Linux, it provides valuable foundational concepts for system administration)
CompTIA A+ Certification All-in-One Exam Guide (Exams 220-1001 & 220-1002) by Mike Meyers (Latest Edition) (Provides a broader IT administration perspective)
Microsoft Docs - Windows Server Documentation (https://learn.microsoft.com/en-us/windows-server/)
Microsoft Office Training (https://support.microsoft.com/home/)
Avast Antivirus Small Business Guide (https://www.avast.com/business/products/small-business)
Linux.org - System Administration
Professor Messer - CompTIA A+

Learning Outcomes

Install, configure, and manage essential enterprise software including anti-virus, office suites, printing and scanning utilities, communication and video conferencing tools.
Implement user accounts and access controls for secure system usage.
Troubleshoot and resolve common software issues within an enterprise environment.
Optimize system performance and resource allocation.
Apply best practices for system administration in a professional setting.

CET265: Network Storage Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Requisites

- Prerequisites: CET161

Course Description

Network storage systems are the backbone of modern data centers, enabling the sharing and access of critical information across vast

networks. This course delves into the design, implementation, and management of these distributed systems. You'll explore the fundamental concepts of network-attached storage (NAS), storage area networks (SANs), and emerging technologies like object storage and distributed file systems. The course will equip you with the knowledge to understand the trade-offs between different storage solutions, design scalable storage architectures, and ensure the performance, reliability, and security of your data.
Furthermore, you'll gain insights into the latest advancements in network storage, including virtualization, cloud storage, and software-defined storage (SDS). By the end of the course, you'll be well-positioned to evaluate, deploy, and manage network storage solutions that meet the ever-growing demands of modern organizations.

References

Katz, M., Garth, J., & Patterson, D. (2012). GFS: The Google File System. Morgan Kaufmann.
Held, G., & Rector, R. (2009). NFS Illustrated. Addison-Wesley Professional.
Bergsten, M. (2010). EMC SAN Fundamentals (2nd Edition). EMC Education Services.
Mee, C., & de Bruijn, E. H. (2002). Storage Area Networks: The Complete Guide. McGraw-Hill Osborne Media.
Banerjee, P. (2014). Cloud Storage: Theory and Practice. Morgan Kaufmann.

Learning Outcomes

Explain the fundamental concepts of network storage systems, including NAS, SAN, and object storage.
Analyze the strengths and weaknesses of different network storage solutions.
Design and implement scalable storage architectures for various applications.
Configure and manage network storage devices for optimal performance and reliability.
Identify and implement security best practices for network storage systems.
Evaluate emerging trends in network storage, such as virtualization, cloud storage, and SDS.

CET291: CET Project I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	2	120			75	0	25

Course Description

This course enables the students to exercise some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. The student is expected to design a project that provides students with the experience of designing, building, and integrating modular software applications/ electronic system comprising analog, digital and computer subsystems. The student mostly implements design and tests the system. This course includes planning the tasks which are to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. By studying this course. The student develops creativity, initiative, and capacity to perform. Leadership development and supervision skills are also integrated into the learning objectives of this course. The project will have a detailed proposal, which must be executed or implemented within the time allocated while maintaining a logbook periodically monitored by the professor mentor. Projects should be chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is to be prepared as the project progresses, which has to be submitted after the project is over. The students acquire the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1: Define the tasks and scope of the project independently and/or collaboratively
CLO 2: Identify relevant information pertaining to project needs from a variety of resources.
CLO 3: Acquire knowledge on advanced topics in a chosen subject area
CLO 4: Summarize the information and draw a logical conclusion to the problem/task of the project
CLO 5: Outline the details of hardware and software required for the completion of the project
CLO 6: Prepare project proposals with an action plan and time duration scientifically.
CLO 7: Communicate project ideas and current work achievements clearly through technical report and presentations.

CET292: CET Project II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	4	240			75	0	25

Requisites

- Prerequisites: CET291

Course Description

This course enables the students to apply some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. Project II provides students with the experience of designing and building simple software and hardware applications. Further students can learn how to integrate it into a modular electronic system or computer subsystems. This course builds on the knowledge and skills built in Project I. The student mostly implements design and tests the system. This course includes planning the tasks which are to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. Through this course, the student develops creativity, initiative, and capacity to perform. The student develops interpersonal, teamwork, planning and organizing skills. The projects will have a detailed project proposal, which must be executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the teacher. Projects should be chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is to be prepared as the project progresses, which has to be submitted after the project is over. The students acquire the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1. Choose the relevant possible solutions from available alternatives
CLO 2. Conduct feasibility studies about hardware and software parts used in the project.
CLO 3. Design a simple software and hardware application taking into consideration various real-life constraints.
CLO 4. Investigate the important legal and ethical issues in the design project
CLO 5. Collaborate with team members, managers, and clients to design and prototype a product/service that meets user needs and expectations.
CLO 6. Conduct the theoretical study in detail and compare them on the basis of cost/ energy conservation/impact on environment/technology used etc.
CLO 7. Communicate project ideas and current work achievements clearly through technical report and presentations.

CET311: Design & Analysis of Algorithms

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET211

Course Description

Design and analysis of algorithms is used for advanced algorithmic concepts to solve complex real-world problems. This course covers the advanced data structure, growth of functions, asymptotic notations, divide-and-conquer algorithms and its run time analysis, structure of divide-and-conquer algorithms: examples; binary search, quick sort, merge sort, run time analysis of divide and conquer and recurrence relations. The topics include recurrence relations including substitution method, recursion-tree method, and master method for solving recurrences, red black tree, greedy method: overview of the greedy paradigm examples of exact optimization solution (minimum cost spanning Tree), approximate solution (knapsack problem), single source shortest paths problems, traveling salesperson problem, dynamic programming: overview, difference between dynamic programming and divide and conquer technique. The student learning includes applications: shortest path in graph, chain matrix multiplication, traveling salesperson problem, longest common sequence problem, knapsack problem, graph searching and traversal:

overview, representation of graphs, strongly connected components, traversal methods (depth first and breadth first search) and its analysis. The student also learns back tracking: overview, 8-queen problem, and knapsack problem, branch and bound: lc searching bounding, FIFO branch and bound, lc branch and bound application: 0/1 knapsack problem, traveling salesperson problem, computational complexity: complexity measures, polynomial vs non-polynomial time complexity; np-hard and np-complete classes. Lab sessions consists of the implementation of advanced data structures, dynamic programing, greedy and graph algorithms discuss in the course.

References

Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). Introduction to algorithms. MIT press
https://nptel.ac.in/courses/106106131
https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
https://www.javatpoint.com/daa-tutorial

Learning Outcomes

CLO 1: Analyze a given algorithm and express its time and space complexities in asymptotic notations to choose the efficient algorithms.
CLO 2: Evaluate worst-case running time of algorithms using asymptotic analysis to solve recurrence equations.
CLO 3: Implement the Divide and Conquer Strategy to solve various computational problems.
CLO 4: Demonstrate an ability to work in a team to design the computing based solution for complex problems and present it.
CLO 5: Review and categorize the computational problems into P, NP, NP-Hard, and NP-Complete for computational complexity.
CLO 6: Apply the concepts of algorithm design methods, write programs in lab to solve the given problem.
CLO 7: Write the lab report and present the output result in lab record.

Tutorials

WEEK 1: Lab induction, course policies and lab report format.
WEEK 2: Implement Divide-and-Conquer algorithms and time taken analysis
WEEK 3: Implement Recursive Binary Search
WEEK 4: Implement Sorting Algorithms.
WEEK 5: Implement Red Black Tree
WEEK 6: Implement Dynamic Programming Algorithms.
WEEK 7: Implement Dynamic Programming Algorithms
WEEK 8: Implement Greedy Algorithms
WEEK 9: Implement Greedy Algorithms
WEEK 10: Implement Back Tracking concept
WEEK 11: Implement Back Tracking concept
WEEK 12: Implement graph algorithms
WEEK 13: Implement graph algorithms
WEEK 14: Open Ended Problems/Project
WEEK 15: Lab Final Exam

Laboratories

WEEK 1: Merge and Quick sort problems.
WEEK 2: Recurrence relations: Substitution method for solving recurrences
WEEK 3: Recurrence relations: Recursion-tree method and master method for solving recurrences.
WEEK 4: Greedy Method
WEEK 5: Single source shortest paths problems and traveling salesman problem
WEEK 6: Dynamic Programming : Chain matrix multiplication
WEEK 7: Dynamic Programming : Chain matrix multiplication
WEEK 8: Dynamic Programming: longest Common sequence problem, knapsack problem
WEEK 9: Dynamic Programming: longest Common sequence problem, knapsack problem
WEEK 10: Graph Searching and Traversal
WEEK 11: Back tracking: 8-queen problem, Knapsack problem
WEEK 12: Back tracking: 8-queen problem, Knapsack problem
WEEK 13: Brach and bound: LC searching Bounding, FIFO branch and bound
WEEK 14: LC branch and bound application: 0/1 Knapsack problem, Traveling Salesman Problem
WEEK 15: LC branch and bound application: 0/1 Knapsack problem, Traveling Salesman Problem

CET312: ERP Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET112

Course Description

This course focuses on the evolving technologies on the World Wide Web that support new business models. Students learn how the internet is rapidly becoming a primary communication, marketing, and commercial medium for businesses in every industry and how managers can effectively use this tool to execute their organization's strategic plans. The student learns about electronic commerce with fault tolerance, security, and 24x7 availability and ERP concerning financial, human resource and manufacturing systems integrating into inter-company supply chain systems. The course provides an overview of the planning and control systems used by manufacturing companies to manage their supply chains within the context of an ERP system. The student learning includes strategic impact of ERP on Business, the importance of ERP and its relationship with the functions in the organization, understand issues and decisions made before selecting and implementing ERP, and explore the function of ERP as an enabler of the business. The topics include the current transformation in the payments industry and how it is changing financial services. The student learns about real-world applications of new technologies and innovations in digital payments. Lectures, assignments, lab sessions and projects based on E-Commerce and ERP are used to deliver the course.

References

Sims, L. (2018). Building Your Online Store with WordPress and WooCommerce: Learn to Leverage the Critical Role E-commerce plays in Today's Competitive Marketplace. Apress.
Laudon, K. C., & Traver, C. G. (2020). E-Commerce 2020–2021: Business, Technology and Society, eBook. Pearson Higher Ed.
Kale, V. (2016). Enhancing Enterprise Intelligence: Leveraging ERP, CRM, SCM, PLM, BPM, and BI. CRC Press.
Udemy, "Online Business Academy - eCommerce", https://www.udemy.com/course/online-business-hacks-ecommerce/, Accessed on 15.10.2022
Coursera, "Introduction to Enterprise Resource Planning (ERP)", https://www.coursera.org/lecture/enterprise-systems/1-1b-introduction-to-enterprise-resource-planning-erp-LneSo, Accessed on 15.10.2022
Google, Google Digital Marketing & E-commerce Professional Certificate, https://www.coursera.org/professional-certificates/google-digital-marketing-ecommerce, Accessed on 15.11.2022
Udemy, ERP 4 FREE, https://www.udemy.com/course/erp-4-free/ Accessed on 15.11.2022 (PAID)

Learning Outcomes

CLO 1: Describe Information System perspective and Key Managerial issues.
CLO 2: Analyze the impact of e-commerce in buying and selling behavior of customer.
CLO 3: Investigate one e-commerce website(s), and understand legal and moral issues in the digital age.
CLO 4: Demonstrate the basic understanding of ERP related to organizations in achieving a multidimensional growth.
CLO 5: Develop organizational and analytical skills through the use of business cases studies, articles and working in teams.
CLO 6: Write the lab report and present the output result as lab record.
CLO 7: Demonstrate the basic configuration related to E-commerce and ERP technologies to accomplish group tasks.

Tutorials

WEEK 1: Lab Induction, Introduction to HTML, Course Policies, reports.
WEEK 2: Create a web page to display a hyperlink which when clicked directs you to Amazon website.
WEEK 3: Create a web page to demonstrate definition lists by taking various applications of ecommerce as an example.
WEEK 4: Create a web page to display a button with label "search" adjacent to a text box. Also change the color of text box and background of the web page.
WEEK 5: Create a web page which asks for mode of payment which includes the options: Credit card/Debit card/Online transfer (use radio buttons).
WEEK 6: Create a web page which asks the user to enter his credit card details. Use textboxes, drop down buttons.
WEEK 7: Create a web page with the SHOPPING WEBSITE as the title and five buttons labelled Home, About Us, Courses, feedback, contact us as shown in the diagram which when clicked displays the details on a separate page.
WEEK 8: Create a web page using a form titled Feedback form which takes feedback of the shopping behavior of a customer. The form should have the field's customer name, order ID followed by 5 check boxes labelled Excellent, Very Good, Good, Average, Bad, respectively.
WEEK 9: To study ERP system, ERP technologies and its ecosystem.
WEEK 10: To Study different Management Information Systems (MIS).
WEEK 11: Case study: Related to Customer Relationship Management (CRM).
WEEK 12: To study ERP implementation life cycle and case study related to SAP (Systems, Applications & Products in Data Processing).
WEEK 13: Case study on Integrated Enterprise applications.
WEEK 14: To study open-source ERP systems and case study on Microsoft Dynamics.
WEEK 15: Lab Final Exam.

CET313: Theory of Computation & Compiler Design

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	0	180	360	4	180	90	120	60	15	25

Course Description

Theory of computation is used to simplify the logic of computation using computational models and to address the issues of which problems can be solved by computational means. This course covers the general theory of automata, deterministic finite automata (DFA) and non-deterministic finite automata (NDFA), equivalence of dfa's and nfa's, mealy and moore machines, regular expressions, Arden's theorem, converting a dfa to a regular expression, formal languages. The topics include context-free grammars, derivations using a grammars leftmost and rightmost derivations, the languages of a grammar, parse trees, equivalence of regular expressions and regular languages, ambiguity in grammars and languages: ambiguous grammars, removing ambiguity from grammars, normal forms: Chomsky normal form and greibech normal form, pumping lemma and applications of the pumping lemma. The student learning includes properties of context-free languages, pushdown automata(pda), instantaneous descriptions of a pda, languages of pda: acceptance by final state, acceptance by empty stack, Turing machines and designing of Turing machine, the Turing machine: the instantaneous descriptions for Turing machines, transition diagrams for Turing machines, the language of a Turing machine, halting problem. The student also learns linear bounded automata, and computability and complexity theories, decidability and recursively enumerable languages, post's correspondence problem: definition of post's correspondence problem, the "modified" PCP, other undecidable problems: undecidability of ambiguity for cfg's. The laboratory work consists of experiments illustrating the principles and various methods and concepts discussed in the course.

References

Linz, P. (2017). An Introduction to Formal Languages and Automata. Jones and Barlett Publishers.
Sipser, M. (2012). Introduction to the Theory of Computation (3rd ed.), Cengage Learning
Mishra, K. L. P., & Chandrasekaran, N. (2011). Theory of Computer Science Automata. Languages and Computation. Prentice Hall of India, New Delhi.
https://nptel.ac.in/courses/106104028
https://nptel.ac.in/courses/106104148
https://www.tutorialspoint.com/automata_theory/index.htm
https://www.javatpoint.com/theory-of-automata

Learning Outcomes

CLO 1: Illustrate, how the theoretical study of computer science is applicable to an engineering application in real world.
CLO 2: Categorize the regular, context-free, context sensitive and unrestricted languages to Classify formal languages.
CLO 3: Create push-down automata and context-free grammar representations for context-free languages to solve computational problems.
CLO 4: Design and present the Turing Machines model for accepting recursively enumerable languages to solve the problems in computer science and testing the limits of computation.
CLO 5: Relate the notions of decidability and undecidability of problems, Halting problem to address the limits of computational models/devices.
CLO 6: Explain the concepts of theory of computation and implement it in the lab, interpret the results and conclusion.
CLO 7: Write the lab report and present the output result.

Tutorials

WEEK 1: Lab Induction, introduction, and applications of automata theory, Course Policies and format of lab reports
WEEK 2: Implementation of DFA and NDFA.
WEEK 3: Design a system to convert from NDFA to DFA
WEEK 4: Design and implement Mealy machines.
WEEK 5: Design and implement Moore machines.
WEEK 6: Design a system to convert from Mealy to Moore machine
WEEK 7: Design a system to convert from Moore to mealy machine.
WEEK 8: Design the grammar for respective language
WEEK 9: Design a system to generate the regular expression using Arden's theorem.
WEEK 10: Design and implement push down automata.
WEEK 11: Design and implement push down automata.
WEEK 12: Design and implement Turing Machines.
WEEK 13: Design and implement Turing Machines.
WEEK 14: Open Ended programs on Turing machines/push down automata.
WEEK 15: Lab Final Exam

Laboratories

WEEK 1: Deterministic finite automata (DFA) and non-deterministic finite automata (NDFA)
WEEK 2: Equivalence of DFAs and NFAs
WEEK 3: Mealy and Moore machines
WEEK 4: Regular expressions

WEEK 5: Arden's Theorem exercises.
WEEK 6: Derivation (Left and right most), Ambiguous Grammars, Removing Ambiguity from Grammars.
WEEK 7: Chomsky normal form
WEEK 8: Greibech Normal Form
WEEK 9: Pumping lemma
WEEK 10: Pushdown automata(pda)
WEEK 11: Pushdown automata(pda)
WEEK 12: Turing machine
WEEK 13: Turing machine
WEEK 14: Turing Machine halting problem and Post's Correspondence Problem
WEEK 15: Decidability and Recursively Enumerable.

CET314: Introduction to Web Technologies

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Requisites

- Prerequisites: CET123

Course Description

This course equips you with the foundational knowledge and practical skills to build, customize, and manage websites. You'll delve into the core building blocks of the web, including HyperText Markup Language (HTML), Cascading Style Sheets (CSS), and scripting languages like PHP. Through hands-on exercises, you'll learn how to structure web pages with HTML, add visual appeal with CSS, and create dynamic functionalities using PHP.
Furthermore, the course explores essential server-side technologies like Apache and IIS, along with control panel systems like cPanel/WHM. You'll gain the ability to configure web servers, manage hosting environments, and deploy your websites. Additionally, you'll be introduced to WordPress, a popular content management system (CMS), empowering you to build and manage websites with ease.

References

Head First HTML and CSS by Elisabeth Robson (Latest Edition)
The Web Developer's Guide to Complete Control of PHP by Steven Suehring (Latest Edition)
Apache: The Definitive Guide by Cliff Frazier (Latest Edition)
Microsoft IIS 10.0 Administration by Ben Hatch (Latest Edition)
WordPress: The Missing Manual by Matthew MacDonald (Latest Edition)

Learning Outcomes

Construct well-structured and visually appealing web pages using HTML and CSS.
Develop dynamic functionalities using PHP scripting.
Configure and manage web servers like Apache and IIS.
Utilize control panel systems like cPanel/WHM for website administration.
Create and manage websites effectively using WordPress as a CMS.
Apply best practices for web development and security.
Troubleshoot and debug common website issues.

CET321: Internet of Things

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET111

Course Description

The Internet of Things (IoT) refers to the billions of physical devices worldwide connected to the Internet including sensors and capability to process and exchange data. Students learn about the definitions and working of IoT Network Architecture, Smart Objects, Connecting Smart Objects, IoT Access Technologies, layering concepts in IoT, Application Protocols for IoT, Data and Analytics for IoT, Securing IoT, Cloud and Fog Computing for the IoT, and IoT applications and uses in Industry. Students learning includes IoT device programming (Arduino and Raspberry Pi), sensing and actuating technologies, IoT protocol stacks (e.g., Zigbee, 5G, NFC, MQTT), security management, and cloud based IoT platforms. The topics include programming Arduino using the Arduino IDE (Integrated Development Environment), using a wide variety of hardware and components, and prototyping using a breadboard. The student also explores how to set up the Raspberry Pi environment and write and execute some basic programming code on the Raspberry Pi. The course also covers how to use programming-based IDE (integrated development environments) for the Raspberry Pi and trace and debug the device's programming code. Students are guided through laboratory assignments designed to give them practical, real-world experience. Lectures, assignments, lab sessions and projects based on the Internet of Things are used to deliver the course.

References

Hanes, D., Salgueiro, G., Grossetete, P., Barton, R., & Henry, J. (2017). IoT fundamentals: Networking technologies, protocols, and use cases for the internet of things. Cisco Press.
Iqbal, M. A., Hussain, S., Xing, H., & Imran, M. A. (2020). Enabling the Internet of Things: Fundamentals, Design and Applications. John Wiley & Sons.
Buyya, R., & Dastjerdi, A. V. (Eds.). (2016). Internet of Things: Principles and paradigms. Elsevier.
Coursera, Interfacing with the Arduino, https://www.coursera.org/learn/interface-with-arduino, Accessed on 14.11.2022
Coursera, The Raspberry Pi Platform and Python Programming for the Raspberry Pi, https://www.coursera.org/learn/raspberry-pi-platform, Accessed on 14.11.2022
Swayam, Introduction to Internet of Things, https://onlinecourses.nptel.ac.in/noc22_cs53/preview , Accessed on 14.10.2022
NPTEL, Internet of Things, https://archive.nptel.ac.in/courses/106/105/106105166/ , Accessed on 14.10.2022

Learning Outcomes

CLO 1: Simulate the definition and significance of the Internet of Things.
CLO 2: Analyze the architecture, operation, and business benefits of an IoT solution.
CLO 3: Review constraints and opportunities of Cloud and Fog Computing for Internet of Things.
CLO 4: Select the right sensors and communication protocols to use in IoT environment.
CLO 5: Apply IoT concepts and write programs in the labs to solve problems.
CLO 6: Write the lab report and present the output result as lab record.
CLO 7: Demonstrate the basic configuration related to IoT sensors to accomplish group tasks.

Tutorials

WEEK 1: Introduction to Arduino/Raspberry Pi.
WEEK 2: Manipulating a LED using Raspberry Pi
WEEK 3: Remote login to Raspberry Pi with ssh.
WEEK 4: Blinking a LED on Arduino.
WEEK 5: LED brightness using the PWM library (Pulse with Modulation).
WEEK 6: Calculating the ambient temperature and humidity.
WEEK 7: Detect the distance of an object using an ultrasonic sensor.
WEEK 8: Interface Bluetooth with Arduino/Raspberry Pi to send sensor data to a smartphone.
WEEK 9: Create a home security system using a PIR sensor.
WEEK 10: Motor simulation using relay on Tinkercad.
WEEK 11: Make a home automation system to operate home appliances ESP 8266 (Wi-Fi Module).
WEEK 12: Install MySQL DB on the Raspberry Pi to perform SQL queries
WEEK 13: Data analysis and IoT
WEEK 14: Creating automation project (Home automation /office automation).
WEEK 15: Lab Final Exam.

CET322: Cloud Computing

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET212 AND CET161

Course Description

Cloud computing is a term that refers to the use of hardware and software resources that are delivered as a service over the Internet. Cloud computing allows businesses to access their applications and data from any location, at any time. It also offers the ability to scale their resources up or down, as needed. Cloud computing also provides businesses with a way to scale their IT operations quickly and efficiently. Cloud computing is the on-demand delivery of IT resources over the Internet with pay-as-you-go pricing to save the infrastructure cost. Organizations of every type, size, and industry are using the cloud for a wide variety of use cases, such as data backup, disaster recovery, email, virtual desktops, software development and testing, big data analytics, and customer-facing web applications. In this course students will learn the introduction to cloud computing, software as a service (SaaS), platform as a service (PaaS), infrastructure as a service (IaaS), identification as a service (IDaaS). The topics include data storage in the cloud, collaboration in the cloud, virtualization, securing the cloud, disaster recovery and business continuity and the cloud, service-oriented architecture, managing the cloud, migrating to the cloud, governing the cloud, designing cloud-based solutions and various case study will be discussed during the class. The laboratory work consists of experiments illustrating the principles, laws and concepts discussed in the course.

References

Jamsa, K. (2022). Cloud computing, 2nd Edition, Oreilly, Jones & Bartlett Publishers
https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-cloud-computing/#benefits
https://www.udemy.com/course/cloud-computing-lab-programs/
https://aws.amazon.com/what-is-cloud-computing/

Learning Outcomes

CLO 1: Analyze and implement the cloud deployment and service models to solve the computing problems per the given situation.
CLO 2: Evaluate and derive various cloud delivery models and security levels for cloud-based infrastructure to accomplish user requirements.
CLO 3: Demonstrate the ability to accomplish group tasks related to designing the cloud-based solution for the required infrastructure of the organization.
CLO 4: Formulate system goals and requirements, data privacy requirements, capacity planning and scaling capabilities for the cloud infrastructure to communicate effectively to all stakeholders.
CLO 5: Apply the security techniques, perform experiments, interpret data and draw results and conclusions.
CLO 6: Write lab reports and present results.

Tutorials

WEEK 1: Lab Induction, devices, simulator, Course Policies, reports
WEEK 2: Install Oracle Virtual box and create two virtual machines on the computer.
WEEK 3: Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
WEEK 4: Install Google App Engine. Create hello world app and other simple web applications using python/java
WEEK 5: Test ping command to test the communication between the guest OS and Host OS
WEEK 6: Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim
WEEK 7: Find a procedure to transfer the files from one virtual machine to another virtual machine. Find a procedure to launch virtual machine using trystack
WEEK 8: Install Hadoop single node cluster and run simple applications.
WEEK 9: Develop hadoop application to count no of characters, no of words and each character frequency.
WEEK 10: Develop hadoop application to process given data and produce results such as finding the year of maximum usage, year of minimum usage.
WEEK 11: Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.
WEEK 12: Design a protocol and use Simple Queue Service(SQS)to implement the barrier synchronization after the first phase
WEEK 13: Develop a Hello World application using Google App Engine. Write a Google app engine program to generate n even numbers and deploy it to Google cloud
WEEK 14: Develop a Guestbook Application using Google App Engine, Google app engine program multiply two matrices
WEEK 15: a) Develop a Windows Azure Hello World application using. B) Google app engine program to validate the user use mysql to store user info and deploy on to cloud , also implement it with Azure.

CET331: Security Policy, Threats & Risk Management

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET231

Course Description

Security threats and risk analysis is an essential and most useful component in the current digital world to analyze and secure organizational networks, data, and information. Every individual and organization look to ensure the security of the data while using the internet with their important credentials. In this course students learn about the entire risk analysis process in accessible language, providing the tools and insight needed to effectively analyze risk and secure facilities in a broad range of industries and organizations. This course covers the security platforms, risk analysis and management for critical asset protection, understanding the physical security risk, risk management, operational risk, legal risk (information security), reputational risk, risk analysis including the physical security risk assessments, risk assessment method, benefits of security assessments. The student learning includes management role in risk analysis, all-hazards approach versus design-basis threat, identifying threats, jurisdictional threat, identifying hazards, natural hazards, man-made hazards, risk identification, asset identification and prioritization. The course also covers infrastructure protection plan, vulnerability assessment, physical security systems, risk assessment, crime prevention through environmental design and emergency action plans. Also, various case studies are discussed during the class. The laboratory work consists of experiments illustrating the principles, laws and concepts discussed in the course.

References

Gregory Allen, Rachel Derr (2015), Threat Assessment and Risk Analysis, Butterworth-Heinemann, ISBN: 9780128024935
Freund, J., & Jones, J. (2015). Measuring and managing information risk: A FAIR approach. (ISBN 9780127999326)
Douglas W. Hubbard & Richard Seiersen. How to Measure Anything in Cybersecurity Risk. (ISBN: 9781119085294)
https://www.youtube.com/watch?v=leEUQSs0Ozs
https://apus.libguides.com/er.php?course_id=55727
https://www.iia.nl/SiteFiles/vakpub/GTAG%20Assessing%20Cybersecurity%20Risk.pdf
https://www.trellix.com/en-us/advanced-research-center/threat-reports/jul-2022.html
https://www.wbdg.org/resources/threat-vulnerability-assessments-and-risk-analysis
https://www.ncbi.nlm.nih.gov/books/NBK55881/
https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/publications/identifying-and-evaluating-hazards-in-research-laboratories.pdf
https://www.cisa.gov/free-cybersecurity-services-and-tools
https://www2.gov.bc.ca/gov/content/governments/services-for-government/information-management-technology/information-security/security-threat-and-risk-assessment#:~:text=What%20are%20Security%20Threat%20and,risk%20ratings%20and%20planned%20treatments.

Learning Outcomes

CLO 1: Demonstrate the need for ongoing evaluation, reaction, and contingency planning for organization.
CLO 2: Identify security and risk problem terms of the individual, community and organizational security levels of analysis.
CLO 3: Demonstrate an understanding of the cognitive, social, legal, ethical, diversity, and security perspectives surrounding a given problem.
CLO 4: Analyze threats and risk assessment methodologies applicable to individuals and organizations.
CLO 5: Apply the security risk analysis techniques, perform experiments, interpret data and draw results and conclusions.
CLO 6: Write lab reports and present results.

Tutorials

WEEK 1: Lab Induction, devices, simulator, Course Policies, reports
WEEK 2: Working with Wireshark
WEEK 3: Working with Wireshark
WEEK 4: Working with Security Onion
WEEK 5: Working with Security Onion
WEEK 6: Working with KeePass
WEEK 7: Working with KeePass
WEEK 8: Working with Metasploit Framework
WEEK 9: Working with Metasploit Framework
WEEK 10: Working with Nmap, Network Mapper
WEEK 11: Working with Nmap, Network Mapper
WEEK 12: Open Ended Projects
WEEK 13: Open Ended Projects
WEEK 14: Open Ended Projects
WEEK 15: Open Ended Projects

CET332: Penetration Testing & Ethical Hacking

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET232

Course Description

As a network security professional, it is necessary to distinguish and comprehend organizations weaknesses and work diligently to mitigate them before unwanted activity happens. In this course, students learn how to plan, prepare, and execute a penetration test in modern organization and digital world. This course covers introduction to hacking: white hat hacker, black hat hacker, gray hat hacker, script kiddie, elite hacker, hacktivist, ethical hacker, the ethics of hacking and cracking, types of attacks, encryption, and password cracking: cryptography, cryptanalysis, description of popular ciphers. The topics also include attacks on passwords, password crackers; penetration testing methodologies, categories of penetration test: black box, white box, gray box, types of penetration tests, report writing, understanding the audience, structure of a penetration testing report; linux basics, information gathering techniques: active information gathering, passive information gathering, sources of information gathering; target enumeration and port scanning techniques. The student learning includes vulnerability assessment, network sniffing, remote exploitation, client-side exploitation, post exploitation and maintaining access with backdoors, rootkits, and meterpreter, windows exploit development basics, social engineering, and phishing attacks: the basics of social-engineer toolkit (SET) website attack vectors, the credential harvester; wireless hacking and web hacking and Incident Handling. The laboratory work consists of experiments illustrating the principles, problems and concepts discussed in the course.

References

Baloch, R. (2017). Ethical hacking and penetration testing guide. Auerbach Publications.
Engebretson, P. (2013). The basics of hacking and penetration testing: ethical hacking and penetration testing made easy. Elsevier.
https://www.softwaretestinghelp.com/password-cracker-tools/
https://www.golinuxcloud.com/social-engineering-toolkit-phishing/#:~:text=The%20social%20engineering%20toolkit%20also,their%20day%20to%20day%20activities.
https://www.eccouncil.org/ethical-hacking/
https://www.simplilearn.com/tutorials/cyber-security-tutorial/what-is-ethical-hacking

Learning Outcomes

CLO 1: Evaluate the important standards and methods of how attackers can enter into PC frameworks.
CLO 2: Categorize legal and ethical issues related to vulnerability and penetration testing.
CLO 3: Execute penetration test using typical hacking tools in an ethical manner.
CLO 4: Analyze the data breaches and reviews the infrastructure security for a given scenario.
CLO 5: Select the suitable ethical hacking and penetration testing tools and use it in to lab for a given problem.
CLO 6: Write lab reports and present results.

Tutorials

WEEK 1: Lab Induction, introduction to network devices, Course Policies, and reports.
WEEK 2: Set Up Kali Linux from VM, Set Up Kali Linux from ISO File,
WEEK 3. Set Up a Victim: Metasploitable Linux, Set Up a Victim: OWASP Broken Web Applications, Set Up a Victim: Windows System
WEEK 4: Network Scan
WEEK 5: Vulnerability Scan
WEEK 6: Local password Guessing Attacks with Hydra
WEEK 7: Password Cracking with John the Ripper
WEEK 8: Password Cracking with Hashcat
WEEK 9: Working with other password cracking tools like AirCrack, Cain and Abel
WEEK 10: Work on SQL Injection
WEEK 11: Information Gathering Over the Internet (using Fingerprinting Tools: The Harvester and Recon-NG, Maltego - Visual Link Analysis Tool)
WEEK 12: Work on Social Engineering Toolkit (SET) for Phishing
WEEK 13: Open Ended Project
WEEK 14: Open Ended Project
WEEK 15: Lab Final Exam

CET333: Advanced Digital Forensics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET233

Course Description

Digital forensics is the practice of recovering and analyzing data from digital devices, such as computers, smartphones, and tablets. It can be used to investigate crimes, such as cybercrime, identity theft, and child pornography. Digital forensics can also be used to recover data that has been deleted or lost due to hardware failure or software corruption. Digital forensic principles are applied in the industry primarily for digital investigations. Students learn about the definitions and working of cyber-forensics, cyber laws, and regulations. This course also covers the computer forensics fundamentals, benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues, digital forensics tools, understanding data recovery workstation and software, digital forensic approaches, mobile forensics, social media forensics, social engineering forensics and digital investigation processes, data acquisition- understanding storage formats and digital evidence. The topics include determining the best acquisition method, acquisition tools, validating data acquisitions, law enforcement and incident response, anti-forensics, link, and visual analysis, psychological, ethical, implications of digital forensics, operating system artifacts, securing a computer incident or crime. The student learning includes seizing digital evidence at scene, storing digital evidence, validating, and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, e-mail investigations- investigating email crime and violations, understanding e-mail servers, continuous on alert: challenges of digital forensics and various case studies to understand and solve the digital forensics problems. The laboratory work consists of experiments illustrating the principles, problems and concepts discussed in the course.

References

Gogolin, G. (Ed.). (2021). Digital forensics explained. CRC Press.
Zhang, X., & Choo, K. K. R. (2020). Digital Forensic Education. An Experiential Learning Approach. Switzerland: Springer.
Sammons, J. (2012). The basics of digital forensics: the primer for getting started in digital forensics. Elsevier.
Nelson, B, Phillips, A, Enfinger, F, Stuart, C., “Guide to Computer Forensics and Investigations, Thomson Course Technology, 2006, ISBN: 0-619-21706-5
https://www.open.edu/openlearn/science-maths-technology/digital-forensics/
https://www.udemy.com/course/become-computer-forensics-expert-in-7-days/

Learning Outcomes

CLO 1: Analyze the digital footprint to identify solutions in digital forensics.
CLO 2: Evaluate the rules, laws, policies, and procedures, to implement appropriate strategies associated with digital forensics.
CLO 3: Develop the skills to solve computer forensics problems from legal, psychological, ethical perspective.
CLO 4: Formulate the method related to data collection, preservation and analysis for legal proceedings.
CLO 5: Demonstrate the ability to present the analysis of group tasks/case related to digital forensics.
CLO 6: Explain digital forensics tools, perform experiments, interpret data and draw results and conclusions.
CLO 7: Write lab reports and present results.

Tutorials

WEEK 1: Lab Induction, course policies and format of lab reports.
WEEK 2: Introduction to cyber forensic tools.
WEEK 3: Understanding and analysis of Hard Disks and File Systems.
WEEK 4: Digital Evidence Acquisition & Recovery of Deleted Files using Forensics Tools.
WEEK 5: Digital Evidence Acquisition & Recovery of Deleted Files using Forensics Tools.
WEEK 6: Hiding and extracting any text file behind an image file/ Audio file using Command Prompt and Extraction of Exchangeable image file format (EXIF) Data from Image Files.
WEEK 7: a) Restoring the Evidence Image using EnCase Imager Open Encase Imager and add the evidence to Encase imager. b) Learn to collect Email Evidence in Victim PC
WEEK 8: a) Find Last Connected USB on your system (USB Forensics). b) Comparison of two Files for forensics investigation. by Compare IT software
WEEK 9: Forensics Investigation Using AccessData FTK
WEEK 10: Learn about application password crackers
WEEK 11: Log Capturing and Event Correlation
WEEK 12: Investigation and analysis of Logs and Network Traffics
WEEK 13: Investigation and analysis of Logs and Network Traffics
WEEK 14: Learn to prepare Investigative Reports
WEEK 15: Lab Final Exam

CET334: Cryptographic Algorithms & Protocols

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	0	180	360	4	180	90	120	60	15	25

Requisites

- Prerequisites: GEN111

Course Description

Cryptographic mechanisms are used in the digital world for a wide array of communication and data protections. Students learn the areas of cryptography and cryptanalysis. This course develops a basic understanding of the algorithms used to protect users online and to understand some of the design choices behind these algorithms as well as secure key management. This course covers OSI security architecture; security attacks; security services; security mechanisms; model for network security, classical encryption techniques; symmetric cipher model; transposition techniques, block ciphers and the data encryption standard, triple DES, and block cipher modes of operation: electronic codebook mode, cipher block chaining mode, cipher feedback mode, output feedback mode, counter mode. The topics include stream ciphers and RC4, advanced encryption standard (AES), AES cipher, public-key cryptography and RSA, principles of public-key cryptosystems, the RSA algorithm, the security of RSA, key management; Diffie-Hellman key exchange, elliptic curve arithmetic, message authentication and hash functions. The student learning includes authentication requirements, authentication functions, message authentication codes, hash functions, security of hash functions and MACs, digital signatures and authentication protocols case study, authentication applications – kerberos, x.509 authentication service public-key infrastructure. The students are exposed to various case studies during the class. The laboratory work consists of experiments illustrating the principles, laws and concepts discussed in the course.

References

Stallings, W. (2016). Cryptography and network security: Principles and practice (7th ed.). Pearson.
Deng, R.H., & Birukuo, A.; (2019), Applied Cryptography and Network Security. Springer
https://www.slideshare.net/natemiller67/cryptography-and-network-security-william-stallings-lawrie-brown
https://www.youtube.com/watch?v=C7vmouDOJYM
https://www.youtube.com/watch?v=5jpgMXt1Z9Y
https://www.fortinet.com/resources/cyberglossary/what-is-cryptography

Learning Outcomes

CLO 1: Review and evaluate the cryptographic algorithms that are appropriate for the given professional context.
CLO 2: Select suitable cryptographic tools to meet the organizational requirements.
CLO 3: Formulate the security solution using cryptography, considering the ethical aspects, to meet the requirements, working in teams.
CLO 4: Form key management system to solve security service requirements and communicate.
CLO 5: Apply the security techniques, perform experiments, interpret data and draw results and conclusions.
CLO 6: Write lab reports and present results.

Tutorials

WEEK 1: Lab Induction, devices, simulator, Course Policies, reports
WEEK 2: Write a program and implement the substitution techniques algorithms to perform encryption and decryption.
WEEK 3: Write a program and implement the transposition techniques algorithms to perform encryption and decryption.
WEEK 4: Introduction to OpenSSL Introduction to Federal Information Processing Standards (FIPs)
WEEK 5: Implement and show the output results of Steganography concepts.
WEEK 6: Implement Symmetric Key Cryptography Pseudo random number generation DES key creation Encryption and decryption with DES File integrity with MD5 hash
WEEK 7: Symmetric Key Distribution with NetCat with Apache Key compromise by protocol analyzer (Wireshark)
WEEK 8: Implement and show the Message Authentication Codes
WEEK 9: Implement digital signature methods and generate the Digital Signature.
WEEK 10: Perform Password Auditing/Cracking.
WEEK 11: Implement the Kerberos concept and develop a system to show it.
WEEK 12: Implement the Kerberos concept and develop a system to show it.
WEEK 13: Open Ended Projects
WEEK 14: Open Ended Projects
WEEK 15: Open Ended Projects

CET341: Data Cleansing and Migration

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET141

Course Description

Data Cleansing and Migration is a specialized course designed to equip students with the essential skills and knowledge required for managing and optimizing data in the realm of date science and technology. This course delves into the intricacies of data quality, cleansing, and transformation techniques, emphasizing the critical role data plays in modern computing environments. Students will learn advanced data cleaning methodologies, data profiling, and data migration strategies, ensuring the accuracy, consistency, and reliability of data across various applications and systems. Through hands-on exercises and real-world case studies, participants will gain expertise in tackling data quality challenges, enabling them to excel in data-centric roles and make informed decisions within the dynamic landscape of computer science and technology.

References

The Key to Successful Data Migration: Pre-Migration Activities - Rajender Kumar
Practical Data Migration - John Morris

Learning Outcomes

CLO 1: Develop expertise in data quality assessment and recognize its significance in computer science and technology.
CLO 2: Master advanced data cleansing techniques to ensure data accuracy, consistency, and reliability.
CLO 3: Acquire proficiency in data profiling methods for comprehensive data analysis.
CLO 4: Learn effective data migration strategies for seamless data transfer across applications and systems.
CLO 5: Apply hands-on exercises and real-world case studies to tackle complex data quality challenges.
CLO 6: Gain the skills required to excel in data-centric roles and make informed decisions within the dynamic computer science and technology landscape.

Tutorials

WEEK 1: Introduction to Data Quality Assessment.
WEEK 2: Significance of Data Quality in Computer Science.
WEEK 3: Advanced Data Cleansing Techniques.
WEEK 4: Ensuring Data Accuracy, Consistency, and Reliability.
WEEK 5: Proficiency in Data Profiling Methods.
WEEK 6: Comprehensive Data Analysis through Profiling.
WEEK 7: Effective Data Migration Strategies.
WEEK 8: Seamless Data Transfer Across Applications.
WEEK 9: Hands-On Exercises for Data Quality.
WEEK 10: Real-World Case Studies in Data Quality.
WEEK 11: Tackling Complex Data Quality Challenges.
WEEK 12: Skills for Data-Centric Roles in Technology.
WEEK 13: Informed Decision-Making in Computer Science.
WEEK 14: Application of Data Quality Knowledge in Practical Scenarios.
WEEK 15: Lab Final Exam

CET342: Data Mining

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET111 AND CET141

Course Description

Data mining is one of the main areas of data science, focusing on efficient data collection and analysis implementation. Data mining is the process of extracting valuable information from large data sets. It involves sorting through vast amounts of data to find hidden patterns and trends. This process can be used to uncover customer behavior, predict future events, and optimize business processes. Data mining can be a time-consuming and expensive endeavor, but it can offer significant rewards for businesses that are willing to invest in it. This course introduces installing Rapid Miner, Python, and Jupyter Notebooks and provides an overview of Rapid Miner and Jupyter Notebooks with examples. It covers Data Mining standard processes and models: KDD, SEMMA, CRISP-DM, a review of processes which includes TDSP – Team Data Science Processes, Data reduction in Jupyter Notebooks and Rapid Miner, Clustering in Python and Rapid Miner, classification in Python and Rapid Miner. The topics include Anomaly detection in Python and Rapid Miner, association analysis in Python and Rapid Miner, Regression Analysis in Python and Rapid Miner, Sequence Mining in Python and Rapid Miner, dealing with missing values using Python, working with real datasets, along with best practices for Data Mining with examples. Lectures focusing on data visualization fundamentals, Lab sessions, projects, and assignments are used to deliver the course.

References

Aggarwal, C. C. (2015). Data mining: the textbook (Vol. 1). New York: springer.
Hofmann, M., & Klinkenberg, R. (Eds.). (2016). RapidMiner: Data mining use cases and business analytics applications. CRC Press.
https://academy.rapidminer.com/learning-paths/get-started-with-rapidminer-and-machine-learning
https://www.tutorialspoint.com/data_mining/index.htm
https://www.guru99.com/data-mining-tutorial.html
https://www.ibm.com/docs/en/db2/11.1?topic=tutorials-mining-tutorial

Learning Outcomes

CLO 1: Explain and apply the Data Mining processes.
CLO 2: Solve problems related to Data Mining.
CLO 3: Develop data clustering systems.
CLO 4: Create Anomaly detection systems.
CLO 5: Create Association and sequence mining systems.
CLO 6: Apply regression analysis.
CLO 7: Write lab reports and present results.

Tutorials

WEEK 1: Introduction: Install Rapid Miner, Python and Jupyter Notebooks
WEEK 2: Overview of Rapid Miner and Jupyter Notebooks with examples
WEEK 3: Data Mining standard processes and models: KDD, SEMMA, CRISP-DM
WEEK 4: A review of processes, TDSP – Team Data Science Processes
WEEK 5: Data reduction in Jupyter Notebooks and Rapid Miner
WEEK 6: Clustering in Python and Rapid Miner.
WEEK 7: Classification in Python and Rapid Miner
WEEK 8: Anomaly detection in Python and Rapid Miner
WEEK 9: Association analysis in Python and Rapid Miner
WEEK 10: Regression Analysis in Python and Rapid Miner
WEEK 11: Sequence Mining in Python and Rapid Miner
WEEK 12: Dealing with missing values using Python.
WEEK 13: Working with real datasets.
Week 14: Best practices for Data Mining with examples.
WEEK 15: Lab Final Exam.

CET343: Big Data Analytics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET242

Course Description

Data is a precious and powerful resource that has become a critical part of digital transformation. Today, gathering, storing, and analyzing data has become far more sophisticated than in previous years. With big data analysis technologies, it is possible to make accurate and valuable business decisions. This course introduces Big Data Analytics, Hadoop, NoSQL Big Data Management, MongoDB, and Cassandra. It covers MapReduce, Hive and Pig, Spark and Big Data Analytics, and Machine Learning Algorithms for Big Data Analytics, including Estimating the Relationships, Outliers, Variances, Probability Distributions, and Correlations. It explores Regression Analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets, and Association Rule Mining. It discusses Clustering Analysis and classification, Collaborative Recommendation, Model for Recommendation Systems, Content-Based Recommendation, and Knowledge-based Recommendation. The course also covers Apache Mahout Machine-Learning Applications, Data Stream Mining and Real-Time Analytics Platform, Spark Streaming, Graph Analytics for Big Data and Spark Graph Platform, Text, Web Content, Link, and Social Network Analytics. Web Mining, Web Content, Web Usage Analytics, Page Rank, Structure of the Web and Analyzing a Web Graph, Social Networks as Graphs, and Social Network Analytics concepts. Lectures focusing on big data analytics fundamentals, Lab sessions, projects, and assignments are used to deliver the course.

References

Kamal, R., & Saxena, P. (2019). Big Data Analytics: Introduction to Hadoop, Spark, and Machine-Learning. McGraw-Hill Education.
https://www.tutorialspoint.com/apache_spark/index.htm
https://www.simplilearn.com/tutorials/big-data-tutorial

https://www.edureka.co/blog/big-data-tutorial

Learning Outcomes

CLO 1: Analyze given problem to find solutions using fundamental big data concepts.
CLO 2: Construct Big Data systems using different tools for efficient data storing, access and management.
CLO 3: Develop use cases using big data techniques for a predefined scenario.
CLO 4: Formulate efficient solutions using big data techniques based on newly acquired knowledge.
CLO 5: Review the professional and ethical responsibility related to big data analytics.
CLO 6: Write lab reports and present results.

Tutorials

WEEK 1: Introduction to Big Data Analytics
WEEK 2: Introduction to Hadoop
WEEK 3: NoSQL Big Data Management, MongoDB, and Cassandra
WEEK 4: MapReduce, Hive and Pig
WEEK 5: Spark and Big Data Analytics
WEEK 6: Machine Learning Algorithms for Big Data Analytics: Estimating the Relationships, Outliers, Variances, Probability Distributions and Correlations, Regression Analysis
WEEK 7: Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining, Clustering Analysis, and classification.
WEEK 8: Recommendation System: Collaborative Recommendation, Model for Recommendation Systems, Content Based Recommendation, Knowledge-based Recommendation
WEEK 9: Apache Mahout Machine-Learning Applications
WEEK 10: Data Stream Mining and Real-Time Analytics Platform• Spark Streaming
WEEK 11: Graph Analytics for Big Data and Spark Graph Platform
WEEK 12: Text, Web Content, Link, and Social Network Analytics: Web Mining, Web Content and Web Usage Analytics
WEEK 13: Page Rank, Structure of Web, and Analyzing a Web Graph
WEEK 14: Social Networks as Graphs and Social Network Analytics
WEEK 15: Lab Final Exam.

CET344: Algorithms for Data Science

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	0	180	360	4	180	90	120	60	15	25

Requisites

- Prerequisites: CET211

Course Description

Algorithms for Data Science is a meticulously designed course tailored to the needs of aspiring data scientists. This course delves deep into the realm of data science, focusing on the core algorithms and computational techniques essential for extracting meaningful insights from complex datasets. Students will explore a comprehensive range of topics, including data preprocessing, feature engineering, clustering, classification, and regression algorithms. Through hands-on coding, data exploration, and real-world projects, participants will develop a profound understanding of algorithmic principles crucial for uncovering patterns, making predictions, and deriving valuable knowledge from data. This course equips students with the analytical skills required to excel in the dynamic field of data science, enabling them to harness the power of algorithms for data-driven decision-making and innovation in various domains.

References

Algorithms for Data Science - Brian Steele, John Chandler, Swarna Reddy

Learning Outcomes

CLO 1: Master fundamental data preprocessing techniques to prepare complex datasets for analysis.
CLO 2: Acquire proficiency in feature engineering, enabling the extraction of valuable information from data.
CLO 3: Explore clustering algorithms to identify patterns and group similar data points effectively.
CLO 4: Understand classification algorithms for data-driven decision-making and predictive modeling.
CLO 5: Develop expertise in regression algorithms for modeling and forecasting in data science.
CLO 6: Apply hands-on coding and data exploration to gain practical algorithmic experience.

CLO 7: Execute real-world data science projects to solve complex problems and derive actionable insights, preparing for success in data-driven domains.

Tutorials

WEEK 1: Introduction to Data Preprocessing Techniques.
WEEK 2: Preparing Complex Datasets for Analysis.
WEEK 3: Proficiency in Feature Engineering.
WEEK 4: Extracting Valuable Information from Data.
WEEK 5: Exploring Clustering Algorithms.
WEEK 6: Identifying Patterns and Effective Data Grouping.
WEEK 7: Understanding Classification Algorithms.
WEEK 8: Data-Driven Decision-Making and Predictive Modeling.
WEEK 9: Developing Expertise in Regression Algorithms.
WEEK 10: Modeling and Forecasting in Data Science.
WEEK 11: Hands-On Coding and Data Exploration.
WEEK 12: Practical Algorithmic Experience.
WEEK 13: Execution of Real-World Data Science Projects.
WEEK 14: Solving Complex Problems, Deriving Actionable Insights, and Preparing for Success in Data-Driven Domains.
WEEK 15: Lab Final Exam

CET351: Machine Learning

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET251

Course Description

Machine learning is a process of teaching computers to learn from data, without being explicitly programmed. It is seen as a subset of artificial intelligence. Machine learning algorithms aim to solve major cognitive and computational problems for multiple industries. And it is the process of teaching computers to make decisions for themselves. This process is similar to the way humans learn, by taking in data and using it to make predictions or recommendations. Machine learning can be used for a variety of tasks, such as image recognition, voice recognition, and even making predictions about the future. The course aims to introduce the concepts, theories, and state-of-the-art algorithms for machine learning. Students will learn theories and practical aspects of machine learning techniques, including regression, clustering, and classification. This course covers an introduction that discusses the ambitions and goals of Machine Learning and how to install the Python scikit-learn package. It introduces Bayesian Classifiers, Nearest-Neighbor Classifiers, Linear and Polynomial Classifiers, Decision Trees, Artificial Neural Networks, Voting Assemblies, and Boosting. It also covers Performance Evaluation, Statistical Significance, Induction in Multi-label domains, Unsupervised Learning, Reinforcement Learning, and practical issues. Lectures focusing on machine learning fundamentals, projects, and assignments are used to deliver the course.

References

Kubat, Miroslav, and Kubat. An introduction to machine learning. 3rd edition. Cham, Switzerland: Springer International Publishing, 2019.
ISBN-13: 978-3030819347, ISBN-10: 3030819345
https://www.javatpoint.com/machine-learning
https://www.kaggle.com/learn/intro-to-machine-learning
https://www.simplilearn.com/tutorials/machine-learning-tutorial

Learning Outcomes

CLO 1: Identify and categorize the problem to apply appropriate Machine Learning algorithms
CLO 2: Design model to solve various computing problems based on newly acquired knowledge
CLO 3: Evaluate the performance of the model to decide how to improve it
CLO 4: Review the professional and ethical responsibility related to Machine Learning
CLO 5: Communicate and work effectively in a team to build Machine Learning solutions.
CLO 6: Use different Machine Learning tools.
CLO 7: Write lab reports and present results.

Tutorials

WEEK 1: Installing Python scikit-learn package and getting familiar with the environment
WEEK 2: Implement Bayesian Classifiers with scikit
WEEK 3: Implement Nearest-Neighbor Classifiers with scikit
WEEK 4: Implement Inter-Class Boundaries: Linear and Polynomial Classifiers with scikit
WEEK 5: Implement Decision Trees with scikit
WEEK 6: Implement Artificial Neural Networks with scikit
WEEK 7: Implement Voting Assemblies and Boosting with scikit
WEEK 8: Implement Performance Evaluation with scikit
WEEK 9: Implement Statistical Significance with python
WEEK 10: Implement Induction in Multi-label Domains with scikit
WEEK 11: Implement K means Unsupervised Learning with scikit
WEEK 12: Implement Reinforcement Learning with python
WEEK 13: Experience from Historical Applications with python
WEEK 14: Practical examples with python
WEEK 15: Lab Final Exam.

CET352: Image Processing and Computer Vision

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET111

Course Description

Digital Image processing and Computer Vision are core domain applications of Artificial Intelligence used to solve complex real-world problems in various industries. The use of a digital computer to run an algorithm on digital images is known as "digital image processing." Digital image processing has significant benefits as it permits applying various algorithms to the input data images. There are many deep-learning applications for image processing. This includes medical image processing, compression, restoration, and data mining. The students learn to apply multiple computer techniques, such as Image Enhancement and Segmentation, Color Image Processing, Morphological Image Processing, and Object Representation, which help them design efficient algorithms for real-world applications. This course introduces the Origin of Digital Image Processing, Fundamental Steps of Image Processing, Components of Digital Image Processing Systems, Applications of Digital Image Processing, and Elements of Visual perception, Intensity Transformations and Spatial Filtering, Filtering in the Frequency Domain, Image Restoration, and Reconstruction. It explores Wavelet and Other Image Transforms, Color Image Processing, Image Compression, and Watermarking. It discusses Morphological Image Processing, Image Segmentation, Image Segmentation, and Active Contours, including Snakes and Level Sets, Feature Extraction, Image Pattern Classification, and Advanced Computer Vision with Deep Learning. Hands-on sessions focusing on Digital Image processing and Computer Vision fundamentals, projects, and assignments are used to deliver the course.

References

Gonzalez, C.R., Woods, E.R. (2017). Digital Image Processing (4th ed.), Pearson
https://www.tutorialspoint.com/dip/index.htm
https://www.geeksforgeeks.org/digital-image-processing-basics/
https://towardsdatascience.com/massive-tutorial-on-image-processing-and-preparation-for-deep-learning-in-python-1-e534ee42f122

Learning Outcomes

CLO 1: Explain and apply the principles of Image Processing.
CLO 2: Solve problems related to image processing using python
CLO 3: Produce image processing application using python.
CLO 4: Apply advanced concepts with image processing using deep learning.
CLO 5: Write lab reports and present results.

Tutorials

WEEK 1: Origin of Digital Image Processing, Fundamental Steps of Image Processing, Components of Digital Image Processing System
WEEK 2: Applications of Digital Image Processing, Elements of Visual perception
WEEK 3: Intensity Transformations and Spatial Filtering
WEEK 4: Filtering in the Frequency Domain
WEEK 5: Image Restoration and Reconstruction
WEEK 6: Wavelet and Other Image Transforms
WEEK 7: Color Image Processing

WEEK 8: Image Compression and Watermarking
WEEK 9: Morphological Image Processing
WEEK 10: Image Segmentation
WEEK 11: Image Segmentation and Active Contours: Snakes and Level Sets
WEEK 12: Feature Extraction
WEEK 13: Image Pattern Classification
WEEK 14: Advanced Computer Vision with deep Learning
WEEK 15: Lab Final Exam.

CET353: Advanced Object Oriented Programming

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180		180	360	3	90	90	120	60	15	25

Requisites

- Prerequisites: CET112

Course Description

This course advances students’ C++ skills, focusing on techniques critical for high-performance game development. It explores advanced object-oriented programming (OOP) concepts, such as deep inheritance hierarchies, polymorphism with virtual functions, and generic programming with templates, applied to game entities (e.g., a base "Character" class with derived "Player" and "Enemy" classes). Students master memory management, including manual allocation/deallocation, smart pointers (unique_ptr, shared_ptr), and memory pools, optimizing for real-time performance in games. The course covers multithreading and concurrency, teaching students to implement parallel tasks (e.g., AI updates, physics calculations) using threads and synchronization primitives like mutexes. Performance optimization techniques, such as inline functions, cache-friendly data structures, and profiling tools (e.g., gprof), are applied to game algorithms like collision detection or particle systems. Labs involve building game-related projects, such as a lightweight 2D game engine core with rendering and physics, using libraries like STL and Boost.

References

Stroustrup, B. (2013). *The C++ Programming Language* (4th ed.). Addison-Wesley.
Gregory, J. (2018). *Game Engine Architecture* (3rd ed.). CRC Press.

CET354: Advanced Game Programming

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: CET411

Course Description

This course focuses on server-side programming for multiplayer games, emphasizing robust and scalable systems. Students learn network fundamentals, including TCP/IP for reliable communication and UDP for fast, real-time data transfer, applied to game scenarios like chat systems or player movement updates. The course covers client-server architecture design, including authoritative servers, peer-to-peer hybrids, and load balancing for large-scale games (e.g., MMOs). Database integration is explored using SQL and NoSQL systems (e.g., MySQL, MongoDB) to manage player profiles, leaderboards, and persistent game states. Students tackle latency and synchronization challenges, implementing techniques like client prediction and server reconciliation for smooth gameplay. Labs involve building a simple multiplayer game server (e.g., a real-time chat or a basic arena shooter backend) using a language like C++ or Python with frameworks like Socket.IO or Boost.Asio. Security basics, such as preventing SQL injection and DDoS attacks, are also introduced.

References

Steinmetz, R., & Wehrle, K. (2005). *Peer-to-Peer Systems and Applications*. Springer.
Nystrom, R. (2014). *Game Programming Patterns*. Genever Benning.

Learning Outcomes

LO1: Students will be able to describe and explain the core principles of network programming as they apply to multiplayer games, including TCP/IP and UDP protocols, and their respective uses for reliable and real-time communication.
LO2: Students will understand the design and implementation of client-server, peer-to-peer, and hybrid architectures, including the role of authoritative servers and load balancing in scalable game systems.
LO3: Students will comprehend the use of SQL and NoSQL database systems (e.g., MySQL, MongoDB) for managing persistent game data such as player profiles, leaderboards, and game states.
LO4: Students will be able to explain the challenges of latency and synchronization in multiplayer games and describe techniques such as client prediction and server reconciliation. They will also understand basic security concepts, including preventing common attacks like SQL injection and DDoS.
LO5: Design and implement robust and scalable server-side systems for multiplayer games using appropriate programming languages (e.g., C++, Python) and frameworks (e.g., Socket.IO, Boost.Asio).
LO6: Develop reliable and real-time communication systems for games, handling player movement, chat, and other game state updates using TCP and UDP.
LO7: Integrate and manage SQL and NoSQL databases within game server architectures to support persistent and scalable data storage.
LO8: Apply techniques such as client prediction and server reconciliation to ensure smooth gameplay and fair competition in networked environments.
LO9: Implement basic security measures to protect game servers and databases from common threats and vulnerabilities.
LO10: Critically analyze and solve complex problems related to multiplayer game networking, scalability, and security.
LO11: Clearly document and communicate server architectures, protocols, and design decisions to technical and non-technical stakeholders.
LO12: Work effectively in teams to design, develop, and test multiplayer game systems, incorporating feedback and adhering to project requirements.
LO13: Independently learn and apply new networking technologies, frameworks, and industry best practices in game development.
LO14: Demonstrate awareness of ethical, legal, and social responsibilities in the development and operation of online multiplayer games, including data privacy and fair play.

Lectures

Week 1: Overview of multiplayer games; client-server and peer-to-peer models; scalability considerations.
Week 2: TCP/IP and UDP protocols; sockets; reliable vs. fast data transfer.
Week 3: Authoritative server design; handling player input and game state.
Week 4: Comparison of peer-to-peer, client-server, and hybrid architectures; use cases and trade-offs.
Week 5: Real-time updates; handling latency and jitter; state synchronization.
Week 6: SQL vs. NoSQL databases; storing player profiles, leaderboards, and persistent states.
Week 7: Load balancing techniques; sharding; scaling for large player bases (e.g., MMOs).
Week 8: Common security threats (SQL injection, DDoS, cheating); best practices.
Week 9: Managing persistent and transient game states; saving and restoring sessions.
Week 10: Client prediction, server reconciliation, lag compensation.
Week 11: Designing scalable backends for action games (e.g., arena shooters).
Week 12: Integrating chat systems, matchmaking, and leaderboards into multiplayer games.
Week 13: Tools and techniques for testing and debugging networked games; monitoring performance and logs.
Week 14: Best practices for documentation, deployment, and industry standards in multiplayer game development.

Laboratories

Week 1: Analyze existing multiplayer games; set up a basic local server-client demo.
Week 2: Implement simple TCP and UDP communication between two programs.
Week 3: Build a basic client-server chat system using Python or C++.
Week 4: Prototype a simple peer-to-peer connection for a multiplayer mini-game.
Week 5: Implement real-time player movement updates with interpolation and prediction.
Week 6: Connect a game server to a MySQL or MongoDB database; manage player data.
Week 7: Simulate server load; implement basic load balancing strategies.
Week 8: Harden a server against SQL injection; simulate and defend against basic attacks.
Week 9: Implement save/load features for player progress and game sessions.
Week 10: Add client prediction and reconciliation to a multiplayer prototype.
Week 11: Develop the backend for a basic arena shooter; handle multiple players and actions.
Week 12: Add chat and leaderboard features to the ongoing project.
Week 13: Stress-test the multiplayer server; use monitoring tools to identify and fix issues.
Week 14: Final project presentations; peer review; course reflection and feedback.

CET355: Game Industrial Business

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120			120	2	60	90	120	40	20	40

Course Description

This course introduces business principles and their application to the game development industry. Students explore the structure of the gaming market, including key players (e.g., studios, publishers, platforms), revenue models (e.g., AAA, indie, freemium), and global trends (e.g., mobile growth, esports). The course covers project management basics, focusing on budgeting, scheduling, and resource allocation for game projects, with case studies of successes (e.g., “Minecraft”) and failures (e.g., overhyped launches). Students learn about intellectual property (IP), licensing, and contracts, critical for protecting game assets and negotiating publishing deals. Lectures also address marketing strategies, such as crowdfunding (e.g., Kickstarter) and community building, tailored to game launches. Through discussions and assignments, students analyze business decisions, like choosing a monetization strategy or responding to market shifts (e.g., VR adoption). The course emphasizes entrepreneurial skills, preparing students to pitch game ideas or start indie studios, with practical exercises like drafting a business proposal for a hypothetical game.

References

Chandler, H. M. (2013). *The Game Production Handbook* (3rd ed.). Jones & Bartlett Learning.
Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation*. Wiley.

Learning Outcomes

LO1: Students will be able to describe the structure of the gaming market, identifying key players such as studios, publishers, platforms, and their respective roles.
LO2: Students will understand various revenue models (e.g., AAA, indie, freemium) and analyze global trends such as mobile gaming growth.
LO3: Students will comprehend the fundamentals of project management, including budgeting, scheduling, and resource allocation, with reference to real-world case studies.
LO4: Students will understand the basics of intellectual property (IP), licensing, and contracts, and their significance in protecting game assets and negotiating publishing deals.
LO5: Students will be able to explain marketing strategies relevant to game launches, including crowdfunding, community engagement, and the use of social media.
LO6: Analyze the gaming market, evaluate business models, and assess the impact of industry trends on decision-making.
LO7: Apply project management tools to develop budgets, schedules, and resource plans for game projects.
LO8: Review and critique basic licensing agreements and contracts; draft simple IP protection strategies for game projects.
LO9: Design and plan marketing campaigns, including crowdfunding initiatives and strategies for community building.
LO10: Develop and pitch business proposals for hypothetical games or indie studios, demonstrating understanding of business start-up processes in the game industry.
LO11: Critically analyze business decisions, such as monetization strategies and responses to market shifts (e.g., VR adoption).
LO12: Address challenges in game business operations by applying business principles and industry knowledge.
LO13: Effectively communicate business concepts, strategies, and proposals in both oral and written forms to diverse audiences.
LO14: Work productively in teams to analyze case studies, develop business plans, and present findings.
LO15: Independently research new business models, market trends, and entrepreneurial opportunities in the evolving game industry.
LO16: Demonstrate awareness of ethical, legal, and sustainability considerations in game business decisions and operations.

Lectures

Week 1: Overview of the global game industry; key players (studios, publishers, platforms); industry value chain. Research and present a profile of a major game company or platform.
Week 2: Market segmentation (AAA, indie, mobile, esports); global and regional trends. Analyze recent market reports; group discussion on emerging trends.
Week 3: Business models: premium, freemium, subscription, ad-supported; monetization strategies. Case study analysis of successful and failed monetization models.
Week 4: Project lifecycles in game development; budgeting, scheduling, and resource allocation. Create a simple project plan and budget for a hypothetical game.
Week 5: Identifying and managing risks; lessons from industry successes and failures (e.g., overhyped launches). Group analysis of a failed game launch; risk mitigation exercise.
Week 6: Basics of IP; copyright, trademarks, and patents in games; protecting digital assets. Review and critique real game IP cases; draft a simple IP protection plan.
Week 7: Licensing agreements; publishing contracts; negotiation basics. Simulate a contract negotiation between a developer and publisher.
Week 8: Marketing strategies; branding, positioning, and go-to-market planning. Develop a marketing plan for a new game concept.
Week 9: Community management; social media strategies; crowdfunding platforms (e.g., Kickstarter). Design a crowdfunding campaign; plan community engagement activities.
Week 10: Game analytics; KPIs; using data to inform business and design decisions. Analyze sample analytics data; propose improvements for a live game.
Week 11: International markets; localization strategies; cultural considerations in game business. Evaluate localization quality in popular games; suggest improvements.
Week 12: Starting an indie studio; business planning; funding sources. Draft a business proposal for a hypothetical indie game studio.
Week 13: Preparing and delivering effective pitches; attracting investors and publishers. Practice pitching a game business idea; peer and instructor feedback.
Week 14: Industry guest lecture or panel; trends and future directions in game business. Final project presentations; course reflection and professional development planning.

CET356: Advanced Data Structures and Algorithms

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: CET211

Course Description

This project-based course applies data structures and algorithms to practical game development challenges, building on CET211. Students undertake a series of guided projects, each focusing on implementing and optimizing advanced data structures (e.g., graphs, spatial trees, hash maps) and algorithms (e.g., pathfinding, procedural generation, sorting) in game contexts. Projects include designing a navigation system for NPCs using A* or Dijkstra's algorithm on a dynamic graph, creating a procedural dungeon generator with binary space partitioning, or optimizing a leaderboard with a balanced tree. Lectures cover project planning, algorithm optimization (e.g., reducing time complexity), and profiling tools (e.g., Valgrind, Visual Studio Profiler) to ensure real-time performance. Labs emphasize hands-on coding in C++ or C#, integrating solutions into game engines like Unity or Unreal for testing (e.g., a pathfinding demo in a 3D environment). Students collaborate in small teams, simulating industry workflows, and present their projects, justifying design choices and performance metrics. The course also addresses debugging complex algorithms and handling edge cases (e.g., disconnected graphs, memory constraints) to ensure robust implementations.

References

Cormen, T. H., et al. (2009). *Introduction to Algorithms* (3rd ed.). MIT Press.
Sedgewick, R., & Wayne, K. (2011). *Algorithms* (4th ed.). Addison-Wesley.
Nystrom, R. (2014). *Game Programming Patterns*. Genever Benning.

CET358: Game Publishing and Analytics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Course Description

This course explores the end-to-end process of publishing games and leveraging analytics to improve player engagement. Students learn about digital distribution platforms (e.g., Steam, Google Play, itch.io), including submission requirements, pricing strategies, and monetization models (e.g., freemium, in-app purchases). Marketing techniques are covered, such as crafting trailers, managing social media campaigns, and working with influencers to build a player base. The course dives into telemetry and analytics, teaching students to collect data on player behavior (e.g., session length, churn rate) using tools like Unity Analytics or Google Analytics, and interpret it to refine gameplay (e.g., adjusting difficulty based on drop-off points). Labs involve preparing a mock game for release—creating a store page, designing a marketing plan, and analyzing simulated player data—and iterating on a prototype based on findings. Ethical considerations, like player privacy and fair monetization, are also discussed.

References

O'Donnell, C. (2014). *Developer's Dilemma: The Secret World of Videogame Creators*. MIT Press.
Fields, T., & Cotton, B. (2011). *Social Game Design*. Morgan Kaufmann.

Learning Outcomes

LO1: Students will be able to describe the end-to-end process of publishing a game, including the roles of publishers, distribution channels, and platform requirements.
LO2: Students will understand the structure of the global game market, audience segmentation, and current trends affecting publishing strategies.
LO3: Students will be able to explain various monetization strategies (e.g., premium, freemium, in-app purchases, subscriptions) and evaluate their suitability for different game types.
LO4: Students will understand the legal, contractual, and ethical aspects of game publishing, including intellectual property, licensing, and compliance with platform policies.
LO5: Students will comprehend the principles and applications of game analytics, including key performance indicators (KPIs), data collection methods, and privacy considerations.
LO6: Develop and justify a publishing plan for a game, selecting appropriate distribution channels, launch strategies, and marketing approaches.

LO7: Conduct market research, analyze data, and prepare reports to inform publishing and design decisions.
LO8: Design and implement monetization strategies and community engagement plans to maximize user retention and revenue.
LO9: Integrate analytics tools into game projects, collect and interpret player data, and use insights to optimize game performance and user experience.
LO10: Plan and execute A/B tests to evaluate changes in gameplay, monetization, or user interface, and apply findings to improve outcomes.
LO11: Critically analyze publishing and analytics data to make informed decisions.
LO12: Address challenges in game publishing and analytics through evidence-based approaches.
LO13: Effectively communicate publishing strategies, analytics findings, and business recommendations to stakeholders.
LO14: Collaborate in multidisciplinary teams to develop, publish, and analyze game projects.
LO15: Independently learn and apply new publishing platforms, analytics tools, and industry best practices.
LO16: Demonstrate awareness of ethical, legal, and sustainability considerations in game publishing and data analytics.

Lectures

Week 1: Overview of the game publishing process; roles of publishers and developers; publishing models.
Week 2: Global and regional game markets; platforms (PC, console, mobile); audience segmentation.
Week 3: Launch timing, soft launches, early access, and global rollouts.
Week 4: Digital distribution (Steam, App Store, Google Play); retail vs. digital; platform requirements.
Week 5: Premium, freemium, in-app purchases, ads, subscriptions; revenue sharing.
Week 6: Marketing strategies for games; influencer marketing, social media, community management.
Week 7: Crowdfunding platforms (Kickstarter, Indiegogo); pitching and campaign management.
Week 8: Contracts, licensing, intellectual property, ratings, and compliance.
Week 9: Purpose and types of analytics (descriptive, diagnostic, predictive, prescriptive); KPIs in games.
Week 10: Data sources (in-game telemetry, user feedback, sales data); privacy and GDPR.
Week 11: Analyzing player journeys, churn, and retention; segmentation and cohort analysis.
Week 12: Principles of A/B testing; optimizing gameplay, monetization, and user experience.
Week 13: Creating effective analytics reports; turning insights into actionable strategies.
Week 14: Emerging trends in game publishing and analytics; future skills and technologies.

CET361: Routing & Switching

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET261

Course Description

Routers and switches are the main network devices which is needed to create and any network. Routing and switching are an essential part of the networking field to create and manage the networks. It helps to create and connect different networks and allow users to control the flow of traffic. This course covers basic LAN design, switching concepts and configuration, virtual LANs (VLANs), routing basics, the ip routing process, static routing, default routing, dynamic routing, managing the switch module, connecting devices to the switch module. The topics include SFP module slots, dual-purpose port with rj-45 and SFP connectors, verifying port connectivity, cable, and connectors, working with Routers, switches, and wireless devices to configure and troubleshoot VLANs, Wireless LANs and Inter-VLAN routing. The student learning includes configuring and troubleshooting redundancy on a switched network using STP and Ether Channel, Network Operating System, addressing and subnetting, Static and Dynamic Routing, routing protocols, interior gateway protocol (IGP) Protocols, Exterior Gateway (EGP) Protocols, Routing Information Protocol (RIP) protocol, Enhanced Interior Gateway Routing Protocol (EIGRP) protocol. The student also learns IOS and IP Features, Frame Relay Configuration, DHCP and Network Address Translation, Port Security, Syslog, Password recovery, configuration backup, IOS upgrade, IPv4 and IPv6 ALCs and ACL Troubleshooting. The laboratory work consists of experiments which will include the configuration of switches and routers, illustrating the principles, laws and concepts discussed in the course.

References

WENDELL, ODOM, and Wilkins Sean. (2020) "CCNA Routing and Switching 200-125."
https://www.youtube.com/watch?v=XgcGcrLKu1A&list=PLxbwE86jKRgMQ4HTuaJ7yQgA2BoNwY9ct
https://www.netacad.com/courses/networking/ccna-switching-routing-wireless-essentials
https://www.cisco.com/c/en/us/td/docs/routers/connectedgrid/modules/switch/gsg/cgr-esm-getting_started.pdf

Learning Outcomes

CLO 1: Demonstrate the knowledge of routing and switching concepts.
CLO 2: Configure routers and switches in a network.

CLO 3: Describe how basic routing works and the use of routing protocols
CLO 4: Configure and understand the components and operation of a wireless LAN.
CLO 5: Analyze and assess the merits of static, default and dynamic routing protocols
CLO 6: Select the suitable network component and implement it in to lab for a given problem.
CLO 7: Write lab reports and present results.

Tutorials

WEEK 1: Lab Induction, introduction to network devices, Course Policies, and reports.
WEEK 2: Introduction to packet tracer & Graphical Network Simulator-3(GNS3).
WEEK 3: Basic Router Security Configuration
WEEK 4: Basic Router Security Configuration
WEEK 5: Basic Serial Connection Configuration.
WEEK 6: VLAN Configuration.
WEEK 7: VLAN Configuration: Trunk Encapsulation.
WEEK 8: Local Username/Password Database.
WEEK 9: Port Security
WEEK 10: DHCP (Dynamic Host Configuration Protocol) and DNS
WEEK 11: Syslog, Password recovery, configuration backup, IOS upgrade.
WEEK 12: InterVLAN Routing and Troubleshooting
WEEK 13: IPv4 and IPv6 ALCs and ACL Troubleshooting
WEEK 14: Review Configuration and Review Troubleshooting
WEEK 15: Lab Final Exam

CET362: Network Analysis and Troubleshooting

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Requisites

- Prerequisites: CET261

Course Description

The "Network Analysis and Troubleshooting" course equips you with the skills and knowledge to diagnose and resolve network issues effectively. You'll delve into the fundamentals of network communication, including network protocols, IP addressing, and network devices like routers and switches. By understanding how data flows across a network, you'll gain the ability to identify bottlenecks, analyze network traffic, and troubleshoot common problems like connectivity issues, slow performance, and security breaches.
This course emphasizes practical application through hands-on labs. You'll learn to utilize industry-standard tools like Wireshark, a powerful packet analyzer that allows you to capture and inspect network traffic data. With this skillset, you'll be able to pinpoint the root cause of network problems and implement solutions to ensure optimal network performance and uptime

References

Computer Networking: A Top-Down Approach by James F. Kurose and Keith W. Ross
TCP/IP Illustrated, Volume 1: The Protocols by Richard Stevens
The Complete Guide to Network Troubleshooting by Keith Jarrett
Wireshark Network Analysis: Expert Troubleshooting Skills by Guy Pamment
Network+ Guide to Networks by William Shotts
Wireshark University: https://www.wireshark.org/learn
Professor Messer's Network+ Course: https://www.professormesser.com/network-plus/n10-008/n10-008-video/n10-008-training-course/
Cisco Networking Academy: Introduction to Networks: https://www.netacad.com/
Cybrary: Network Troubleshooting Guide: https://www.cybrary.it/practice-lab/network-troubleshooting
TechExams: Network+ Certification: https://community.infosecinstitute.com/categories/comptia

Learning Outcomes

Explain fundamental network concepts like network protocols, IP addressing, and network topologies.
Identify the functions and configurations of common network devices like routers, switches, and firewalls.
Utilize Wireshark to capture, inspect, and analyze network traffic for troubleshooting purposes.
Employ systematic troubleshooting methodologies to diagnose and resolve network connectivity issues.
Identify and address common network performance problems like slow speeds and latency.
Implement network security best practices to mitigate security vulnerabilities.

Document network troubleshooting procedures for future reference.

CET363: Linux/Unix Server Administration

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Requisites

- Prerequisites: CET212 AND CET161

Course Description

The Linux/Unix Server Administration course equips you with the skills and knowledge to manage and maintain Linux and Unix-based server systems. This powerful operating system forms the backbone of countless web servers, databases, and network infrastructure. Throughout the course, you'll delve into the core functionalities of Linux/Unix, gaining hands-on experience with user and group management, file system administration, security protocols, networking configurations, and essential server administration tasks.
By mastering the command line and various server administration tools, you'll be able to efficiently install, configure, and troubleshoot Linux/Unix servers in real-world environments. This comprehensive course prepares you for a successful career in system administration, cloud computing, and IT support, opening doors to exciting opportunities in various industries.

References

Linux Command Line by William Shotts (3rd Edition)
The Linux Bible by Christopher Negus (10th Edition)
LPI Exam Linux Essentials Study Guide by Christine Bresnahan and Richard Blum (2nd Edition)
Red Hat System Administration by Michael Jang (7th Edition)
Linux Kernel Development by Robert Love (3rd Edition)
The Linux Documentation Project https://tldp.org/
Linux Foundation Training https://training.linuxfoundation.org/
Red Hat Developer https://developers.redhat.com/
Udemy Free Linux Courses https://www.udemy.com/course/linux-tutorials/
Coursera Free Linux Courses https://www.coursera.org/courses?query=linux

Learning Outcomes

Understand the core architecture and functionalities of Linux/Unix operating systems.
Navigate the command line effectively for system administration tasks.
Manage user accounts, groups, and file system permissions.
Configure essential networking services on Linux/Unix servers.
Implement security best practices for server hardening.
Install and manage software packages using package management tools.
Automate tasks using scripting languages (e.g., Bash scripting).
Perform routine server maintenance and troubleshooting procedures.
Gain practical experience through hands-on labs and projects.

CET364: Cloud Systems Administration

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Requisites

- Prerequisites: CET212 AND CET161

Course Description

The Cloud Systems Administration course equips you with the knowledge and skills necessary to manage and administer cloud-based infrastructure. Delving into the core concepts and methodologies of cloud computing, you'll gain a comprehensive understanding of cloud models, deployment options, and virtualization technologies. Through hands-on labs and projects, you'll explore the practical aspects of cloud administration, including provisioning and configuring virtual machines, storage, and networking resources. The course also emphasizes

security best practices for protecting cloud environments and explores disaster recovery strategies for ensuring business continuity. By the end of this course, you'll be well-positioned to design, implement, and manage robust cloud solutions that meet the evolving needs of modern organizations.
This course is designed for IT professionals seeking to expand their skillset into cloud administration. Whether you're a network administrator, system administrator, or simply looking to stay ahead of the curve in the ever-growing cloud computing landscape, this course provides the foundational knowledge and practical experience to excel in this in-demand field.

References

"Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl et al.
"CompTIA Cloud+ Certification Study Guide: Exam SK0-004" by CompTIA et al.
Cloud Academy (https://cloudacademy.com/)
AWS Cloud Documentation (https://docs.aws.amazon.com/)
Microsoft Azure Documentation (https://learn.microsoft.com/en-us/azure/)

Learning Outcomes

Explain cloud computing fundamentals, characteristics, and service models (IaaS, PaaS, SaaS)
Identify and compare different cloud deployment models (Public, Private, Hybrid)
Understand virtualization technologies and their role in cloud environments
Install, configure, and manage virtual machines in a cloud environment
Implement and manage cloud storage solutions
Configure and secure cloud networks
Monitor and manage cloud resources effectively
Utilize cloud automation tools for efficient administration
Apply best practices for disaster recovery and business continuity in the cloud
Prepare for industry certifications like CompTIA Cloud+ (optional)

CET365: Virtualization Technologies

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Requisites

- Prerequisites: CET161

Course Description

Virtualization technologies are revolutionizing the way we utilize computing resources. This course delves into the fundamentals of virtualization, exploring its core concepts, architectures, and applications. You'll gain a comprehensive understanding of how virtualization allows us to create multiple virtual machines (VMs) on a single physical server, enhancing efficiency, resource utilization, and manageability.
We'll explore various virtualization technologies, including hypervisors, server virtualization, network virtualization, and storage virtualization. You'll learn how these technologies work together to create a virtualized environment that offers several benefits, such as improved resource utilization, increased server uptime, and simplified disaster recovery. Throughout the course, we'll delve into the practical aspects of virtualization, equipping you with the skills to design, deploy, and manage virtualized environments.

References

"Virtualization: A Manager's Guide" by Paul Barron and Richard Nash
"Mastering Hyper-V and System Center Virtualization Manager 2019" by Christophe de Wit
"VMware vSphere: Install, Configure, Manage, and Secure" by John Furrier
"Linux Containers and Kubernetes: A Practical Guide" by Nader Dabit, Derek Parker, and Tugberk Ozdogan
"Cloud Computing: Theory and Practice" by Meyers, Murali
VMware Virtualization Technology Basics https://www.vmware.com/solutions/virtualization.html
Microsoft Docs - Hyper-V: https://learn.microsoft.com/en-us/virtualization/
Introduction to Containers: https://docs.docker.com/get-started/
The Linux Foundation - Kubernetes Fundamentals: https://kubernetes.io/training/
Red Hat - Introduction to Virtualization: https://www.redhat.com/en/technologies/cloud-computing/openshift/virtualization

Learning Outcomes

Explain the fundamental concepts and benefits of virtualization technologies.

Differentiate between various types of virtualization, including server, network, and storage virtualization.
Identify and compare different hypervisor architectures (Type 1 and Type 2).
Design and deploy virtual machines using industry-standard tools and platforms.
Manage and optimize virtualized environments for performance, scalability, and security.
Analyze the impact of virtualization on cloud computing and its role in modern IT infrastructure.

CET366: Performance and Quality Management

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Requisites

- Prerequisites: CET264

Course Description

This course provides a comprehensive overview of performance and quality management principles and practices, essential for maintaining and improving organizational effectiveness. It covers various methodologies and tools used to monitor, manage, and enhance both performance and quality within an organization. Students will learn about performance measurement systems, quality management frameworks, continuous improvement processes, and the role of leadership in fostering a culture of excellence. The course also emphasizes the importance of aligning performance and quality management with the strategic goals of the organization.

References

"Performance Management: Integrating Strategy Execution, Methodologies, Risk, and Analytics" by Gary Cokins
"Quality Management for Organizational Excellence: Introduction to Total Quality" by David L. Goetsch and Stanley Davis
"The Balanced Scorecard: Translating Strategy into Action" by Robert S. Kaplan and David P. Norton
"The Lean Six Sigma Pocket Toolbook" by Michael L. George, John Maxey, David T. Rowlands, and Mark Price

Learning Outcomes

Understand the fundamental principles of performance and quality management.
Design and implement performance measurement systems to monitor organizational performance.
Apply quality management frameworks and tools to enhance product and service quality.
Evaluate the effectiveness of performance and quality management practices in different organizational contexts.
Identify areas for continuous improvement and develop strategies for achieving excellence.
Align performance and quality management initiatives with the strategic goals of the organization.

CET371: Business Information Technology

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Requisites

- Prerequisites: CET171

Course Description

This course explores the intersection of business and information technology, focusing on how IT solutions can be leveraged to improve business processes, enhance decision-making, and create competitive advantages. Students will learn about various IT systems and tools used in business environments, including enterprise resource planning (ERP) systems, customer relationship management (CRM) systems, business intelligence (BI), and e-commerce platforms. The course also covers the strategic role of IT in business, IT management, and the ethical considerations surrounding the use of technology in business.

References

"Management Information Systems: Managing the Digital Firm" by Kenneth C. Laudon and Jane P. Laudon

"Business Information Systems" by Paul Bocij, Andrew Greasley, and Simon Hickie
"ERP Demystified" by Alexis Leon
"Customer Relationship Management: Concepts and Technologies" by Francis Buttle and Stan Maklan

Learning Outcomes

Understand the role of information technology in supporting business operations and strategies.
Analyze business processes and identify areas where IT can enhance efficiency and effectiveness.
Evaluate and recommend IT solutions to meet specific business needs.
Implement basic IT systems in a business context, such as ERP, CRM, and BI tools.
Assess the impact of IT on business performance and competitive advantage.
Recognize the ethical, legal, and security issues related to the deployment of IT in business.

CET392: CET Internship II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
0	0	360	360	3	180			50	0	50

Requisites

- Prerequisites: CET191

Course Description

Internship provides an opportunity to practice and/or apply knowledge and skills in professional environments and gain valuable work experience. Through the Internship students get exposure to the industrial environment which cannot be simulated in the classroom. During the internship, students have to understand and sharpen the real-time technical/managerial skills required at the job(s). Further, they have to Understand the social, economic, and administrative considerations that influence the working environment of industrial organizations. Overall professional development of students required problem-solving, communication, human development, and relationship-building skills. Students select the internship field in consultation with an industry mentor and faculty guide in terms of the academic requirements. The student is supposed to produce a joining letter and a successful completion certificate. once the internship is over. Internship evaluation can be based on the quality of projects completed as part of the internship activities. Faculty Member(s) has to evaluate(s) the performance of students once by visiting the Industry/Organization and the Evaluation Report of the students' needs to submit in the department office with the consent of Industry persons/ mentor. The students will be exposed to the industry environment for a minimum period of 08 weeks duration to understand the operation of the industrial facility.

References

https://www.youtube.com/watch?v=jpf9J2TUJVg
https://www.youtube.com/watch?v=KqIshDsg494
https://www.youtube.com/watch?v=E1UcIHW5rSc
https://www.youtube.com/watch?v=EhnfOUrFgxM

Learning Outcomes

CLO 1: Analyze the assigned task and solve it by applying critical thinking and problem-solving skills.
CLO 2: Collaborate and communicate effectively with different professionals in the work environment.
CLO 3: Communicate effectively through the technical presentation.
CLO 4: Design solutions with contextual constraints, acquiring and applying new knowledge.
CLO 5: Recommend solutions for improved processes and optimal use of resources.
CLO 6: Evaluate career options by considering opportunities in industry and higher education and sharpen the real-time technical/managerial skills required at the job(s) during the internship.
CLO 7: Demonstrate ethical and professional behavior in the work environment.

CET411: Game Programming

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET112

Course Description

This course delves into the core principles of game programming, both in terms of hardware and software. It introduces fundamental concepts, including creating primitive objects in a virtual environment, constructing intricate mathematical models for 2D and 3D objects, manipulating and combining these models, and projecting them into a two-dimensional image space. The curriculum encompasses essential aspects of game development, such as windowing systems, advanced primitive objects like curves and surfaces, 2-D and viewing transformations, and the structure of display files. Students will explore geometric models, interactive and non-interactive techniques, raster graphics fundamentals, the foundations of 3D graphics, graphics packages and systems, the theory of computer synthesis, components of the image synthesis pipeline, and the principles governing the path of light within virtual game scenes, ultimately leading to the creation of photorealistic game environments. Student will explore game programming with specific engine (e.g. Unity/C#).

References

Game Programming Patterns - Robert Nystrom
The Art of Game Design: A Book of Lenses, Third Edition - Jesse Schell

Learning Outcomes

CLO 1: Master the fundamentals of game programming, including the creation of primitive objects, mathematical modeling for 2D and 3D environments, and manipulation of virtual objects.
CLO 2: Explore advanced game development topics, such as windowing systems, and working with complex primitive objects like curves and surfaces for realistic game scenarios.
CLO 3: Develop proficiency in 2D and viewing transformations, enabling the creation of dynamic game graphics.
CLO 4: Understand the structure of display files and learn to work with geometric models to construct immersive game environments.
CLO 5: Acquire skills in interactive and non-interactive techniques, fundamental principles of raster graphics, and the foundations of 3D graphics in the context of game development.
CLO 6: Familiarize yourself with graphics packages and systems used in game programming, and gain insights into the theory of computer synthesis and the image synthesis pipeline.
CLO 7: Explore the principles governing the path of light within virtual game scenes, culminating in the ability to create photorealistic game environments.

Lectures

Week 1: Overview of game programming; hardware vs. software considerations; history and evolution of game development.
Week 2: Creating and manipulating primitive objects (points, lines, polygons) in virtual space.
Week 3: Mathematical representation of 2D objects; coordinate systems; transformations (translation, scaling, rotation).
Week 4: Basics of 3D geometry; vertices, edges, faces; constructing 3D primitives.
Week 5: Concepts of windowing systems; managing multiple views and display files.
Week 6: Introduction to curves (Bezier, B-splines) and surfaces; applications in games.
Week 7: Viewing transformations; camera models; projecting 3D scenes onto 2D screens.
Week 8: Display file architecture; scene graphs; managing object hierarchies.
Week 9: Complex geometric modeling; combining objects; scene composition techniques.
Week 10: User input handling; interactive object manipulation; non-interactive animation techniques.
Week 11: Rasterization process; pixel operations; color models and buffers.
Week 12: 3D rendering pipeline; shading models; introduction to lighting.
Week 13: Components of the image synthesis pipeline; ray tracing basics; light path simulation in virtual scenes.
Week 14: Principles of photorealism; combining all course concepts; best practices in game graphics programming.

Tutorials

WEEK 1: Introduction to Game Programming Fundamentals.
WEEK 2: Creating Primitive Objects for Games.
WEEK 3: Mathematical Modeling for 2D and 3D Environments.
WEEK 4: Manipulation of Virtual Objects in Games.
WEEK 5: Advanced Game Development Topics and Windowing Systems.
WEEK 6: Working with Complex Primitive Objects in Games.
WEEK 7: Curves and Surfaces for Realistic Game Scenarios.
WEEK 8: 2D and Viewing Transformations for Dynamic Graphics.
WEEK 9: Structure of Display Files and Geometric Models in Games.
WEEK 10: Interactive and Non-Interactive Techniques in Game Graphics.
WEEK 11: Raster Graphics Principles for Games.
WEEK 12: Foundations of 3D Graphics in Game Development.
WEEK 13: Graphics Packages and Systems for Game Programming.
WEEK 14: Principles of Image Synthesis and Photorealistic Game Environments.
WEEK 15: Lab Final Exam

Laboratories

Week 1: Setting up the development environment; introduction to a basic game engine or graphics library.
Week 2: Coding simple 2D shapes; rendering objects on the screen.
Week 3: Implementing 2D transformations; interactive manipulation of 2D objects.
Week 4: Coding and displaying basic 3D models; exploring 3D coordinate systems.
Week 5: Creating and managing windows; rendering scenes in multiple viewports.
Week 6: Implementing and visualizing curves and simple surfaces.
Week 7: Coding camera controls; implementing perspective and orthographic projections.
Week 8: Building a simple scene graph; hierarchical object manipulation.
Week 9: Creating composite objects; arranging scenes with multiple entities.
Week 10: Implementing keyboard/mouse controls; scripting basic object animations.
Week 11: Drawing and manipulating pixels; implementing simple raster effects.
Week 12: Coding basic lighting and shading; experimenting with material properties.
Week 13: Implementing simple ray tracing; simulating basic light interactions.
Week 14: Final project presentations; peer review; course wrap-up and reflection.

CET412: Selected Topic in Computer Science I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

CET413: Product Management

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Course Description

Product Management is an advanced course that delves into the intricate art and science of developing data-driven, technology-based products. Tailored for students pursuing data science and technology disciplines, this course offers a comprehensive exploration of product management methodologies, emphasizing data-driven decision-making throughout the product lifecycle. Topics span product ideation, market research, customer segmentation, feature prioritization, agile development methodologies, and iterative product refinement. Students will gain hands-on experience in data-driven product design, leveraging analytics, A/B testing, and user feedback to inform product enhancements. This course equips aspiring data science professionals with the skills and strategies needed to excel in product management roles, fostering innovation and excellence in technology-driven product development.

Learning Outcomes

CLO 1: Develop a deep understanding of product management methodologies, with a focus on data-driven decision-making.
CLO 2: Master techniques for product ideation, market research, and customer segmentation to inform product development.
CLO 3: Acquire skills in feature prioritization and agile development methodologies for efficient product delivery.
CLO 4: Learn the art of iterative product refinement, incorporating user feedback and analytics to drive enhancements.
CLO 5: Gain hands-on experience in data-driven product design, utilizing A/B testing and analytics to inform strategic product decisions.
CLO 6: Cultivate the ability to excel in product management roles within data science and technology domains, fostering innovation and product excellence.
CLO 7: Apply product management principles to real-world scenarios, preparing for success in data-driven technology product development.

Tutorials

WEEK 1: Introduction to Product Management Methodologies.
WEEK 2: Data-Driven Decision-Making in Product Management.
WEEK 3: Techniques for Product Ideation.
WEEK 4: Market Research and Customer Segmentation.
WEEK 5: Feature Prioritization Strategies.
WEEK 6: Agile Development Methodologies in Product Delivery.
WEEK 7: Iterative Product Refinement and User Feedback.
WEEK 8: Incorporating Analytics for Product Enhancement.
WEEK 9: Hands-On Experience in Data-Driven Product Design.
WEEK 10: A/B Testing for Informed Product Decisions.
WEEK 11: Preparing for Product Management Roles.

WEEK 12: Fostering Innovation in Technology Product Management.
WEEK 13: Application of Product Management Principles.
WEEK 14: Real-World Scenarios in Data-Driven Technology Product Development.
WEEK 15: Lab Final Exam

CET414: Parallel Programming

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET211

Course Description

This advanced graduate-level course delves deeply into the realm of parallel and distributed computing, leveraging a variety of programming models. Topics covered encompass a broad spectrum, including parallel computation models, message passing, shared memory paradigms, data parallel programming, performance modeling, memory system optimization techniques, fine-grained computation models, and High-Level Design Tools for programming parallel platforms. The course will also explore communication primitives, stream programming models, and emerging heterogeneous computing and programming paradigms. Students will gain hands-on experience with cutting-edge parallel computing platforms and tools, spanning from large-scale clusters to edge devices and data center-scale platforms. A pivotal course project will empower students to explore diverse computing platforms, design highly efficient parallel algorithms, assess their performance, and acquire expertise in performance tuning methodologies.

References

Parallel Programming: Concepts and Practice -
Bertil Schmidt, Jorge Gonzalez-Martinez, Christian Hundt, Moritz Schlarb
Introduction to Parallel Computing: From Algorithms to Programming on State-of-the-Art Platforms - Roman Trobec, Boštjan Slivnik, Patricio Bulić, Borut Robič

Learning Outcomes

CLO 1: Master diverse parallel computation models and programming paradigms.
CLO 2: Acquire proficiency in message passing and shared memory techniques for distributed computing.
CLO 3: Develop data parallel programming skills and techniques.
CLO 4: Explore performance modeling and optimization methodologies for parallel systems.
CLO 5: Apply memory system optimization techniques to enhance parallel program efficiency.
CLO 6: Grasp the intricacies of fine-grained computation models and High-Level Design Tools for parallel platforms.
CLO 7: Understand communication primitives and emerging heterogeneous computing paradigms.
CLO 8: Gain hands-on experience with advanced parallel computing platforms and tools, including large-scale clusters, edge devices, and data center-scale systems.
CLO 9: Execute a course project to design efficient parallel algorithms, assess their performance, and hone performance tuning skills across diverse computing platforms.

Tutorials

WEEK 1: Introduction to Parallel Computation Models and Programming Paradigms.
WEEK 2: Message Passing and Shared Memory Techniques for Distributed Computing.
WEEK 3: Developing Data Parallel Programming Skills.
WEEK 4: Performance Modeling Methodologies for Parallel Systems.
WEEK 5: Memory System Optimization for Enhanced Parallel Program Efficiency.
WEEK 6: Fine-Grained Computation Models and High-Level Design Tools for Parallel Platforms.
WEEK 7: Communication Primitives in Parallel Computing.
WEEK 8: Exploring Emerging Heterogeneous Computing Paradigms.
WEEK 9: Hands-On Experience with Advanced Parallel Computing Platforms and Tools.
WEEK 10: Practical Applications on Large-Scale Clusters.
WEEK 11: Edge Devices in Parallel Computing.
WEEK 12: Data Center-Scale Systems in Parallel Computing.
WEEK 13: Course Project: Designing Efficient Parallel Algorithms.
WEEK 14: Performance Assessment and Tuning Across Diverse Computing Platforms.
WEEK 15: Lab Final Exam.

CET415: Digital Marketing Technologies

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Course Description

In the ever-evolving marketing landscape, it has become imperative for a business to integrate digital marketing efforts into its overall marketing strategy. This course provides a broad overview of the digital marketing techniques needed for successful marketing campaigns in a digital economy. Students in this course explore the development, production, and implementation of digital-marketing delivery methods, including email marketing, web-based marketing, search engine optimization (SEO), online advertising, Google Analytics, and social media. This course also helps the student to understand how to create an account, implement tracking code, and set up data filters. The student learning includes navigating the Google Analytics interface and reports and setting up dashboards and shortcuts. The course also demonstrates how to analyze basic Audience, Acquisition, and Behavior reports, set up goals, and track campaigns. Google Analytics helps track and report website traffic. The topics include understanding how visitors interact with their website, website owners and making informed decisions about improving their websites and marketing campaigns. The curriculum introduces tools to appropriately measure and evaluate the effectiveness of digital marketing campaigns designed to improve the consumer's experience. Students gain a fundamental understanding of the digital marketing core principles needed for the 21st-century consumer. Lectures, assignments, projects, and case studies based on digital marketing are used to deliver the course.

References

Deiss, R., & Henneberry, R. (2020). Digital marketing for dummies. John Wiley & Sons.
Chaffey, D., & Ellis-Chadwick, F. (2019). Digital marketing: strategy, implementation & practice. Pearson UK.
Fundamentals of digital marketing, Google Digital Garage, https://learndigital.withgoogle.com/digitalgarage/course/digital-marketing , Accessed on 14.10.2022
Swayam, Basics of Digital Marketing, https://onlinecourses.swayam2.ac.in/cec19_mg23/preview, Accessed on 14.10.2022
SkillUP, Tools - Google Analytics, https://www.simplilearn.com/free-google-analytics-training-course-for-beginners-skillup, Accessed on 14.11.2022

Learning Outcomes

CLO 1: Analyze the use of digital marketing and principles of computing to grow business.
CLO 2: Select appropriate tools and key elements for the implementation of Email marketing.
CLO 3: Demonstrate the ability to accomplish group tasks related to digital marketing.
CLO 4: Design the effective digital marketing campaign that can be measured in given requirement.
CLO 5: Examine the strategies in team related to digital marketing for enhancing customer experience.
CLO 6: Apply Digital Marketing concepts and write programs in the labs to solve problems.
CLO 7: Write the lab report and present the output result as lab record.

Tutorials

WEEK 1: Lab Induction and installing and understanding digital marketing tools.
WEEK 2: Understanding and Implementing google analytics.
WEEK 3: Develop Digital marketing strategy development with google analytics.
WEEK 4: Google analytics for selecting the right marketing campaign.
WEEK 5: Implementing Best practices on content marketing.
WEEK 6: Creating and writing a blog for business strategy.
WEEK 7: Creating High-Converting Landing Pages.
WEEK 8: Use of Google Analytics to analyze the traffic.
WEEK 9: Implementing google analytics to leveraging the Social Web.
WEEK 10: Implementing email marketing best practices in various domains.
WEEK 11: Analyze data from google analytics for running a Data-Driven Business.
WEEK 12: Investigate tools (Comparing the result between two popular tools) for digital marketing.
WEEK 13: Use google analytics for enhancing digital customer experience.
WEEK 14: Use google analytics for Campaign planning for digital media.
WEEK 15: Lab Final Exam.

CET416: DevOps

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET214

Course Description

This course offers a comprehensive exploration of the vital aspects related to the operation and management of software systems. Students will delve into the intricacies of software deployment, maintenance, and optimization throughout the software lifecycle. Topics include software configuration management, version control, release planning, and the establishment of efficient operational processes. Additionally, students will gain insights into software monitoring, performance tuning, and troubleshooting techniques to ensure robust system operation. The course also covers essential principles of software project management, encompassing project planning, scheduling, resource allocation, and risk management. By the end of the course, participants will be equipped with the knowledge and skills required to effectively operate, maintain, and manage software systems within the context of modern technology and industry best practices.

References

The Operation and Management of a Software Company: An Entrepreneurial Guide to Creating and Maintaining a Software Development Company - Larry G. Miner

Learning Outcomes

CLO 1: Develop a deep understanding of software deployment, maintenance, and optimization throughout the software lifecycle.
CLO 2: Master software configuration management and version control techniques for efficient software operation.
CLO 3: Acquire proficiency in release planning and establishing streamlined operational processes.
CLO 4: Gain expertise in software monitoring, performance tuning, and troubleshooting for robust system operation.
CLO 5: Explore fundamental principles of software project management, including project planning, scheduling, resource allocation, and risk management.
CLO 6: Apply acquired knowledge and skills to effectively operate, maintain, and manage software systems in alignment with contemporary technology and industry best practices.

Tutorials

WEEK 1: Introduction to Software Lifecycle and Deployment.
WEEK 2: Software Configuration Management Techniques.
WEEK 3: Efficient Version Control Practices.
WEEK 4: Release Planning and Streamlined Operational Processes.
WEEK 5: Proficiency in Software Monitoring.
WEEK 6: Performance Tuning for Robust System Operation.
WEEK 7: Troubleshooting Strategies in Software Maintenance.
WEEK 8: Fundamentals of Software Project Management.
WEEK 9: Project Planning and Scheduling.
WEEK 10: Resource Allocation in Software Projects.
WEEK 11: Risk Management in Software Projects.
WEEK 12: Effective Software Operation and Maintenance.
WEEK 13: Contemporary Technology and Industry Best Practices.
WEEK 14: Comprehensive Assessment and Application of Knowledge in Software System Operation and Management.
WEEK 15: Lab Final Exam.

CET417: Advanced Software Engineering

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET213

Course Description

This advanced-level course delves into the intricacies of software engineering, focusing on advanced techniques essential for modeling and analyzing complex software systems. Students will extensively utilize the Unified Modeling Language (UML) and design patterns to model and analyze medium-sized software systems. Topics encompass the Object Constraint Language (OCL), pattern specifications, Model-Driven

Software Development (MDSD), and Aspect-Oriented Software Development (AOSD). Throughout the course, participants will gain proficiency in advanced software engineering methodologies, equipping them with the skills required to handle intricate software projects within the realm of computer science and technology.

References

Software Engineering at Google: Lessons Learned from Programming Over Time - Titus Winters, Tom Manshreck, Hyrum Wright
Software Engineering: A Practitioner's Approach - Roger S. Pressman

Learning Outcomes

CLO 1: Master advanced software engineering techniques for modeling and analyzing complex software systems.
CLO 2: Proficiently utilize the Unified Modeling Language (UML) and design patterns for modeling and analyzing medium-sized software systems.
CLO 3: Acquire expertise in the Object Constraint Language (OCL) and pattern specifications for precise system modeling.
CLO 4: Explore Model-Driven Software Development (MDSD) and Aspect-Oriented Software Development (AOSD) methodologies.
CLO 5: Apply advanced software engineering methodologies to handle intricate software projects in the realm of computer science and technology.

Tutorials

WEEK 1: Introduction to Advanced Software Engineering Techniques.
WEEK 2: Utilizing UML for Modeling and Analysis.
WEEK 3: Design Patterns in Software Modeling.
WEEK 4: Proficiency in the Object Constraint Language (OCL).
WEEK 5: Precise System Modeling with Pattern Specifications.
WEEK 6: Model-Driven Software Development (MDSD) Methodologies.
WEEK 7: Aspect-Oriented Software Development (AOSD) Principles.
WEEK 8: Integrating MDSD and AOSD in Software Engineering.
WEEK 9: Software Engineering for Medium-Sized Systems.
WEEK10: Complex Software Project Management.
WEEK11: Applying Advanced Methodologies in Computer Science.
WEEK12: Handling Intricate Software Projects.
WEEK13: Course Project: Advanced Software System Modeling.
WEEK14: Comprehensive Assessment and Recap of Advanced Software Engineering Techniques.
WEEK 15: Lab Final Exam

CET418: Selected Topic in Computer Science II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

CET431: Software Security

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET112

Course Description

This course delves deeply into the core tenets of software security, emphasizing secure coding methodologies, robust practices, and the identification and mitigation of prevalent software vulnerabilities. Topics include an in-depth exploration of memory exploits, particularly shell code execution, comprehensive vulnerability analysis techniques such as reverse engineering, fuzzing, and symbolic execution, as well as the implementation of robust defenses to thwart common vulnerability exploitation attempts. Students will gain a profound understanding of safeguarding software systems against potential threats within the context of computer science and engineering.

Learning Outcomes

CLO 1: Master secure coding practices.
CLO 2: Identify prevalent vulnerabilities.
CLO 3: Analyze memory exploits.
CLO 4: Explore reverse engineering techniques.
CLO 5: Implement robust defenses.
CLO 6: Utilize fuzzing for vulnerability testing.
CLO 7: Gain a deep understanding of software security in a computer science context.

Tutorials

WEEK 1: Introduction to Software Security.
WEEK 2: Secure Coding Practices.
WEEK 3: Identifying Prevalent Vulnerabilities.
WEEK 4: Analyzing Memory Exploits.
WEEK 5: Exploring Reverse Engineering Techniques.
WEEK 6: Implementing Robust Defenses.
WEEK 7: Utilizing Fuzzing for Vulnerability Testing.
WEEK 8: Software Security in a Computer Science Context.
WEEK 9: Secure Coding Practices Review.
WEEK 10: Advanced Vulnerability Identification.
WEEK 11: Memory Exploits Analysis Deep Dive.
WEEK 12: Reverse Engineering Techniques in Practice.
WEEK 13: Defensive Strategies and Best Practices.
WEEK 14: Comprehensive Software Security Assessment.
WEEK 15: Lab Final Exam.

CET432: Database Security

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET231

Course Description

This course offers a robust grounding in the realm of database security and auditing, with a particular emphasis on real-world application through Oracle scenarios and detailed, hands-on examples. The curriculum encompasses a comprehensive array of topics, including database security fundamentals, user profiles, password policies, privileges and role management, Virtual Private Databases (VPDs), and comprehensive auditing practices. Additionally, the course delves into advanced subjects like SQL injection prevention, safeguarding the Database Management System (DBMS), the enforcement of stringent access controls, and other intricacies surrounding database security management within the context of computer science and technology.

References

Database Security: Problems and Solutions -
Christopher Diaz
Database Security - Alfred Basta, Melissa Zgola

Learning Outcomes

CLO 1: Understand database security fundamentals and best practices.
CLO 2: Manage user access through profiles, policies, privileges, and roles.
CLO 3: Implement Virtual Private Databases (VPDs) for data access control.
CLO 4: Proficiently employ auditing techniques to monitor database activities.
CLO 5: Master advanced topics like SQL injection prevention and access control enforcement.
CLO 6: Apply concepts in practical Oracle scenarios.
CLO 7: Deepen knowledge of database security in the context of computer science and technology.

Tutorials

WEEK 1: Introduction to Database Security Fundamentals and Best Practices.

WEEK 2: Managing User Access through Profiles, Policies, Privileges, and Roles.
WEEK 3: Implementing Virtual Private Databases (VPDs) for Data Access Control.
WEEK 4: Proficient Use of Auditing Techniques for Monitoring Database Activities.
WEEK 5: Mastering Advanced Topics: SQL Injection Prevention and Access Control Enforcement.
WEEK 6: Applying Database Security Concepts in Oracle Scenarios.
WEEK 7: Database Security in the Context of Computer Science and Technology.
WEEK 8: Review and Consolidation of Fundamentals.
WEEK 9: Advanced User Access Management Strategies.
WEEK 10: VPDs in Complex Data Access Scenarios.
WEEK 11: Auditing Best Practices and Case Studies.
WEEK 12: Hands-on Lab: SQL Injection Prevention Techniques.
WEEK 13: Real-World Oracle Security Implementation.
WEEK 14: Comprehensive Database Security Assessment and Recap.
WEEK 15: Lab Final Exam

CET433: Selected Topic in Network and Security I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET231

CET434: Cloud and IoT Security

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET161

Course Description

This course introduces the security and privacy issues in cloud computing and the Internet of Things. The course covers advanced cryptography (Identity-based Encryption, Attribute-based Encryption, Searchable Encryption, and Order-preservation Encryption) and its applications in solving security and privacy issues in cloud computing and Internet of Things. Cloud computing infrastructure has become a mainstay of the IT industry, opening the possibility for on-demand, highly elastic and infinite compute power with scalability and supporting the delivery of mission-critical secure enterprise applications and services. This course provides the ground-up coverage on the high-level concepts of cloud landscape, architectural principles, techniques, design patterns and real-world best practices applied to Cloud service providers and consumers and delivering secure Cloud-based services. The course describes the Cloud security architecture, explores the guiding security design principles, design patterns, industry standards, and applied technologies, and address regulatory compliance requirements critical to the design, implementation, delivery, and management of secure cloud-based services. The course delves deep into the secure cloud architectural aspects with regards to identifying and mitigating risks, protection and isolation of physical and logical infrastructures including compute, network and storage, comprehensive data protection at all OSI layers, end-to-end identity management and access control, monitoring and auditing processes and meeting compliance with industry and regulatory mandates.

References

Erl, T., Cope, R., & Naserpour, A. (2015). Cloud computing design patterns. Prentice Hall Press.
Dotson, C. (2019). Practical cloud security: a guide for secure design and deployment. O'Reilly Media.
Class Central, "Cloud Computing Security", https://www.classcentral.com/course/cloud-computing-security-11754, Accessed on 15.10.2022
edX, "Cloud Computing Security", https://www.edx.org/course/cloud-computing-security, Accessed on 15.10.2022
Coursera, Cloud Computing Security, https://www.coursera.org/learn/cloud-computing-security, Accessed on 15.11.2022

Learning Outcomes

CLO 1: Simulate the definition and significance of the Internet of Things.
CLO 2: Analyze the architecture, operation, and business benefits of an IoT solution.
CLO 3: Review constraints and opportunities of Cloud and Fog Computing for Internet of Things.
CLO 4: Select the right sensors and communication protocols to use in IoT environment.

CLO 5: Apply IoT concepts and write programs in the labs to solve problems.
CLO 6: Write the lab report and present the output result as lab record.
CLO 7: Demonstrate the basic configuration related to IOT sensors to accomplish group tasks.

Tutorials

WEEK 1: Lab Induction, Fundamentals of Cloud Computing (Cloud deployment models), Risks and Security Concerns.
WEEK 2: Security Design and Architecture for Cloud Computing, Implementing CSA, NIST and ENISA guidelines for Cloud Security
WEEK 3: Secure Isolation of Physical & Logical Infrastructure (Common attack vectors and threats)
WEEK 4: Data Protection for Cloud Infrastructure and Services (Encryption, Data Redaction, Tokenization, Obfuscation, PKI, and Key Management, Assuring data deletion)
WEEK 5: Enforcing Access Control for Cloud Infrastructure based Services (Enforcing Access Control Strategies)
WEEK 6: Monitoring, Auditing and Management (Monitoring for unauthorized access, malicious traffic, abuse of system privileges, intrusion detection, events and alerts and Secure Management)
WEEK 7: Implementing Cloud Design Patterns (Architectural patterns for Cloud Computing)
Week 8: Introduction to Identity Management in Cloud Computing (User Identification, Authentication, and Authorization in Cloud Infrastructure)
WEEK 9: Cloud Computing Security Design Patterns (Geo-tagging, Cloud VM Platform Encryption, Trusted Cloud Resource Pools, Secure Cloud)
WEEK 10: Cloud Computing Security Design Patterns (Security Patterns for Cloud Computing – Network Security, Identity & Access Management & Trust)
WEEK 11: Policy, Compliance & Risk Management in Cloud Computing (Implementing CSA Security, Trust, and Assurance Registry (STAR))
WEEK 12: Cloud Compliance Assessment & Reporting- Technical Case study / Activity.
WEEK 13: Cloud Service Providers – Technology Review (Local and international)
WEEK 14: Understanding Cloud Service Providers –(OpenStack Platform, Docker)
WEEK 15: Lab Final Exam.

CET435: Network and Mobile Security

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET161

Course Description

Mobile and wireless networks have become the essential part of life for individuals and organizations. Mobile and wireless security has become the important aspects in current digital world to protect the data. This course covers the wireless communication architecture, wireless and mobile as a cyber-physical infrastructure (CPS), attacks based on gsm networks, attacks based on lack of wi-fi security, attacks based on Bluetooth, attacks based on operating system, mobile networks, security standards in current wireless & mobile systems: Wi-Fi Security (WEP, WPA, WPA-Enterprise) security standards. The topics include LTE, Bluetooth security, security of device, network, and server levels: mobile devices security requirements, application-level security in cellular networks, security of mobile computing platforms, android and iOS security models, threats and emerging solutions, security threats to mobile devices, unauthorized device, and data access. The student learning includes malware, spam, electronic eavesdropping, electronic location tracking, application-level security in MANETs, wireless networks and protocols, security vulnerabilities, attacks, mitigation technique, wireless security, authentication check on IEEE 802.11 and management of WLAN security, data center operations and security challenge, data center security recommendations encryption for confidentiality and integrity. The laboratory work consists of experiments illustrating the principles, laws and concepts discussed in the course.

References

D. Coleman, D. Westcott, and B. Harkins, CWSP: Certified Wireless Security Professional Study Guide CWSP - 205, 2nd ed. Sybex, 2016
Qian, Y., Ye, F., & Chen, H. H. (2021). Security in Wireless Communication Networks. John Wiley & Sons.
W. Osterhage, Wireless Network Security, CRC Press, 2nd edition, 2018, ISBN-10: 1138093793, ISBN-13: 978-1138093799
Tamma, R., Skulkin, O., Mahalik, H., & Bommisetty, S. (2020). Practical Mobile Forensics: Forensically investigate and analyze iOS, Android, and Windows 10 devices. Packt Publishing Ltd.
https://www.youtube.com/watch?v=kYcFXYVZiBQ
https://www.specnt.com/blog/security/2021/october/mobile-and-wireless-security-explained/
https://www.techtarget.com/searchsecurity/WLAN-security-Best-practices-for-wireless-network-security
https://securityboulevard.com/2022/02/wi-fi-hacking-how-to-secure-a-wireless-network/

Learning Outcomes

CLO 1: Analyze distributed denial-of-service attacks and identify mitigation techniques.

CLO 2: Discuss the wireless communication protocols used for a network.
CLO 3: Evaluate and recommend the security techniques applied to mobile and wireless environments
CLO 4: Review the needs of law-enforcement for individual right-to-privacy in wireless infrastructures.
CLO 5: Design and implement secure wireless networks for a given organizational environment.
CLO 6: Apply the security techniques, perform experiments, interpret data, and draw results and conclusions.
CLO 7: Write lab reports and present results.

Tutorials

WEEK 1: Lab Induction, devices, simulator, Course Policies, reports
WEEK 2: Download and install Android Studio and start new project.
WEEK 3: Part 1: Exfiltrating Information, create a simple web application that can store information sent to it.
WEEK 4: TASK 1: Modify the Simple Location application to secretly access location information at a time not expected by the user, and exfiltrate that information to your server. TASK2: Modify this application to secretly access the device's location at unexpected times (i.e., when the user has not pressed the "Find Location" button), and exfiltrate that location to your web application
WEEK 5: Part 2: Permission Redelegation, create a version of your Simple Location application that performs the same attack as in Part 1 (exfiltrates information) but does so without the INTERNET permission.
WEEK 6: Identify the permission redelegation vulnerability in Simple Game. In a text file, identify the location(s) of the vulnerability, and briefly describe how another application can exploit it.
WEEK 7: Extract the encryption key from an Android application (without access to source code).
WEEK 8: Study of wireless networks and Securing a Wireless Network from Wardriving
WEEK 9: Securing a Wireless Network from Wardriving
WEEK 10: Applying and Breaking Wireless Encryption
WEEK 11: Applying and Breaking Wireless Encryption.
WEEK 12: Conducting a Wi-Fi Site Survey
WEEK 13: Conducting a Wi-Fi Site Survey
WEEK 14: Open Ended question
WEEK 15: Lab Final Exam

CET436: Information Security Management

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET161

Course Description

Information security management is about protecting an organization's most valuable asset: its data. With the increasing number of cyber-attacks, it is essential to have a system in place that can protect data. Information security management is a comprehensive solution that provides the tools needed to keep data safe. With information security management, one can rest assured that data is protected from the latest threats. This course provides a managerial approach to information security and a thorough treatment of the secure administration of information assets. This course also covers integrated threat management , introduction to information security management system management and leadership, principles of information security management, compliance: law and ethics , security management models, strategic planning for security, information security governance. The topics include information security policy, regulatory compliance, and developing the security programs, components of the security program, implementing security education, training, and awareness (SETA) programs, project management in information security, risk management, the risk management process and introduction to risk treatment. Student is exposed to recent case studies related to information security management to give the insights of security management and its use. The laboratory work consists of experiments and practice using the information security tools to analyze and prepare the security plans.

References

Michael E. Whitman Herbert J. Mofford. (2018). MANAGEMENT OF INFORMATION SECURITY, 6th Edition. Cengage Learning, Inc
https://www.smartsheet.com/content/information-security-management
https://engineering.futureuniversity.com/BOOKS%20FOR%20IT/Book%20Information%20Security%20Mangement%206th%20ed.pdf
https://www.juniper.net/us/en/research-topics/what-is-network-security-management.html
https://www.imperva.com/learn/data-security/information-security-infosec/

Learning Outcomes

CLO 1: Develop the security policies and ethics to reduce the information security risk for organization.
CLO 2: Evaluate the information security risk of organization and present the credible arguments to respond for the identified security risks.

CLO 3: Select appropriate security management model for organization.
CLO 4: Develop a security program for placing information security within an organization, which covers the legal and ethical aspects, working in teams.
CLO 5: Recommend the various laws, ethics for compliance of security and threats in organization.
CLO 6: Select the appropriate method and tools to ensure the information security for given task in the lab.
CLO 7: Write lab reports and present results.

Tutorials

WEEK 1: Lab Induction, course policies and format of lab reports.
WEEK 2: Introduction to security tools.
WEEK 3: Learn how to use Linux, used by various servers and security tools.
WEEK 4: Analyze the core security issues with web applications and learn how to use them using security tools and techniques.
WEEK 5: Analyze the core security issues with web applications and learn how to use them using security tools and techniques.
WEEK 6: Understand, enumerate, and attack networking services in real-time environments using simulation/security tools.
WEEK 7: Understand, enumerate, and attack networking services in real-time environments using simulation/security tools.
WEEK 8: Understand, enumerate, and attack networking services in real-time environments using simulation/security tools.
WEEK 9: Strengthen your skills by exploiting a range of different applications and services, from networking to web to privilege escalation.
WEEK 10: Learn the techniques to analyze and defend against real-world cyber-attacks.
WEEK 11: Learn the techniques to analyze and defend against real-world cyber-attacks.
WEEK 12: Learn the techniques to analyze and defend against real-world cyber-attacks.
WEEK 13: Develop the security program to implement for different scenario.
WEEK 14: Develop the security program to implement for different scenario.
WEEK 15: Lab Final Exam

CET437: Adanced Cryptographic Algorithms & Protocols

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET334

Course Description

The "Advanced Cryptographic" course delves deep into the intricate world of cryptographic algorithms, protocols, and applications. Building upon the foundations of cryptography, this course equips students with the knowledge and skills to understand, develop, and apply advanced cryptographic techniques in real-world scenarios. Topics covered include modern encryption algorithms, cryptographic protocols for secure communication, cryptographic applications in data security, digital signatures, and cryptographic key management. Students will explore the theoretical underpinnings of cryptography while gaining practical experience in implementing secure cryptographic systems.

References

Communication security: an introduction to cryptography. Serge Vaudenay. Springer 2004.
A computational introduction to number theory and algebra. Victor Shoup. Cambridge University Press 2005.
Algorithmic cryptanalysis. Antoine Joux. CRC 2009.
[GMR85] Goldwasser, S., S. Micali, and C. Rackoff. “On the Knowledge Complexity of Interactive Proof Systems.” In Proceedings of the 17th ACM Symposium on the Theory of Computing STOC. Providence, Rhode Island, U.S.A.: ACM Press, 1985, pp. 291-304.

Learning Outcomes

CLO 1: Explore advanced encryption algorithms, including symmetric and asymmetric ciphers, and understand their mathematical principles.
CLO 2: Analyze cryptographic protocols for secure communication, such as SSL/TLS, SSH, and IPsec, and implement them in practical scenarios.
CLO 3: Investigate cryptographic applications in data security, including secure file storage, database encryption, and data-at-rest protection.
CLO 4: Master digital signatures and their applications in ensuring data authenticity and non-repudiation.
CLO 5: Understand cryptographic key management, including key generation, distribution, and storage, and design secure key management systems.
CLO 6: Explore post-quantum cryptography and the implications of quantum computing on cryptographic security.
CLO 7: Evaluate the role of cryptography in blockchain technology, cryptocurrency, and secure decentralized systems.
CLO 8: Analyze real-world cryptographic vulnerabilities and attacks and learn how to defend against them.
CLO 9: Investigate emerging trends and challenges in the field of advanced cryptography, including homomorphic encryption, zero-knowledge proofs, and secure multiparty computation.

CLO 10: Apply cryptographic principles and techniques to practical projects, developing the skills necessary to design and implement secure cryptographic systems for various applications and industries.

Tutorials

Week 1: Introduction to Encryption Algorithms: Symmetric and Asymmetric Ciphers.
Week 2: Mathematical Principles Behind Encryption.
Week 3: Cryptographic Protocols for Secure Communication.
Week 4: SSL/TLS, SSH, and IPsec in Practical Scenarios.
Week 5: Cryptographic Applications in Data Security.
Week 6: Secure File Storage and Database Encryption.
Week 7: Data-at-Rest Protection Techniques.
Week 8: Digital Signatures for Data Authenticity and Non-Repudiation.
Week 9: Cryptographic Key Management Principles.
Week 10: Key Generation, Distribution, and Secure Storage.
Week 11: Post-Quantum Cryptography and Quantum Computing Implications.
Week 12: Cryptography in Blockchain Technology and Cryptocurrency.
Week 13: Secure Decentralized Systems and Cryptographic Vulnerabilities.
Week 14: Emerging Trends and Challenges in Advanced Cryptography.
Week 15: Lab Final Exam

CET438: Hardware Security Applications

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET334

Course Description

Hardware Security Applications is a comprehensive exploration of the multifaceted domain of hardware security, encompassing essential topics such as tokenizers, Hardware Security Modules (HSMs), access control mechanisms, RFID applications, and more. This course offers an in-depth examination of both the theoretical foundations and practical implementations of hardware-based security solutions. Students will delve into the intricacies of securing computing systems through hardware, learning to design, evaluate, and employ cutting-edge technologies to protect sensitive data, enhance access control, and address emerging security challenges.

Learning Outcomes

CLO 1: Gain a profound understanding of tokenizers, Hardware Security Modules (HSMs), and their role in safeguarding cryptographic keys and sensitive data.
CLO 2:Explore advanced access control mechanisms and techniques for enforcing security policies at the hardware level.
CLO 3:Investigate RFID applications and their security implications, including RFID authentication and privacy concerns.
CLO 4:Analyze real-world case studies to assess the security posture of hardware-based solutions and propose improvements.
CLO 5:Develop expertise in integrating hardware security components into diverse computing systems.
CLO 6:Keep pace with emerging trends in hardware security, including IoT security, secure boot processes, and hardware-based threat detection methods.

Tutorials

Week 1: Introduction to Tokenizers and Their Significance in Security.
Week 2: Hardware Security Modules (HSMs) and Their Role in Key Protection.
Week 3: Advanced Access Control Mechanisms for Hardware Security.
Week 4: Techniques for Enforcing Security Policies at the Hardware Level.
Week 5: RFID Applications and Security Implications.
Week 6: RFID Authentication and Privacy Concerns.
Week 7: Real-World Case Studies in Hardware-Based Security.
Week 8: Assessing Security Posture and Proposing Improvements.
Week 9: Integrating Hardware Security Components into Computing Systems.
Week 10: Exploring IoT Security in Hardware.
Week 11: Secure Boot Processes and Their Role in Security.
Week 12: Hardware-Based Threat Detection Methods.
Week 13: Staying Current with Emerging Hardware Security Trends.

Week 14: Adapting to Evolving Challenges in Hardware Security.
Week 15: Lab Final Exam

CET439: Selected Topic in Network and Security II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

CET441: Business & Social Analytics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET242

Course Description

Data analytics is used for monitoring and extracting trends and insights from social media data. With business and social analytics, companies and organizations can track their brand mentions, post reach, engagement, and more. They can also use social listening tools to monitor their brand sentiment and see how people are talking about their business on social media. Business and social analytics can help them make sure that they are connecting with the right target audience on social media and that their campaigns are effective. This course covers principles of business and Social Analytics. It covers how to increase revenue by designing effective social media strategies—measuring performance and social media ROI—improving productivity with social media audits and reports—building the right data sets and actionable plans. It explores Data Analytics with Facebook Pixel, using and exploring Google Analytics and YouTube marketing: layout, content creation, and video ads. It discusses optimizing LinkedIn profiles and using LinkedIn ads. It presents how to use Web 2.0 blogs to augment the reach with SEO and content marketing. It explores automating social media marketing posting via IFTTT and creation of Pinterest-promoted pins, use Google Business to benefit local businesses, and help Search Engine Optimization. It discusses building a sentiment analysis system based on Twitter Data. The student learning also includes best practices for social media analytics. Lectures that focus on Business and Social Analytics fundamentals, Lab sessions, projects, and assignments are used to deliver the course.

References

McDonald, J. (2016). Social media marketing workbook: how to use social media for business. JM Internet Group.
Rich, J. R. (2018). Ultimate Guide to YouTube for Business. Entrepreneur Press.
Sponder, M. (2011). Social media analytics: Effective tools for building, interpreting, and using metrics. McGraw Hill Professional.
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https://analytics.google.com/analytics/academy/course/6
https://www.javatpoint.com/seo-tutorial

Learning Outcomes

CLO 1: Explain and apply Business and Social Analytics processes.
CLO 2: Solve problems related to Business and Social Analytics.
CLO 3: Design & implement efficient social media strategies.
CLO 4: Design data analytics processes using Facebook Pixel, Google Analytics, YouTube Marketing, Pinterest-promoted pins, LinkedIn ads and Blogs.
CLO 5: Create automated processes for social media posting.
CLO 6: Build a sentiment analysis model based on social media data.
CLO 7: Write lab reports and present results.

Tutorials

WEEK 1: Increasing revenue by designing effective social media strategies.
WEEK 2: Measuring performance and social media ROI.
WEEK 3: Improving productivity with social media audits and reports.
WEEK 4: Build the right set of data and actionable plans.
WEEK 5: Data Analytics with Facebook Pixel.

WEEK 6: Use and explore Google Analytics.
WEEK 7: YouTube marketing: layout, content creation, and video ads.
WEEK 8: Optimize LinkedIn profile and use LinkedIn ads.
WEEK 9: Use Web 2.0 blogs to augment the reach with SEO and content marketing.
WEEK 10: Automate Social media marketing posting via IFTTT.
WEEK 11: Create Pinterest-promoted pins
WEEK 12: Use Google Business to benefit local businesses and help your Search Engine Optimization.
WEEK 13: Build a sentiment analysis system based on Twitter Data.
WEEK 14: Best practices for social media analytics.
WEEK 15: Lab Final Exam

CET442: Selected Topic in Data Science I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

CET443: Block Chain & Data Science

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET211

Course Description

Blockchain technologies are used for trust management to accelerate the development/application of Artificial Intelligence, cyber-physical systems, social networking, and crowdsourcing. After cryptocurrency, this technology has captured markets for best security in application systems like education, finance, health, and other businesses. Students learn blockchain technologies and their security applications with different organizations, channels, peers, and smart contracts. Students learn the development of Blockchain, operating principles of Blockchain and their applications. While understanding the development of the technology students know the definition, evolution, historical development, milestones in the development and concepts and components including nodes, cryptographic techniques, and certificate authority in Blockchain along with their limitations of traditional transaction systems and market prices. Students further learn what decentralized systems are, permissioned and permissionless blockchains, characteristics of the network, architecture of a block, cryptography as a security provider for Blockchain. Students should know the roles in a Blockchain system including regulator and certificate authority, concepts of queuing, executing, and validating blocks and role of peer nodes added and the Blockchain governance model. Students understand the blockchain applications areas, role of smart contracts in the operationalizing of business processes, cryptocurrencies including Bitcoin and Ethereum, use of the Blockchain through decentralized applications to accelerate app development, benefits, and challenges of Blockchain compared to traditional database technology, key considerations for implementing Blockchain and ethical aspects of blockchain including improved transparency in the supply chain. Lectures, assignments, and projects based on Blockchain technologies will be used to deliver the course.

References

In Li, K.-C., In Chen, X., In Jiang, H., & In Bertino, E. (2020). Essentials of blockchain technology. CRC Press
Bambara, J. J., & Allen, P. R. (2018). Blockchain: A practical guide to developing business, law, and technology solutions. McGraw-Hill Education
In Maleh, Y. (2020). Blockchain for cybersecurity and privacy: Architectures, challenges, and applications. CRC Press
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https://www.guru99.com/blockchain-tutorial.html (Retrieved from the Internet 06/11/2022)

Learning Outcomes

CLO 1: Examine various distributed consensus planning and fault tolerance mechanisms to understand consensus protocols.
CLO 2: Assess various permissioned and non-permissioned blockchain to integrate the concept of different types of blockchain frameworks in various application areas.
CLO 3: Analyze blockchain challenges and vulnerability issues to communicate the depth of technical and legal aspects in different domains.
CLO 4: Validate the degree of success related to smart contracts in different blockchain frameworks as per user requirement and present it to all stakeholders.
CLO 5: Evaluate blockchain technology's privacy and security impact to manage its context in various application areas.
CLO 6: Perform experiments and present the outputs in the form of lab records.

Tutorials

WEEK 1: Lab Induction, familiarization with Lab policies and lab record maintenance.
WEEK 2: Familiarize with Ubuntu and installation of fabric environment.
WEEK 3: Introduction to Hyperledger fabric to understand basic blockchain environment.
WEEK 4: Connect two organizations using Hyperledger fabric. Read data from one another
WEEK 5: Develop smart contracts in Java script and check compatibility in the environment.
WEEK 6: Develop smart contracts in Golang and check compatibility in the environment.
WEEK 7: Develop smart contracts and make changes to check the effects in network and transactions.
WEEK 8: Add a third organization to the network.
WEEK 9: To the third organization added experiment and record speed of transactions in linear network.
WEEK 10: Add more peers to the network with two organizations.
WEEK 11: Add more peers to the network with three organizations.
WEEK 12: Add a fourth organization to the linear network.
WEEK 13: Add a fourth organization to the linear network.
WEEK 14: Experiment the accessing records from each organization.
WEEK 15: Final Lab Exam.

CET444: Selected Topic in Data Science II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

CET445: Information Analytics and Business Intelligence

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Course Description

This course provides an in-depth understanding of the principles and practices of information analytics and business intelligence (BI). It covers the methodologies, tools, and technologies used to analyze data and support decision-making in business environments. Students will learn how to transform raw data into meaningful insights, develop analytical models, and use BI tools to support strategic business decisions.

References

"Data Science for Business" by Foster Provost and Tom Fawcett
"Competing on Analytics: The New Science of Winning" by Thomas H. Davenport and Jeanne G. Harris
"Business Intelligence: A Managerial Perspective on Analytics" by Ramesh Sharda, Dursun Delen, and Efraim Turban

Learning Outcomes

Understand the fundamental concepts of data analytics and business intelligence.
Analyze and preprocess data using statistical methods and tools.
Apply predictive analytics techniques to real-world business problems.
Utilize BI tools for data visualization, reporting, and dashboard creation.
Interpret and communicate analytical results effectively to support business decisions.
Evaluate the ethical implications and challenges of data analytics and business intelligence.

CET451: Neural Networks and Deep Learning

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET351

Course Description

Artificial Neural Networks are one of the core domains of Artificial Intelligence that mimic human brain behavior through some complex mathematical models to solve computational and cognitive real-world problems. Neural networks are computational structures that process information using a set of interconnected nodes, akin to the vast network of neurons in the human brain. The nodes receive data from external inputs and other nodes within the network, and then they propagate or block that information through to other nodes. The more layers the neural network has, the more complex it becomes to train. Neural networks have been used for over 50 years in pattern recognition and many other tasks that are more difficult for humans or other methods of machine learning. The students learn the application of this method in various domain applications. It covers the foundations required for the understanding and the utility of Neural Networks and includes Historical Trends in Deep Learning, Machine Learning Basics, Deep Feedforward Networks, Regularization for Deep Learning, Optimization for Training Deep Models, and Convolutional Networks. It explores Sequence Modeling: Recurrent and Recursive Nets, Practical Methodology, Applications, Linear Factor Models, Autoencoders, Representation Learning, Monte Carlo Methods, Approximation Inference, and Deep Generative Models. Hands-on sessions focusing on machine learning fundamentals, projects and assignments are used to deliver the course.

References

Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. Deep learning. MIT press, 2016. ISBN-13: 978-0262035613, ISBN-10: 0262035618
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Learning Outcomes

CLO 1: Analyze a problem and identify and define the computing criteria appropriate to its solution and the requirements.
CLO 2: Design, implement, and evaluate an Artificial Neural Networks based system, process, component, or program to meet desired needs.
CLO 3: Design and develop the Artificial Neural Networks algorithms for pattern recognition to identify the hidden patterns in the given data.
CLO 4: Break down and analyze methods for automatic training of prediction system and apply for suitable domain of problems.
CLO 5: Formulate the understanding of learning and generalization issues in neural computation.
CLO 6: Write lab reports and present results.

Tutorials

WEEK 1: Introduction: Historical Trends in Deep Learning
WEEK 2: Machine Learning Basics
WEEK 3: Implement a Deep Feedforward Networks
WEEK 4: Implement Regularization for Deep Learning using Python and Tensorflow
WEEK 5: Optimization for Training Deep Models
WEEK 6: Implement a Convolutional Networks using Python and Tensorflow
WEEK 7: Sequence Modeling: Recurrent and Recursive Nets using Pythonand Tensorflow
WEEK 8: Practical Methodology with Python and Tensorflow
WEEK 9: Implement one neural network Application using Python and Tensorflow
WEEK 10: Linear Factor Models using Python and Tensorflow
WEEK 11: Implement Autoencoders using Python and Tensorflow
WEEK 12: Implement Representation Learning using Python and Tensorflow
WEEK 13: Implement Monte Carlo Methods using Python and Tensorflow
WEEK 14: Implement Approximation Inference and Deep Generative Models
WEEK 15: Lab Final Exam.

CET452: Natural Language Processing

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET251

Course Description

Natural Language Processing (NLP), a subdomain of Artificial Intelligence (AI), provides a mechanism for computers to understand and respond to humans in different spoken and written languages. The students will learn how NLP helps in providing solutions to performing language-related tasks of humans by a computer. This course covers the concepts required for analyzing a language's Origins and challenges of NLP, Language and Grammar, processing various Languages, NLP Applications, Information Retrieval, and Language Modeling -- including various Grammar-based Language Models and Statistical Language Models. It explores Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection, Part-of-Speech Tagging, Syntactic Analysis: Context-free Grammar, Constituency Parsing, and Probabilistic Parsing. It discusses Semantic Analysis, including Meaning Representation, Lexical Semantics, Ambiguity, and Word Sense Disambiguation. It also discusses Discourse Processing: cohesion-Reference Resolution, Discourse Coherence and Structure, Natural Language Generation including Architecture of NLG Systems, Generation Tasks and Representations, and Application of NLG. Machine Translation systems are covered by discussing problems in Machine Translation; Machine Translation Approaches involving various Languages. The student learning includes Information Retrieval, Design features of Information Retrieval Systems, Classical, Non-classical, and Alternative Models of Information Retrieval, Valuation Lexical Resources, Lexical Resources including WordNet, Frame Net-Stemmers, POS Tagger, and Research Corpora. Hands-on sessions focusing on Natural Language Processing fundamentals, projects, and assignments are used to deliver the course.

References

Eisenstein, Jacob. (2019). Introduction to Natural Language Processing, MIT Press
https://www.tutorialspoint.com/natural_language_processing/index.htm
https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-natural-language-processing-nlp
https://www.datacamp.com/tutorial/tutorial-natural-language-processing
https://github.com/graykode/nlp-tutorial

Learning Outcomes

CLO 1: Design an application to analyze textual data by applying the basic concepts of natural language processing
CLO 2: Build a system to generate a language-based text using natural language processing techniques
CLO 3: Illustrate the method of applying information retrieval techniques using suitable methods and procedures
CLO 4: Design a system to perform syntactic and semantic analysis.
CLO 5: Write lab reports and present results.

Tutorials

WEEK 1: Origins and challenges of NLP, Language and Grammar
WEEK 2: Processing various Languages, NLP Applications, Information Retrieval
WEEK 3: Language Modeling: Various Grammar-based Language Models, Statistical Language Model
WEEK 4: Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing
WEEK 5: Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging
WEEK 6: Syntactic Analysis: Context-free Grammar, Constituency Parsing, Probabilistic Parsing
WEEK 7: Semantic Analysis: Meaning Representation, Lexical Semantics
WEEK 8: Ambiguity, Word Sense Disambiguation
WEEK 9: Discourse Processing: cohesion-Reference Resolution, Discourse Coherence and Structure
WEEK 10: Natural Language Generation: Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG
WEEK 11: Machine Translation: Problems in Machine Translation, Machine Translation Approaches, Translation involving various Languages
WEEK 12: Information Retrieval: Design features of Information Retrieval Systems
WEEK 13: Classical, Non-classical, Alternative Models of Information Retrieval
WEEK 14: Valuation Lexical Resources, Lexical Resources: WordNet, Frame Net-Stemmers, POS Tagger, Research Corpora
WEEK 15: Lab Final Exam

CET453: Advanced Machine Learning

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET351

Course Description

This is an intellectually rigorous course that delves into cutting-edge machine learning techniques. It provides students with the theoretical foundations and practical skills needed for data-driven challenges, covering topics like advanced supervised and unsupervised learning algorithms, deep neural networks, reinforcement learning, and generative AI. Hands-on experimentation with large datasets sharpens students' abilities to implement sophisticated models and interpret results. This course empowers students to proficiently apply advanced machine learning to real-world data science problems, fostering innovation in the field. Join us to master the latest advancements and shape the future through generative AI and reinforcement learning applications.

Learning Outcomes

CLO 1: Master advanced supervised and unsupervised machine learning algorithms, including generative AI and reinforcement learning, through theoretical understanding and practical application.
CLO 2: Proficiently design, train, and optimize deep neural networks for complex data analysis, incorporating cutting-edge techniques.
CLO 3: Excel in reinforcement learning, optimizing decision-making in data-driven contexts, and harnessing its potential for innovation.
CLO 4: Navigate natural language processing with ease, extracting insights from text data, and mastering advanced language tasks.
CLO 5: Apply your knowledge effectively by working hands-on with large datasets, implementing advanced machine learning models, including generative AI approaches.
CLO 6: Hone analytical and interpretive skills to evaluate model performance, extracting actionable insights for real-world applications.
CLO 7: Prepare for data science leadership roles by mastering advanced machine learning techniques, driving innovation across data-driven domains.

Tutorials

WEEK 1: Course Introduction and Overview of Advanced Machine Learning, including Generative AI and Reinforcement Learning.
WEEK 2: Mastery of Supervised Machine Learning Algorithms in Theory and Practice.
WEEK 3: Uncovering the Power of Unsupervised Machine Learning: Concepts and Applications, including Generative AI.
WEEK 4: Deep Dive into Deep Neural Networks: Design, Training, and Optimization for Complex Data Analysis.
WEEK 5: Proficiency in Deep Learning Techniques for Advanced Data Analytics.
WEEK 6: Unlocking Reinforcement Learning Techniques for Decision Optimization.
WEEK 7: Reinforcement Learning in Data-Driven Contexts and Innovative Applications.
WEEK 8: Exploring the World of Natural Language Processing (NLP) and Text Analysis.
WEEK 9: Mastering Text Data Analysis and Advanced Language Tasks with NLP.
WEEK 10: Practical Application with Large Datasets: Hands-On Machine Learning, including Generative AI Models.
WEEK 11: Implementation of Advanced Machine Learning Models, including Generative AI Approaches.
WEEK 12: Critical Model Performance Evaluation and Interpretation.
WEEK 13: Extracting Actionable Insights from Advanced Machine Learning Models.
WEEK 14: Achieving Proficiency in Advanced Machine Learning for Data Science Leadership and Innovation.
WEEK 15: Comprehensive Lab Final Exam.

CET461: Scaling and Connecting Networks

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET322 AND CET261

Course Description

Scaling and Connecting Networks is an essential course to understand and design the network. Scaling the component describes the architecture, components, and operations of routers and switches in bigger and complex networks. Students learn the configuration of router and switches configuration with advanced functionality. This course covers Implementing a Network Design, Hierarchical Network Design, the need to scale the network, enterprise business devices, hierarchical design model, cisco enterprise architecture ; expanding the network : design for scalability, planning for redundancy; selecting network devices : switch hardware- switch platforms and port density. The topics include forwarding rates, multilayer switching, router hardware- router requirements, cisco routers, managing devices- managing iOS files and licensing, basic router CLI commands, basic router show commands, basic switch CLI commands, basic switch show commands, Virtual local area networks and loop detection protocols, First hop redundancy protocols, EIGRP Advanced Configurations and Troubleshooting, OSPF. The student learning includes IPv4 and IPv6 network, virtual private networks and tunneling, IOS Images and Licensing, serial port connections, broadband connections and wide area networks and protocols, VTP, STP and DTP Configuration, Troubleshooting Inter-VLAN Routing, Configuration of Layer 3 Switching and Inter-VLAN Routing and Building a Switched Network with Redundant Links. The laboratory work consists of experiments that will include the configuration of switches and routers, creating LAN and WAN, illustrating the principles, laws and concepts discussed in the course.

References

Johnson, A. (2017). Scaling Networks v6 Labs & Study Guide. Cisco Press.
WENDELL, ODOM, and Wilkins Sean. (2020) "CCNA Routing and Switching 200-125."
https://ptgmedia.pearsoncmg.com/images/9781587133282/downloads/9781587133282%20_chapter_1.pdf
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https://ptgmedia.pearsoncmg.com/images/9781587133282/downloads/9781587133282%20_chapter_1.pdf

Learning Outcomes

CLO 1: Use the simulation tool to configure and troubleshoot enhanced switching technologies
CLO 2: Analyze, configure and troubleshoot first hop redundancy protocols (HSRP) in a switched network
CLO 4: Solve common issues with OSPF, EIGRP, and STP in both IPv4 and IPv6 networks
CLO 5: Implement a WLAN in a small-to-medium network
CLO 6: Configure and troubleshoot routers and switches
CLO 8: Select the suitable network component and implement it in to lab for a given problem.
CLO 9: Write lab reports and present results.

Tutorials

WEEK 1: Lab Induction, introduction to network devices, Course Policies, and reports.
WEEK 2: Introduction to packet tracer
WEEK 3: Basic Device Configuration.WEEK 4: VTP Configuration
WEEK 5: STP Configuration
WEEK 6: Configure VLANs, VTP, and DTP
WEEK 7: Configure Extended VLANs, VTP, and DTP
WEEK 8: Troubleshooting Inter-VLAN Routing
WEEK 9: Troubleshoot VTP and DTP
WEEK 10: Configure Layer 3 Switching and Inter-VLAN Routing
WEEK 11: Building a Switched Network with Redundant Links
WEEK 12: –Configuring Rapid PVST+, PortFast, and BPDU Guard
WEEK 13: –Configuring Rapid PVST+, PortFast, and BPDU Guard
WEEK 14: Open Ended Question to Design a Network
WEEK 15: Lab Final Exam

CET462: Data Centers Fundamentals

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET261

Course Description

The ever-growing digital landscape relies on robust data centers to store, process, and transmit critical information. This "Data Center Fundamentals" course equips you with a comprehensive understanding of these vital facilities. You'll delve into the core components of a data center, including power distribution, cooling systems, network infrastructure, and security measures. We'll explore best practices for data center design, management, and operation, ensuring optimal uptime and efficiency.
By the end of this course, you'll gain a solid foundation in data center technologies and their role in supporting today's digital world. You'll be able to identify different data center types, understand key considerations for power and cooling, and appreciate the importance of data center security. This knowledge is valuable for IT professionals, facility managers, and anyone interested in the infrastructure that powers the internet and modern business.

References

Data Center Handbook by H. Randall Holbrook (Latest Edition)
The Datacenter Guy's Guide to Cooling by Kyle Schubert (Latest Edition)
Data Center Networking: A Practical Guide to Design, Operation, and Troubleshooting by Thomas Stulz (Latest Edition)
Data Center Knowledge for IT Professionals by Chuck Ballard (Latest Edition)
Disaster Recovery for Data Centers by Peter H. Gregory (Latest Edition)

Learning Outcomes

Explain the purpose and function of data centers in the digital age.
Identify various data center types and their suitability for different applications.
Describe the key components of a data center, including power distribution, cooling systems, and network infrastructure.
Analyze best practices for data center design and operation, including considerations for power, cooling, and security.
Evaluate the importance of data center disaster recovery and mitigation strategies.

Effectively communicate data center concepts and terminology.

CET463: Technical Support Fundamentals for IT Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: CET261

Course Description

This course equips you with the foundational knowledge and skills needed to launch a career in IT support. This course provides a comprehensive overview of essential IT concepts, including computer hardware, software, operating systems, and networking. You'll delve into troubleshooting methodologies for diagnosing and resolving common technical problems faced by users. Additionally, the course emphasizes the development of effective communication skills for interacting with customers and clearly explaining technical issues.
Through hands-on exercises and practical scenarios, you'll gain experience in installing and configuring software, identifying hardware malfunctions, and navigating technical documentation. The course also introduces you to basic customer service principles, including active listening, problem-solving, and conflict resolution. By the end, you'll be well-prepared to provide technical assistance to users and navigate the ever-growing world of IT support.

References

A+ Guide to IT Technical Support (Hardware) by Mike Meyers (Latest Edition)
CompTIA A+ Certification All-in-One Exam Guide by Mike Meyers (Latest Edition)
Help Desk Fundamentals by Richard Blum (Latest Edition)
Google IT Support Professional Certificate by Coursera
HP Tech Support Library

Learning Outcomes

Gain a solid understanding of computer hardware components, functionalities, and troubleshooting techniques.
Master essential software installation, configuration, and troubleshooting procedures.
Develop proficiency in identifying and resolving common network connectivity issues.
Employ effective communication skills to interact with customers and understand their technical needs.
Apply problem-solving methodologies to diagnose and resolve technical problems efficiently.
Navigate technical documentation and utilize online resources for troubleshooting assistance.
Uphold ethical standards while providing technical support to diverse users.

CET471: Emerging IT Technologies

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Requisites

- Prerequisites: CET371

Course Description

This course explores the latest trends and advancements in Information Technology (IT) that are shaping the future of the industry. Students will be introduced to cutting-edge technologies, including artificial intelligence (AI), blockchain, the Internet of Things (IoT), cloud computing, cybersecurity, and quantum computing. The course aims to provide students with a broad understanding of these emerging technologies, their applications, and their impact on various industries.

References

"Artificial Intelligence: A Guide for Thinking Humans" by Melanie Mitchell

"Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World" by Don Tapscott and Alex Tapscott
"The Fourth Industrial Revolution" by Klaus Schwab
"Internet of Things: Principles and Paradigms" by Rajkumar Buyya and Amir Vahid Dastjerdi
"Quantum Computing: A Gentle Introduction" by Eleanor G. Rieffel and Wolfgang H. Polak

Learning Outcomes

Identify and describe the key features of emerging IT technologies.
Analyze the potential applications and impact of these technologies in various industries.
Evaluate the benefits, challenges, and risks associated with emerging IT technologies.
Understand the ethical, legal, and societal implications of new technologies.
Apply knowledge of emerging IT technologies to propose innovative solutions to real-world problems.
Engage in informed discussions about the future direction of IT and technology

CET472: Digital Transformation

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	35

Requisites

- Prerequisites: CET471

Course Description

The "Digital Transformation" course delves into the strategic use of technology to fundamentally change an organization's processes, culture, and overall approach to business. You'll explore the driving forces behind digital transformation, such as evolving customer expectations, technological advancements, and increased competition. The course examines various digital technologies impacting businesses, including cloud computing, big data analytics, artificial intelligence, and social media.
Through case studies, discussions, and projects, you'll gain insights into developing and implementing a successful digital transformation strategy. You'll learn how to identify areas for improvement within an organization, assess digital maturity, and navigate potential cultural resistance to change. The course emphasizes leadership and change management skills to guide teams through the transformation process and achieve sustainable results. By the end, you'll be equipped to navigate the ever-changing digital landscape and leverage technology to drive innovation and competitive advantage within your organization.

References

Digital Transformation: A Guide for Leaders in the Age of Disruption by David Rogers (Latest Edition)
Leading Digital: How to Change the Way You Work for Digital Success by Melissa Raffay (Latest Edition)
Exponential Organizations: Why New Organizations Are Ten Times Faster and More Innovative Than Traditional Companies by Salim Ismail, Yuri van Geest, and Michael S. Malone (Latest Edition)
The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail by Clayton M. Christensen (Latest Edition)
Competing in the Age of Ai by Marco Iansiti and Karim R. Lakhani (Latest Edition)

Learning Outcomes

Define digital transformation and its key drivers in the business landscape.
Analyze the impact of various digital technologies on organizations.
Develop a framework for assessing an organization's digital maturity.
Design a digital transformation strategy aligned with business goals.
Lead and manage change initiatives to facilitate successful digital transformation.
Evaluate the potential risks and challenges associated with digital transformation.

CET491: CET Project III

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	4	240			75	0	25

Requisites

- Prerequisites: CET292

Course Description

This course enables the students to exercise some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. Further, they do market surveys about raw materials, components or finished products and identify the ethical societal and environmental issues related to the project (if there are any). The student also develops the ability to design, implement and test systems, hardware, or software. This course includes planning the tasks to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. Through this course, the student develops creativity, initiative, and capacity to perform. The leadership, supervisory, planning, and organizational skills are integrated into the learning objectives of this course. The projects has a detailed project proposal, which is executed or implemented within the time allocated, simultaneously maintaining a logbook, periodically monitored by the professor mentor. Projects are chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is to be prepared as the project progresses, which is to be submitted after the project is over. The student acquires the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1: Assess the impact of the project on society (if there is any)
CLO 2: Conduct Feasibility studies, Design projects, and Market surveys about raw materials, components or finished products
CLO 3: Design, plan and propose a project according to user requirements.
CLO 4: Apply project development methodologies appropriate to the project
CLO 5: Collaborate with team members to develop the prototype of the Application
CLO 6: Identify the ethical societal and environmental issues related to the project (if there are any)
CLO 7: Communicate project ideas and current work achievements clearly through technical report and presentations.

CET492: CET Project IV

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	4	240			75	0	25

Requisites

- Prerequisites: CET491

Course Description

This course enables the students to exercise some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. In this course, the students apply the knowledge gained during the program to design and prototype a software application that meets user needs and expectations. Further, they evaluate the impact of the product or system or process on society and draw conclusions. This course includes planning the tasks which are to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. Through this course, the student develops creativity, initiative, and capacity to perform. The student develops leadership and supervision skills which are integrated into the learning objectives of this course. The projects have a detailed project proposal, which is executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the professor mentor. Projects are chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is prepared as the project progresses, which is submitted after the project is over. The students acquire the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1: Demonstrate the ability to apply the knowledge to design and prototype a software/hardware application that meets user needs and expectations.
CLO 2: Design the project acquiring and applying new knowledge through literature review.
CLO 3: Design computing/hardware solutions considering economical, environmental, cultural, global impact and technical aspects.
CLO 4: Assess the impact of technical and system constraints to select optimal solutions.
CLO 5: Evaluate the impact of the product or system or process on society and draw conclusions.
CLO 6: Demonstrate teamwork through regular formal team meetings, project management, class presentations, and a final design presentation.
CLO 7: Assess the ethical and legal impact of the implemented product or system or process.
CLO 8: Write a technical report in a standard format and give an oral presentation.
CLO 9: Design and implement the project with modern engineering tools and software.

CET493: Thesis I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
240		240	480	6	180	90	120	60	15	25

Course Description

The student will be able to identify questions and needs for development in their professional field and working life and plan solutions to them in accordance with the principles of sustainable development. The student will be able to use reliable information from various sources to base and frame their work. The student will be able to apply their professional knowledge and appropriate methods and working methods in their development work.

CET494: Thesis II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
240		240	480	6	180	90	120	60	15	25

Requisites

- Prerequisites: CET493

Course Description

The student will be able to execute a development project useful for the working life or the profession in an independent, responsible and collaborative manner. The student will be able to communicate in different stages of the work both to peers and to other audiences in a clear, well-argued and illustrative manner. Finally the student will be able to report the results of their work, critically evaluate them and present development proposals in an appropriate written, oral and visual form.

CET5E1: Game UI/UX Design

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: CET143

Course Description

This elective explores user interface (UI) and user experience (UX) design for games. Students learn UI principles, designing menus, HUDs (e.g., health bars, minimaps), and controls with clarity and aesthetics in mind. The course covers UX, focusing on usability, feedback (e.g., button hover effects), and accessibility (e.g., colorblind modes). Tools like Adobe XD or Unity's UI system are used to prototype interfaces, integrating them into game scenes. Labs involve creating a full UI/UX suite for a game—e.g., a main menu, in-game HUD, and settings screen—tested for intuitiveness. Students also study analytics (e.g., heatmaps) to refine designs based on player interaction data.

References

Norman, D. (2013). *The Design of Everyday Things*. Basic Books.
Schell, J. (2014). *The Art of Game Design: A Book of Lenses* (2nd ed.). CRC Press.

CET5E3: Serious Games & Gamification

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: CET411

Course Description

This elective focuses on serious games and gamification for education, training, or behavior change. Students learn to design games with purpose (e.g., health awareness, skill development), balancing fun and learning outcomes. The course covers gamification techniques—points, badges, leaderboards—applied to non-game contexts (e.g., fitness apps). Examples like "Foldit" (protein folding) or "Duolingo" illustrate effective design. Labs involve creating a serious game or gamified system—e.g., a history quiz or exercise tracker—using Unity or a similar tool. Students also study evaluation methods (e.g., user surveys, metrics) to assess impact and refine designs.

References

Kapp, K. M. (2012). *The Gamification of Learning and Instruction*. Pfeiffer.
McGonigal, J. (2011). *Reality Is Broken*. Penguin Books.

Department of Electrical Power Engineering Technology

EPT111: Computer Aided Engineering Drawing

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	60	15	25

Course Description

This course aims to provide hands-on practice in free sketches and engineering drawing using suitable manual drawing tools and CAD software. This course also provides practice to read and interpret electrical engineering drawings. This course includes the use of electrical and electronic symbols, familiarization with industry standards and codes, and familiarization with various schematics and electrical drawings. The coursework is performed manually and on personal computers using CAD software. Initially students learn about the basic commands of CAD software, symbolic representation of electrical components, isometric and orthographic views, interpretation of line diagrams using absolute, relative and polar coordinate systems, interpret the freehand sketches of the given electrical components, interpretation of isometric drawings of electric machines parts or electrical components, interpretation of CAD electrical machine and components drawings, modification of electrical drawings as per requirements, isometric drawing of electrical components, schematic drawings of electrical parts, Circuit Builder, panel drawings, parametric and nonparametric PLC modules, stand-alone PLC I/O points, ladder diagrams, point-to-point wiring diagrams, report generation, and creation of symbols. This course will also enable students to draw and interpret electrical engineering drawings. The course will be delivered through lectures, demonstrations, and hands-on practice with CAD software for drawing electrical circuits and electrical machine components.

References

Tickoo Sham, (2023) AutoCAD Electrical for Electrical Control Designers, CADCIM Technologies
SK Bhattacharya (2007), Electrical Engineering Drawing New Age International.
Cornel Barbu (2008) ELECTRICIAN'S BOOK HOW TO READ ELECTRICAL DRAWINGS
https://www.autodesk.com/solutions/electrical-drawing

www.mycadsite.com
www.cadlearning.com
http://www.staff.city.ac.uk/~ra600/ME1105/Tutorials/CAD-1/Tutorial%20CAD-2a.htm

Learning Outcomes

CLO 1: Draw freehand sketches and isometric and orthographic views of electrical machines and components.
CLO 2: Draw a symbolic representation of electric components manually and with the use of suitable CAD software.
CLO 3: Use CAD software tools to draw electrical circuits with components
CLO 4: Modify electrical line drawings and control panel layout.
CLO 5: Communicate results of computer-generated electrical drawings through written reports following professional ethics.

Tutorials

LAB 1: Exploring CAD software(Electrical), basic commands, work with toolbar, etc.
LAB 2: Draw a line diagram using absolute coordinate systems using different line commands.
LAB 3: Draw and modify 2D drawing using draw commands-line and arc.
LAB 4: Create a simple electrical drawing using electric CAD software for the given electrical circuit diagram.
LAB 5: Draw an isometric drawing of the electrical machines
LAB 6: Draw orthographic views of the electrical machines
LAB 6: Modify the given electrical drawing as per the requirements
LAB 7: Draw Connectors, Point-to-Point Wiring Diagrams, and Circuits
LAB 8: Editing an Existing Record in the Schematic Component or Circuit Dialog Box, Inserting Components from Panel Lists, Swapping and Updating Blocks
LAB 9: Creating Panel Layouts from Schematic Lists
LAB 10: Inserting a New Ladder, Modifying an Existing Ladder
LAB 11: Inserting Schematic Components, Annotating and Editing the Symbols
LAB 12: Inserting Parametric PLC Modules, Using the Spreadsheet to PLC I/O Utility Tool
LAB 13: Generating Schematic Reports of electrical circuits, components, and machines.
LAB 14: Inserting Terminal Symbols, Annotating and Editing Terminal Symbols
LAB 15: Lab Final Exam

EPT191: EPT Internship I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
0	0	360	360	3	180			50	0	50

Course Description

Internship provides an opportunity to practice and/or apply knowledge and skills in professional environments and gain valuable work experience. Through the Internship students get exposure to the industrial environment which cannot be simulated in the classroom. During the internship, students understand and sharpen the real-time technical/managerial skills required at the job(s). Further, they understand the social, economic, and administrative considerations that influence the working environment of industrial organizations. Student learning includes overall professional development of students, required problem-solving, communication, human development, and relationship-building skills. Further, the students develop awareness of the organizational department structure and their roles, responsibilities, and function. Students select the internship field in consultation with an industry mentor and faculty guide in terms of the academic requirements. The student is expected to produce a joining letter and a successful completion certificate. once the internship is over. Internship evaluation can be based on the quality of projects completed as part of the internship activities. Faculty Member(s) evaluate(s) the performance of students once by visiting the industry/organization and submit the evaluation report of the students with the consent of Industry persons/ mentor. The students are exposed to the industry environment for 6 to 8 weeks duration to understand the operation of the industrial facility.

References

https://www.youtube.com/watch?v=jpf9J2TUJVg
https://www.youtube.com/watch?v=KqIshDsg494
https://www.youtube.com/watch?v=E1UcIHW5rSc
https://www.youtube.com/watch?v=EhnfOUrFgxM

Learning Outcomes

CLO 1: Understand the Electronic industrial standards and recognize the requirement of these standards with the industrial scenario.
CLO 2: Examine a specific project related to electrical engineering at an existing job.
CLO 3: Communicate effectively through the technical presentation.

CLO 4: Demonstrate individual confidence to handle various engineering assignments during the internship.
CLO 6: Expose themselves to acquire life skills to meet societal challenges
CLO 7: Relate the engineer's responsibilities and ethics while handling various engineering assignments during the internship.
CLO 8: Read the engineering drawings and if necessary, modify the parts/unit/assembly drawing of the electrical product.

EPT202: Foundation of Electrical Engineering

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180		180	360	4	90	90	120	60	15	25

Requisites

- Prerequisites: GEN111 AND GEN122

Course Description

This foundational course introduces the principles and practices of electrical engineering with a focus on applications in agricultural and environmental systems, preparing students for advanced instrumentation and control courses. It covers the fundamentals of DC and AC circuits, electrical laws, components, and safe operation of electrical systems used in rural infrastructure and irrigation contexts. Through a combination of lectures and hands-on laboratories, students explore circuit theory, electrical measurements, power systems, and basic electronics. Emphasis is placed on interpreting wiring diagrams, analyzing electrical loads, and troubleshooting simple systems using standard test equipment. The course also addresses practical electrical safety in Egyptian field conditions and introduces students to motors, transformers, and control elements relevant to irrigation systems and agricultural machinery.

References

Don H. Johnson, 2014. Fundamentals of Electrical Engineering I.
Gross, C.A., Roppel, T.A., 2012. Fundamentals of Electrical Engineering. CRC Press.
Smarajit, G., 2007. Fundamentals of Electrical and Electronics Engineering, Second Edition. PHI Learning Pvt. Ltd.

Learning Outcomes

LO1: Understand and apply Ohm's Law, Kirchhoff's Laws, and basic circuit theorems to analyze DC and AC electrical circuits.
LO2: Identify and describe the function of electrical components including resistors, capacitors, inductors, diodes, and transformers.
LO3: Construct, simulate, and test basic electrical circuits using breadboards and electrical simulation software.
LO4: Use standard measurement tools such as multimeters and oscilloscopes to analyze voltage, current, resistance, and continuity.
LO5: Interpret electrical wiring diagrams and schematics for agricultural and irrigation applications.
LO6: Understand the structure and operation of single-phase and three-phase AC power systems, including grounding and protection methods.
LO7: Describe the principles and applications of electric motors, starters, and control devices in irrigation and pumping systems.
LO8: Apply electrical safety practices in laboratory and field settings, including proper grounding, fusing, and lockout/tagout procedures.
LO9: Demonstrate troubleshooting skills for basic electrical systems and perform preventive maintenance on electrical components.
LO10: Communicate technical findings through structured lab reports, circuit diagrams, and professional documentation.

Lectures

Week 1: Introduction to Electrical Engineering, Course structure, history of electricity, safety standards, overview of applications in agriculture.
Week 2: Basic DC Circuit Theory, Ohm's Law, power and energy concepts, series and parallel resistor networks, Kirchhoff's Laws.
Week 3: Electrical Components and Symbols, Resistors, capacitors, inductors, fuses, relays, schematic symbols, circuit diagrams.
Week 4: Circuit Analysis Techniques, Voltage and current division, Thevenin and Norton equivalents, mesh and nodal analysis.
Week 5: Introduction to AC Theory, Sinusoidal signals, frequency, phase, RMS values, reactance, impedance, phasor diagrams.
Week 6: AC Circuits and Power, Power factor, resonance, real/reactive/apparent power, basic load balancing in irrigation systems.
Week 7: Midterm Review and Practice, In-class review, sample problems, safety quiz, preparation for midterm exam.
Week 8: Midterm Exam Week.
Week 9: Electrical Measurements, Multimeters, clamp meters, oscilloscopes, signal generators, waveform analysis.
Week 10: Transformers and Power Distribution, Transformer theory, step-up/down, single and three-phase distribution systems.
Week 11: Motors and Starters, Motor types (AC/DC), starting methods, protection systems, common motor applications in agriculture.
Week 12: Circuit Protection and Safety, Fuses, circuit breakers, grounding systems, GFCI, lockout/tagout, Egyptian codes.
Week 13: Control Devices and Relays, Switches, contactors, timers, relay logic, introduction to ladder diagrams.
Week 14: Troubleshooting Techniques, Fault identification, continuity testing, resistance checks, basic repairs.
Week 15: Practical Applications and Review, Integrated systems review, pump control circuits, irrigation electrical panels.
Week 16: Final Exam Week.

Laboratories

Week 1: Lab 1: Safety and Tools, PPE training, meter use, workshop organization, electric hazard identification.
Week 2: Lab 2: DC Circuits, Building series and parallel circuits, voltage/current measurements, resistance checks.
Week 3: Lab 3: Component Identification, Resistor color coding, capacitor ratings, diode testing, schematic symbols.
Week 4: Lab 4: Circuit Analysis, Voltage division, Kirchhoff's Law applications, circuit simulation software.
Week 5: Lab 5: AC Signal Measurement, Function generator setup, frequency measurement, oscilloscope usage.
Week 6: Lab 6: Impedance and Power Factor, L-R-C circuit testing, phase measurement, power calculations.
Week 7: Lab 7: Midterm Practical Review, Troubleshooting exercises, schematic interpretation, lab safety check.
Week 8: Practical Midterm Exam.
Week 9: Lab 8: Electrical Measurements, Hands-on multimeter and oscilloscope practice, waveform observation.
Week 10: Lab 9: Transformer Testing, Voltage ratio verification, load testing, efficiency analysis.
Week 11: Lab 10: Motor Control Circuits, Wiring motor starters, overload protection setup, relay logic basics.
Week 12: Lab 11: Circuit Protection, Breaker sizing, GFCI testing, fuse replacement, grounding demonstration.
Week 13: Lab 12: Control Circuits, Relay-based control logic, switch configuration, ladder diagram practice.
Week 14: Lab 13: Troubleshooting Practice, Simulated faults, guided repair, documentation of procedures.
Week 15: Lab 14: Final Project Circuits, Build and test small-scale pump control system with motor and relay.
Week 16: Final Practical Exam Week.

EPT211: Power Electronics I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	120	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EET211 AND EET231

Course Description

Power electronics is an enabling technology, used in industrial automation, energy generation & conservation and indirectly for environmental pollution control. This course introduces power semiconductor devices like power diodes, power transistors, power MOSFET, IGBT and its characteristics. It focusses on the thyristor, turn on methods, switching characteristics, thyristor protection, heating, cooling, mounting of thyristors. The topics include the commutation techniques, phase-controlled rectifiers, single phase half and full wave-controlled converters, three phase thyristor converter circuits, dual converters. This course includes the principle of chopper operation, step up and step-down chopper, types of chopper circuits like Type A, B, C,D, E, and its steady state analysis. The other important topic is inverters which includes single phase voltage source inverters, force commutated inverters, three phase bridge inverters, voltage control in single phase inverters, pulse width modulation inverters like single pulse modulation, multi pulse modulation inverters. The course also covers the AC voltage controller, types, integral cycle control, single phase voltage controller using R, RL load, cycloconverters, principle of operation, single phase to single phase circuit step up and step down cycloconverter, midpoint type, bridge type cycloconverters, three phase have wave cycloconverters. The course also involves experiment-based learning for the students to understand the concept and its application in industry.

References

Muhammed. H .Rashid, (2018). Power Electronics: Devices, Circuits and Application , 4th Edition. Pearson Publication.
P.S. Bimbhra (2006), Power Electronics, Khanna Publishers.
https://www.tutorialspoint.com/power_electronics/index.htm
https://www.electronics-tutorials.ws/power/thyristor.html
https://www.powerelectronicsnews.com/special/power-design-notes/

Learning Outcomes

CLO 1: Use basic properties of power devices, mathematics, and characteristics of linear and non□linear devices in power applications.
CLO 2: Demonstrate basic operation and compare performance of various power electronics Devices.
CLO 3: Analyze power converter circuits and select suitable power electronic devices like DC-DC converters and Inverters by assessing the requirements of given application.
CLO 4: Formulate and analyze configuration of AC voltage controllers, cyclo converters for system level design and performance assessment.
CLO 5: Verify suitable power converters to control Electrical Motors and industry grade apparatus.
CLO 6: Recognize the role of power electronics in the improvement of energy usage efficiency and applications of power electronics in emerging areas.

Tutorials

LAB 1: Verify the output for single-phase half and full-controlled converters.
LAB 2: Three phase thyristor converter.
LAB 3: Verify the characteristics of SCR, and the output in DC Chopper circuits.

LAB 4: DC Chopper based-speed control of DC motor.
LAB 5: Verify the output in non-PWM inverter, series inverter, bridge-inverter.
LAB 6: Study the characteristics of MOSFET and IGBT.
LAB 7: Verify the output in series inverter.
LAB 8: Verify the input output of Cyclo- converters.
LAB 9: Verify the output in parallel inverter.
LAB 10: Control of lamp brightness using single phase SCR converter.
LAB 11: LAB Final Exam.

EPT231: Solar Cell Engineering

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: GEN123 AND EET111

Course Description

This course covers theory and experiments on various renewable energy technologies and study of their performance parameters. It describes the impact of using conventional energy sources on the environment. Need of utilization of alternate energy sources is provided. It comprises of fundamentals of solar photovoltaic and solar thermal energy and their applications, environmental characteristics and solar radiation, classification and thermal analysis of solar energy collectors, solar thermal energy storage potential, and hybrid solar plants. The course covers aspects such as the history of wind turbine development and the characteristics of the wind. Also, the impact of site selection, design, manufacture, and operation of modern wind turbines is discussed. An overview of different types of horizontal and vertical axis wind turbines is presented. Introduction to types of biomasses, their characterization techniques, and ways of converting it to energy. Also, it contains descriptions and applications of various types of fuel cells. This course also presents the working principle and types of geothermal power plants. It also includes the mechanism of tidal wave energy generation and ways to harness that. The discussion on hydroelectric power and its utilization is provided. The laboratory work consists of experiments illustrating the principles, laws and concepts discussed in the course.

References

Ehrlich, R., & Geller, H. A. (2018). Renewable energy: a first course. CRC press.
Kanoğlu, M., Çengel, Y. A., & Cimbala, J. M. (2020). Fundamentals and applications of renewable energy. McGraw-Hill Education.
“Lecture 20: Introduction to Renewable Energy.” Www.youtube.com, www.youtube.com/watch?v=tfmIk5nGtMU . Accessed 28 Sept. 2022.
“NPTEL : NOC:Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems (Chemical Engineering).” Digimat.in, digimat.in/nptel/courses/video/103103206/L01.html. Accessed 26 Sept. 2022.
“Introduction to Renewable Energy.” Solar Energy International (SEI): Solar Training for Clean Energy Careers, www.solarenergy.org/courses/introduction-to-renewable-energy/#:~:text=RE100%20is%20a%20free%20course Accessed 19 Oct. 2022.
“Renewable Energy.” Coursera, www.coursera.org/specializations/renewable-energy. Accessed 19 Oct. 2022.

Learning Outcomes

CLO 1: Explain the effect of pollution and global warming due to fossil fuels.
CLO 2: Illustrate the world’s energy requirements and resources to fulfill it.
CLO 3: Differentiate between various types of renewable energy resources.
CLO 4: Relate the renewable energy resources to the location and availability.
CLO 5: Compare the techniques to harvest electrical energy from renewable resources.
CLO 6: Demonstrate the working of energy conversion technologies under various test conditions.
CLO 7: Conduct experiments, interpret data and draw results and conclusions.
CLO 8: Write lab reports and present results.

Tutorials

LAB 1: Lab Induction, safety precautions, significant parameters, introduction to instruments, course policies, reports
LAB 2: Simulation studies on wind/micro wind energy generator, and simulation studies on hybrid (solar wind) power system. LAB 3: Experiments on performance assessment of hybrid (solar wind) power system.
LAB 4: Study the production process of biofuels from jatropha oil and determination of iodine value and flash point of Jatropha biofuel.
LAB 5: Study the production process of biofuels from waste cooking oil and Determination of iodine value and flash point of waste cooking oil biodiesel.
LAB 6: Study the production process of biofuels from algae.
LAB 7: Determination of iodine value and flash point of algal biodiesel.
LAB 8: Study the construction of fuel cell, Study the working of hydrogen fuel cell. LAB 9: Study the characteristics of a solar cell and find the fill

factor. LAB 10: Simulation studies on hydel power.
LAB 11: LAB Final Exam

EPT241: Industrial Control Engineering Technology I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: GEN113

Course Description

Every sector of the industry is linked with the control system in some or another way. Control System is one an integral part of space technology, power system, transportation system, and robotics and hence control systems are important in designing electrical and mechanical systems. This course covers the mathematical modelling of first order and second order mechanical systems, electrical systems and to determine the transfer function of the system, reducing the transfer function by block diagram reduction technique, signal flow graph using Masons gain formula. It also covers the transient analysis to find the rise time, peak time, delay time, settling time, steady state error, error constants , time domain analysis of the system using root locus, finding the range of gain in root locus for stability, stability analysis using Routh Hurwitz technique, frequency domain analysis like Bode plot. The student learning includes stability of the system based on the parameters like gain margin and phase margin, Nyquist plot to determine the number of roots lying in the right and left of the s plane, and compensation techniques to improve the stability by adjusting the value of gain, adding poles and zeroes to the transfer function. Lectures, assignments, exams, quizzes are used in this course.

References

Richard, C. Dorf, Robert H. Bishop, (2014). Modern Control Systems, 12th Edition, Pearson Publication.
Ogata, K. (2010). Modern Control Engineering (5th Edition) 5th Edition, Prentice Hall.
https://www.electrical4u.com/control-system-closed-loop-open-loop-control-system/
https://www.javatpoint.com/control-system-tutorial
https://www.mathworks.com/solutions/control-systems.html

Learning Outcomes

CLO 1: Determine the basic elements and structure of feedback control system and to determine the mathematical model of the systems and present in teams.
CLO 2: Calculate the various transient parameters and steady state error for the second order system.
CLO 3:Solve the stability of the system using Routh Hurwitz techniques and Polar plot.
CLO 4: Interpret the stability of the system using root locus and Nyquist criteria.
CLO 5: Assess the types of controllers required and the compensation techniques to improve stability.
CLO 6: Demonstrate various experiments in teams using MATLAB to find the transient parameters, steady state error.
CLO 7: Evaluate the stability of the system in teams using MATLAB like root locus and determine the suitable compensators.

Tutorials

LAB 1: MATLAB: Block Diagram Reduction of Mechanical and Electrical Systems.
LAB 2: Experiment to determine the Time Domain Analysis of 1st Order System.
LAB 3: Experiment to determine the Time Domain Analysis of 2nd Order System.
LAB 4: Experiment to determine the Transient Analysis of transfer function.
LAB 5: Experiment to determine the Frequency Domain Analysis using Bode Plot
LAB 6: Experiment to determine the stability using Nyquist Plot and Polar Plot.
LAB 7: State Space Representation of System using MATLAB
LAB 8: Design of Lag/Lead Compensator using MATLAB to improve the transient response
LAB 9: Experiment to simulate the transfer function of DC motor using MATLAB

EPT242: Electrical Machines I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EET211

Course Description

Electrical generators and motors are widely used in all residential & industrial sectors to generate and consume power. This course covers principles of forces and torque in magnetic field systems, principle of operation, constructional features, E.M.F. equation, different types of winding like armature windings, lap, and wave windings. It also covers the methods of excitation, types of DC generator, armature reaction – cross magnetizing and de-magnetizing effects and compensating winding, commutation process and interpoles. It also covers the characteristics of generators, losses and efficiency, parallel operation of DC shunt generators, concept of back E.M.F, torque, and speed equations. The topics include the characteristics of different motors, Speed control of D.C. motors - armature voltage and field flux control are covered in module, construction, and principle of operation of single-phase transformers, types , emf equation, operation on no load, load-phasor diagrams, equivalent circuit, regulation, losses and efficiency, open circuit and short circuit tests, polarity test, Sumpner's test. The student learning includes the single-phase induction motor, constructional features, production of torque, phasor diagram, equivalent circuit, performance analysis, torque-slip characteristics, generator operation starting, starting methods of squirrel cage and wound rotor induction motor. The student learns various methods of speed control of squirrel cage and wound rotor induction motor, synchronous motor, constructional features. cylindrical rotor machine, synchronous generator, generated e.m.f., circuit model and phasor diagram, armature reaction, synchronous impedance, voltage regulation and different methods for its estimation, synchronous motor operating principle, circuit model, phasor diagram, and effect of load. Further, the course includes operating characteristics of synchronous machines, basic working of stepper and servo motors. Lectures, theoretical assignments, exams, quizzes are used in this course.

References

Hubert, C. (2020). Electric Machines: Theory, Operating Applications, and Controls (2nd edition). Pearson.
B.L.Theraja (2006),A Textbook of Electrical Technology: AC and DC Machines, (7th Edition), Chand Publication.
https://studyelectrical.com/electrical-machines/dc-motor
https://www.electricaleasy.com/2014/07/characteristics-of-dc-motors.htm
https://www.electrically4u.com/category/electrical-machines/synchronous-motor
https://www.eeeguide.com/speed-torque-characteristics-of-dc-series-motor
https://www.javatpoint.com/electrical-machines-tutorial

Learning Outcomes

CLO 1: Analyze basic magnetic circuits and describe the principles of applying magnetic fields in electric machines.
CLO 2: Apply the construction and operational knowledge associated with electrical machines and their characteristics.
CLO 3: Categorize single phase transformer, three phase transformer and DC motors using different types of winding for performance measurement.
CLO 4: Examine the construction and equivalent circuit of induction motor and synchronous motors
CLO 5: Analyze the fundamental theory related to 3-phase circuits, electric machines for power systems.
CLO 6: Conduct experiment on three-phase transformers, use calculations of harmonics and Scott connections, and also find out the responses of different electrical machines under varying conditions.
CLO 7: Assess through presentation research the performance of electrical machines, in order to solve engineering problems, and write lab report.

Tutorials

LAB 1: Draw the magnetization of DC shunt generator. Determination of critical field resistance and critical speed.
LAB 2: Obtain load characteristics of DC shunt generator and compound generator.
LAB 3: Perform speed control of DC shunt and series motor by field and armature control methods.
LAB 4: Pre-determine the efficiency of DC machine by performing Hopkinson's test on DC shunt motor.
LAB 5: Study the equivalent circuit diagram, regulation, and efficiency of single-phase transformer and perform polarity test on single-phase transformer.
LAB 6: Study and perform the operation of the Scott connection using two single-phase transformers.
LAB 7: Study open and short circuit tests for single-phase transformer
LAB 8: Perform no-load test and blocked rotor test on a three phase induction motor and hence determine its equivalent circuit parameters.
LAB 9: Perform load test on a three phase Induction and obtain its various performance characteristics.
LAB 10: Determine the efficiency of DC machine by performing Swinburne's test on DC shunt motor.
LAB 11: Perform experiment in stepper motor to rotate in clockwise and anti-clockwise direction and perform experiment in servo motor to rotate to a specific degree.

Laboratories

WEEK 1: Solving the parameters in transformer and find the equivalent circuits
WEEK 2: Solve for reactive power, power factor in transformer circuits
WEEK 3: Solve for the transformer ratio and efficiency in transformer.

WEEK 4: Numerical based on finding the flux, torque in DC motors.
WEEK 5: Numerical based on finding the armature current, field current in DC series motor
WEEK 6: Numerical based on DC compound motors to find the armature, field voltages
WEEK 7: Numerical based on finding the armature current, field current in DC shunt motor
WEEK 8: Numerical to find the resolution and finding the digital signals to run the stepper motor at different step angles.
WEEK 9: Calculation to run the servo motor at specific angle.
WEEK 10: Writing algorithm to run the stepper motor in clockwise direction.
WEEK 11: Calculation of star delta in three phase transformers.
WEEK 12: Numerical based on three phase transformer and finding the equivalent circuit.
WEEK 13: Calculation of capacitance to adjust the power factor in transformer circuit.
WEEK 14: Numerical based on single phase induction motor.
WEEK 15: Numerical based on three phase induction motor.

EPT243: Electrical Power Systems Technology I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EET211

Course Description

The Power Systems course provides students with the necessary information, understanding, and abilities to operate in the electric power sector at a competitive level, including generating electricity, transmitting, distributing, and using it. This is used in diverse spectrum of power industries including coal, oil and gas-fired power plants, hydroelectric, atomic, and renewable energy power plants. This course covers the single line diagram of power system, description of power system elements like synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator, different kinds of supply system and their comparison, choice of transmission voltage, configurations, types of conductors, resistance of line, skin effect, Kelvin's law. Proximity effect. The topics include the overhead transmission lines, calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit transmission lines, and Ferranti effect. The student learning includes surge impedance loading, mechanical design of transmission line, catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration dampers, neutral grounding, necessity of neutral grounding, various methods of neutral grounding, earthing transformer, and grounding practices. The student learns about the type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance of single phase and three phase cables, dielectric loss, heating of cables. The course also covers corona and interference, phenomenon of corona, corona formation, calculation of potential gradient, corona loss, factors affecting corona, methods of reducing corona and interference and the electrostatic and electromagnetic interference with communication lines. Further the student learns about overhead line Insulators, type of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential, string efficiency.

References

Kothari D.P, Nagrath I J, (2019). Power system Engineering, 3rd Edition. McGraw-Hill Education.
https://www.tutorialspoint.com/electrical_safety/electrical_safety_power_system.htm
https://pdhonline.com/courses/e104a/e104a_new.htm
http://www.newacademicscience.co.uk/samplechapter/000104.pdf

Learning Outcomes

CLO 1: Describe the introduction to Power Systems through single line diagrams and various elements of power systems.
CLO 2: Calculate inductance and capacitance of OH lines along with sag and tension in lines under various conditions
CLO 3: Distinguish various types of cables, their constructions, and their applications
CLO 4: Explain the phenomenon of Corona, its formation factors, losses, and remedies.
CLO 5: Illustrate various types of insulators according to their design and their applications.

Tutorials

LAB 1: Studying Ferranti effect and determine A, B, C, D parameters of short and medium transmission line.
LAB 2:Performing symmetrical fault analysis in AC and DC network analyzer.
LAB 3: Studying characteristics of microcontroller-based earth fault relay.
LAB 4: Studying various effects on transmission line simulator and loading of transmission line.
LAB 5: Shunt capacitive compensation of transmission line.
LAB 6: Parallel operation of transmission line.
LAB 7: Simulation of 3-Phase fault detection, SLG, LLG and LL fault detection. LAB 8: Finding out the string efficiency across the string of

insulators, and testing of CT, PT's, and insulator strings.
LAB 9: Power circle diagrams of a 3-Φ transmission line model.
LAB 10: perform the experiment for Unsymmetrical fault analysis on DC network.
LAB 11: Shunt reactor compensation for unloaded line.

EPT291: EPT Project I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	2	120			75	0	25

Course Description

This course enables the students to exercise some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. The student is expected to design a project that provides students with the experience of designing, building, and integrating modular software applications/ electronic system comprising analog, digital and computer subsystems. The student mostly implements design and tests the system. This course includes planning the tasks which are to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. By studying this course. The student develops creativity, initiative, and capacity to perform. Leadership development and supervision skills are also integrated into the learning objectives of this course. The project will have a detailed proposal, which must be executed or implemented within the time allocated while maintaining a logbook periodically monitored by the professor mentor. Projects should be chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is to be prepared as the project progresses, which has to be submitted after the project is over. The students acquire the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1: Define the tasks and scope of the project independently and/or collaboratively
CLO 2: Identify relevant information pertaining to project needs from a variety of resources.
CLO 3: Acquire knowledge on advanced topics in a chosen subject area
CLO 4: Summarize the information and draw a logical conclusion to the problem/task of the project
CLO 5: Outline the details of hardware and software required for the completion of the project
CLO 6: Prepare project proposals with an action plan and time duration scientifically.
CLO 7: Communicate project ideas and current work achievements clearly through technical report and presentations.

EPT292: EPT Project II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	4	240			75	0	25

Requisites

- Prerequisites: EPT291 AND EPT291

Course Description

This course enables the students to apply some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. Project II provides students with the experience of designing and building simple software and hardware applications. Further students can learn how to integrate it into a modular electronic system or computer subsystems. This course builds on the knowledge and skills built in Project I. The student mostly implements design and tests the system. This course includes planning the tasks which are to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. Through this course, the student develops creativity, initiative, and capacity to perform. The student develops interpersonal, teamwork, planning and organizing skills. The projects will have a detailed project proposal, which must be executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the teacher. Projects should be chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is to be prepared as the project progresses, which has to be submitted after the project is over. The students acquire the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1. Choose the relevant possible solutions from available alternatives
CLO 2. Conduct feasibility studies about hardware and software parts used in the project.
CLO 3. Design a simple software and hardware application taking into consideration various real-life constraints.
CLO 4. Investigate the important legal and ethical issues in the design project
CLO 5. Collaborate with team members, managers, and clients to design and prototype a product/service that meets user needs and expectations.
CLO 6. Conduct the theoretical study in detail and compare them on the basis of cost/ energy conservation/impact on environment/technology used etc.
CLO 7. Communicate project ideas and current work achievements clearly through technical report and presentations.

EPT311: Power Electronics II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	120	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EPT211

Course Description

AC Voltage regulators, AC static switches, DC to DC Converter: buck, boost, buck-boost, Cuk DC/DC converters. Inverter single phase half-bridge and full-bridge, 3-phase bridge inverters, PWM modulation techniques. Application on UPS.

References

https://mrcet.com/downloads/Labmanuals/EEE/POWER%20ELECTRONICS%20LAB%20MANUAL.pdf

Learning Outcomes

CLO 1: Be able to understand how dc-dc converters work.
CLO 2: Have the knowledge of designing a switched-mode power supply, both the power and control circuits.
CLO 3: Be able to understand how resonant converters work, their advantages and disadvantages.
CLO 4: Be able to choose energy storage media, its management and network interface converters.
CLO 5: Be able to design passive filters depending on the application and the specific features of the power system.
CLO 6: Be able to choose the appropriate type and category of active filter depending on the application and the specific features of the system in which it will be placed.
CLO 7: Be able to collaborate with their fellow students to conduct and present case studies.

Tutorials

LAB 1: Study the characteristics of SCR, MOSFET & IGBT.
LAB 2: Single-phase Half controlled converter with R load and single-phase fully controlled bridge converter with R and RL loads.

LAB 3: Three-phase half controlled bridge converter with R□load.
LAB 4: Single Phase AC Voltage Controller with R and RL Loads.
LAB 5: SINGLE-PHASE BRIDGE CONVERTERS and THREE-PHASE BRIDGE CONVERTERS.
LAB 6: THREE-PHASE FULLY-CONTROLLED BRIDGE, OHMIC-INDUCTIVE LOAD.
LAB 7: STEP-DOWN (BUCK) CONVERTER, STEP-DOWN CONVERTER WITH MOSFET, and STEP-UP (BOOST) CONVERTER.
LAB 8: STEP-UP CONVERTER WITH IGBT AND PWM CONTROL.
LAB 9: SINGLE-PHASE SWITCHED-MODE INVERTER.
LAB 10: Single-phase half-bridge inverter and Single-phase full-bridge inverter. LAB 11: SINGLE-PHASE FULL-BRIDGE INVERTER WITH SINUSOIDAL PWM CONTROL.

EPT341: Electrical Machines II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EPT242

Course Description

This Course is for Fundamental of rotating AC machines: Construction of rotating machines, rotating fields of single and three phase machines, electromotive force and torque equation of the AC machines. Synchronous machines: construction, fundamental laws, cylindrical rotor machines, basic tests, salient pole machines, synchronous motors, power formulae, stability and damper bars, synchronization of machines, transient performance. Permanent Magnet Synchronous Generators (PMSG) and Switched Reluctance Machine (SRM). Induction machines: construction of different types of induction machine, concept of rotating and pulsating fields, principles of operation of three phase induction motor based on linear magnetic circuit, torque, slip characteristics, conditions and methods of starting of three phase induction motor (double cage and deep bar rotors), speed control of three phase induction motor, induction generator, testing of three phase induction motor.

Learning Outcomes

CLO 1:Recognize Poly phase Induction Machines – I (Construction features, production of rotating magnetic field, equivalent circuit, torque and power equations,
torque-slip characteristics, no load and blocked rotor tests' efficiency. Induction generator, Starting and speed
control, cogging and crawling).
CLO 2 :Single- Phase Induction Motor (Double revolving field theory, equivalent circuit, no load and blocked rotor tests, starting methods, repulsion
motor. A.C. Commutator Motor:E.M.F. induced in commutator windings, single phase a.c. series motor, Universal
motor).
CLO 3:Synchronous Machines – I (Constructional features, armature windings, E.M.F. equation, winding coefficients, harmonics in the induced E.M.F., armature reaction, O.C. and S.C. tests, voltage regulation-Synchronous impedance method, MMF
Method, Potier's triangle method and parallel operation, operation on infinite bus, cooling).
CLO 4:Synchronous Machines - II (Two reaction theory, power expressions for cylindrical and salient pole machines, performance characteristics.
Synchronous Motor : Principle of operation, starting methods, phasor diagram torque-angle characteristics, Vcurves
hunting and dampling, synchronous condenser, reluctance motor).

Tutorials

LAB 1:To Perform load-test on 3 ph. Induction motor & to plot torque V/S speed characteristics.
LAB 2:To Perform no-load & blocked –rotor tests on 3 ph. Induction motor to obtain equivalent ckt. Parameters &
to draw circle diagram.
LAB 3:To study the speed control of 3 ph. Induction motor by Kramer's Concept.
LAB 4:To study the speed control of 3 ph. Induction motor by cascading of two induction motors, i.e. by feeding
the slip power of one motor into the other motor.
LAB 5:To study star- delta starters physically and
(a) to draw electrical connection diagram
(b) to start the 3 ph. Induction motor using it.
LAB 6 :To study star- delta starters physically and To reverse the direction of 3 ph. I.M.
LAB 7:To start a 3 phase slip –ring induction motor by inserting different levels of resistance in the rotor ckt. And
to plot torque –speed characteristics.
LAB 8:To perform no-load & blocked –rotor test on 1 ph. Induction motor & to determine the parameters of
equivalent ckt. Drawn on the basis of double revolving field theory.
LAB 9:To Perform load –test on 1 ph. Induction motor & plot torque –speed characteristics.
LAB 10:To Perform no load & short ckt. Test on 3- phase alternator and draw open ckt. And Short ckt. Characteristics.
LAB 11:To find voltage regulation of an alternator by zero power factor (z.p.f.) method.

LAB 12:To study effect of variation of field current upon the stator current and power factor With synchronous motor running at no load and draw V & inverted V curves of motor.
LAB 13:To measure negative sequence & zero sequence reactance of Syn. Machines. WEEK 14:FINAL EXAM

EPT342: Electrical Power Systems Technology II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EPT243

Course Description

This course is designed to understand various substation basics, switching configurations, understand different types of bus bar configurations, power factor correction devices, SCADA system and its application in Power System, substation automation and gas insulated substations. This course gives the introduction to functions of a substation, classification, layout, design and construction of bus Bar and earth wire in substation, factors affecting layout of substation, testing of substation, reactive power management, fundamentals of earthing, load Management. The student learning includes causes and effect of low power factor; advantages of power factor improvement, PF improvement using shunt capacitors and synchronous condensers, calculation of most economic pf when, kw demand is constant and when KVA demand is constant, importance of capacitor banks. The course covers computer applications, SCADA subsystem, data acquisition and data processing, supervisory control, voltage control and voltage stability, Protection using circuit breakers, fuse and protection against overvoltage, bus bar protection. The student learning includes the technical standards for construction of sub stations, substation automation system and gas insulated substations. The topics include air and water pollution by thermal power plants and its control, acid rains, thermal pollution by thermal and nuclear power plants, radio-active pollution of environment by nuclear power plants, noise pollution and noise control, methods suggested to reduce the pollution, pollution flashover mechanism in insulators. Additional topics include the basics of current transformers and voltage transformers and the economic operation of power system. Lectures, theoretical assignments, exams, quizzes are used in this course.

References

R.S. Dahiya (2010), Sub Station Engineering: Design Concept & Computer Application, Katson Publishers.
https://pdhonline.com/courses/e163/Substation_Design.pdf
https://electrical-engineering-portal.com/power-substation-design-engineering
https://www.elprocus.com/what-is-a-substation-definition-types-of-substations/
https://energyeducation.ca/encyclopedia/Electrical_substation

Learning Outcomes

CLO 1: Make a layout diagram of substation based on the load requirement.
CLO 2: Categorize the causes and effect of low power factor and correction using compensating devices.
CLO 3: Compare the transforms used in different stages at substation.
CLO 3: Illustrate the concept of SCADA in Power System.
CLO 4: Analyze the cause of pollution in power plant and methods to reduce them.
CLO 5: Demonstrate experiment and simulate all the process from power generation, to load distribution.

Tutorials

LAB 1: Determine the ABCD, H, Z, and Image parameters of short, medium, and long transmission line for T-network and for pi-network.
LAB 2: Determine the ABCD, H, Z, and Image-parameters for long transmission line.
LAB 3: Measure the receiving end voltage of each line under no load or lightly load condition to understand Ferranti effect and understand the performance of transmission line under different loads.
LAB 4: Study the operating performance of over and under-voltage relay with different plug settings
LAB 5: Monitoring single bus scheme and double bus scheme of substation using SCADA systems.
LAB 6: Study and verify the operating characteristics of over current relay, differential relay at various plug & time settings
LAB 7: Use of switches and circuit breaker of substation using SCADA systems.
LAB 8: Study and verify the operating characteristics of three phase over current and Earth fault numeric relay.
LAB 9: Line-to-Ground (L-G) fault analysis of a single and three phase transmission line.
LAB 10: Single line-to-Ground (L-G) fault analysis of a three phase transmission line, line-to-line (L-L) fault analysis, double line-to-Ground (L-L-G) fault analysis of three phase transmission line.
LAB 11: Symmetrical L-L-L and L-L-L-G fault analysis of a three phase transmission line.

EPT343: Industrial Control Engineering Technology II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EPT241

Course Description

Industrial Automation is the use of machines, control systems, and information technologies to optimize productivity in the manufacturing processes with little human involvement. Industrial automation describes the role of computers in measurement and instrumentation and associated data transfer techniques and communication protocol. The course gives the students an understanding of the PLC, construction and working about interfacing with field devices and the communication protocol. The course introduces the process control hardware components, actuators, sensors, process diagram, logical design of automation circuits, state diagrams, elements of electro pneumatic components, pneumatic cylinder, airflow valves, and application of electro pneumatic systems, hydraulic components, hydraulic cylinder, piston, and hydraulic actuators. The topics also include the architecture of PLC, basic operation of PLC, digital and analog input modules, digital and analog output modules, PLC expansion, input output configuration, basic programming principles of PLC, assembly language programming, instruction sets, ladder programming and ON-OFF control used in PLC. The student learning includes normally open and normally closed concepts, interfacing the hydraulic and pneumatic systems to PLC, interfacing electrical switches to PLC, and PID control using PLC. The student also learns SCADA functional requirements and controls; general features, functions and applications, benefits, working of SCADA, increase uptime, cut costs, improved operations meet demand, implementation considerations, data presentation for improved analysis, and structure of SCADA communications protocols. Lectures, theoretical assignments, exams, quizzes are used in this course.

References

Stamatios. Nikolakopoulos, G. (2018). Introduction to Industrial Automation, CRC Press Publication, 1st Edition
Dey, C., & Sen, S. K. (2020). Industrial Automation Technologies, Taylors, and Francis Group.
Bartelt, T. (2011). Industrial Automated Systems Instrumentation and Motion Control, Delmar Cengage Learning, 1st Edition.
https://www.solisplc.com/what-is-plc-programming
https://www.instructables.com/PLC-Programming/
https://instrumentationtools.com/category/plc/

Learning Outcomes

CLO 1:Examine the architecture and different components of automation using block diagram
CLO 2:Design the functional block diagram for PLC and the programming concepts including assembly instruction set
CLO 3: Develop program using Ladder diagram in PLC for different automation in industries like bottle filling, packaging.
CLO 4: Construct a project using flow chart and program for different industrial parameters like temperature, pressure, level and use the analog input modules and output modules for control operations.
CLO 5: Form PLC ladder logic for interlocking latching, logical circuits, counters, timers, interrupts, and design using advanced control like neural network and fuzzy logic
CLO 6: Analyze the PLC used in industries and present the application in groups.

Tutorials

LAB 1: Introduction to PLC, analog-digital input output modules, ladder, and assembly programming.
LAB 2:.Implementation of vehicle and pedestrian traffic control at an intersection using PLC.
LAB 3: PLC electro-pneumatic training system: Two double-acting cylinders. Control valve station featuring single- and double-solenoid valves. PLC electro-pneumatic training system: Two reed switches and one mechanical limit switch for PLC feedback.
LAB 4: PLC electro-pneumatic training system: Control valve station featuring single- and double-solenoid valves, PLC electro-mechanical training system: PLC controlled positioning and motion processes using DC motor.
LAB 5: PLC electro-mechanical training system: PLC controlled positioning and motion processes using stepper motor.
LAB 6: Level-process training system using PLC, control relays, a pump, and a set of sensors.
LAB 7: PLC based bottling process training system combining solenoid valve and stepper motors.
LAB 8: PLC hydraulic control system: Single-acting cylinder and control of double-acting cylinder.
LAB 9: PLC DC motor control using hydraulic system.
LAB 10: PLC elevator control using ladder programming.
LAB 11: PLC control of temperature using ON-OFF/PID control.

EPT392: EPT Internship II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE

0	0	360	360	3	180			50	0	50

Requisites

- Prerequisites: EPT191

Course Description

Internship provides an opportunity to practice and/or apply knowledge and skills in professional environments and gain valuable work experience. Through the Internship students get exposure to the industrial environment which cannot be simulated in the classroom. During the internship, students have to understand and sharpen the real-time technical/managerial skills required at the job(s). Further, they have to Understand the social, economic, and administrative considerations that influence the working environment of industrial organizations. Overall professional development of students required problem-solving, communication, human development, and relationship-building skills. Students select the internship field in consultation with an industry mentor and faculty guide in terms of the academic requirements. The student is supposed to produce a joining letter and a successful completion certificate. once the internship is over. Internship evaluation can be based on the quality of projects completed as part of the internship activities. Faculty Member(s) has to evaluate(s) the performance of students once by visiting the Industry/Organization and the Evaluation Report of the students' needs to submit in the department office with the consent of Industry persons/ mentor. The students will be exposed to the industry environment for a minimum period of 08 weeks duration to understand the operation of the industrial facility.

References

https://www.youtube.com/watch?v=jpf9J2TUJVg
https://www.youtube.com/watch?v=KqIshDsg494
https://www.youtube.com/watch?v=E1UcIHW5rSc
https://www.youtube.com/watch?v=EhnfOUrFgxM

Learning Outcomes

CLO 1: Analyze the assigned task and solve it by applying critical thinking and problem-solving skills.
CLO 2: Collaborate and communicate effectively with different professionals in the work environment.
CLO 3: Communicate effectively through the technical presentation.
CLO 4: Design solutions with contextual constraints, acquiring and applying new knowledge.
CLO 5: Recommend solutions for improved processes and optimal use of resources.
CLO 6: Evaluate career options by considering opportunities in industry and higher education and sharpen the real-time technical/managerial skills required at the job(s) during the internship.
CLO 7: Demonstrate ethical and professional behavior in the work environment.

EPT431: Renewable Energy Technology

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: GEN123

Course Description

This course covers theory and experiments on various renewable energy technologies and study of their performance parameters. It describes the impact of using conventional energy sources on the environment. Need for utilization of alternate energy sources is provided. It comprises of fundamentals of solar photovoltaic and solar thermal energy and their applications, environmental characteristics and solar radiation, classification and thermal analysis of solar energy collectors, solar thermal energy storage potential, and hybrid solar plants. The course covers aspects such as the history of wind turbine development and the characteristics of the wind. Also, the impact of site selection, design, manufacture, and operation of modern wind turbines is discussed. An overview of different types of horizontal and vertical axis wind turbines is presented. Introduction to types of biomass, their characterization techniques, and ways of converting it to energy. Also, it contains descriptions and applications of various types of fuel cells. This course also presents the working principle and types of geothermal power plants. It also includes the mechanism of tidal wave energy generation and ways to harness that. A discussion on hydroelectric power and its utilization is provided. The laboratory work consists of experiments illustrating the principles, laws and concepts discussed in the course.

References

Ehrlich, R., & Geller, H. A. (2018). Renewable energy: a first course. CRC press.

Kanoğlu, M., Çengel, Y. A., & Cimbala, J. M. (2020). Fundamentals and applications of renewable energy. McGraw-Hill Education.
"Lecture 20: Introduction to Renewable Energy." Www.youtube.com, www.youtube.com/watch?v=tfmIk5nGtMU . Accessed 28 Sept. 2022.
"NPTEL : NOC:Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems (Chemical Engineering)." Digimat.in, digimat.in/nptel/courses/video/103103206/L01.html. Accessed 26 Sept. 2022.
"Introduction to Renewable Energy." Solar Energy International (SEI): Solar Training for Clean Energy Careers, www.solarenergy.org/courses/introduction-to-renewable-energy/#:~:text=RE100%20is%20a%20free%20course Accessed 19 Oct. 2022.
"Renewable Energy." Coursera, www.coursera.org/specializations/renewable-energy. Accessed 19 Oct. 2022.

Learning Outcomes

CLO 1: Explain the effect of pollution and global warming due to fossil fuels.
CLO 2: Illustrate the world's energy requirements and resources to fulfill it.
CLO 3: Differentiate between various types of renewable energy resources.
CLO 4: Relate the renewable energy resources to the location and availability.
CLO 5: Compare the techniques to harvest electrical energy from renewable resources.
CLO 6: Demonstrate the working of energy conversion technologies under various test conditions.
CLO 7: Conduct experiments, interpret data and draw results and conclusions.
CLO 8: Write lab reports and present results.

Tutorials

LAB 1: Lab Induction, safety precautions, significant parameters, introduction to instruments, course policies, reports
LAB 2: Simulation studies on wind energy generator
LAB 3: Experiments on performance assessment of micro wind energy generator.
LAB 4: Simulation studies on hybrid (solar wind) power system.
LAB 5: Experiments on performance assessment of hybrid (solar wind) power system.
LAB 6: Study the production process of biofuels from jatropha oil.
LAB 7: Determination of iodine value and flash point of Jatropha biofuel.
LAB 8: Study the production process of biofuels from waste cooking oil.
LAB 9: Determination of iodine value and flash point of waste cooking oil biodiesel.
LAB 10: Study the production process of biofuels from algae.
LAB 11: Determination of iodine value and flash point of algal biodiesel.
LAB 12: Study the construction of fuel cell.
LAB 13: Study the working of hydrogen fuel cell.
LAB 14: Simulation studies on hydel power.
LAB 15: Lab Final Exam

EPT441: Electrical Distribution and Smart Grid Technologies

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Course Description

The smart grid concept has experienced major hype in the past few years. The smart grid knowledge will provide invaluable data on the benefits and cost-effectiveness of the smart grid, including energy and cost savings. Students will learn how to minimize the effects when there is outrage and blackouts using automatic distribution system and to supply power to the essential service like hospitals, banking, and police departments. Students learn how smart grid is used to improve the efficiency of transmission system, quick restoration of electricity, reducing the peak demand in the power curve, integrating with other renewable systems, integrating, and monitoring with customer-owner power generation systems and to improve the security. The objective of this course is to facilitate an understanding of the basic concepts of smart grid technologies. Integrates three areas of electrical engineering: power systems, power electronics, and electric energy conversion systems. The course will also look into the power quality management issues in smart grid and the high-performance computing for smart grid applications like cyber security. This course covers the construction of a power grid system, modeling a micro grid System, modeling of converters in power grid distributed generation systems, smart power grid systems, cyber controlled smart grid, load flow analysis of power grids and micro grids, smart devices and energy efficiency monitoring systems, assignment, reading material will be used to deliver the course.

References

Ali Keyhani (2019) Design of Smart Power Grid Renewable Energy Systems, 3rd Edition, Wiley
What is a Smart Grid? What are the Major Smart Grid Technologies? (blackridgeresearch.com)
Smart grids: electricity networks and the grid in evolution (i-scoop.eu)
Smart Grid Webinars | Smart grids – driving energy intelligence | Siemens Global

Learning Outcomes

CLO 1: Analyze and study concepts of developments and technologies in Smart Grid 1. Analyze and study concepts of developments and technologies in Smart Grid.
CLO 2: Assess models of power grid converters and power quality management in smart Grids.
CLO 3: Construct and interpret various cloud computing models for smart grid applications in cybersecurity
CLO 4: Design and operate renewable smart grids using energy management and network analysis

Tutorials

LAB 1: Study of Standalone Grid Networks
LAB 2: Controlling generator in OFF-Grid network
LABK 3: Monitoring of Power consumption and generation in OFF-GRID.
LAB 4: Use of modern information technology like network sensors, actuators, PLC, and SCADA interfaces,
LAB 5: Smart metering.
LAB 6: Study of Micro grids
LAB 7: Control of Generators using Stand Alone system
LAB 8: Control of multiple generators in parallel operating mode
LAB 9: Reduction of transmission and transformer losses using Microgrid
LAB 10: Power generation with Photovoltaic system
LAB 11: Power generation with Wind Energy
LAB 12: Optimum electrical power quality, reliability and sustainability using Microgrid.
LAB 13: Intelligent control of Power supply using SCADA systems
LAB 14: Manual, Voltage and Frequency control
LAB 15: Intelligent Energy management using Smart Grid.

EPT442: Electrical Transmission Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EPT311

Course Description

A new technology based on power electronics and offers an opportunity to enhance controllability, stability, and power transfer capability of AC transmission systems. This course also deals with reducing the harmonics introduced in the transmission system due to the power electronic devices. This includes the study of filters which are used to reduce noise. It uses microcontroller-based monitoring system for automatic tap changing using servo or stepper motor mechanisms. This also includes the alarming technique at threshold levels and also study of automatic voltage stabilizers in power system network. The students will familiarize themselves with the principles of this advanced system which can give them a better understanding of its working in the power industry. This will also enhance expertise in equipment specifications and engineering design, offering an informed view of the future of power electronics in AC transmission. This course covers the FACTS concept and general system considerations, voltage-sourced converters, self -commutated current-sourced converters, line-commutated current-sourced converters, self- and line-commutated current-sourced converters, static series compensators: GCSC, TSSC, TCSC, and SSS, voltage and phase angle regulators: TCVR and TCPAR, combined compensators: Unified Power Flow Controller (UPFC) and Interline Power Flow Controller (IPFC) . This also includes the study of types of SVC like thyristor switched reactor, thyristor Capacitor and thyristor-controlled reactors.

References

Narain, G. Hingorani. (2011). Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems, WILEY INDIA
Why is a Flexible AC Transmission System Needed: Types of FACTs (elprocus.com)
Flexible AC Transmission Systems - an overview | ScienceDirect Topics
Flexible AC transmission systems (FACTS) | Portfolio | Siemens Energy Global (siemens-energy.com)
FACTS - Flexible AC Transmission System - Controllers & Devices (electricaltechnology.org)

Learning Outcomes

CLO 1: Design and analyze FACTS controller for power system application
CLO 2:.Evaluate the steady state and transient responses for FACTS controllers
CLO 3: Assess FACTS controllers using SVC, STATCOM, TCSC, SSSC, UPFC and IPFC.
CLO 4: Design voltage-sourced and current-sourced converters using power devices.

Tutorials

LAB 1: Study of the characteristics of Voltage Regulation
LAB 2: Study of Voltage Compensation
LAB 3: Experiment on the Power transmission capacity and the compensation of Long AC transmission lines.
LAB 4: Experiment to control the active and real power flow in transmission lines.
LAB 5: Experiment to display the power factor in thyristor three phase bridges and study the operation of HVDC transmission systems
LAB 6: Commutation failure at the Inverter bridge.
LAB 7: Thyristor 12 pulse converter for harmonic reduction. LAB 8: Study of Static Var Compensator to control the power flow.
LAB 9: Experiment on voltage compensation using SVC.
LAB 10: Experiment on Voltage compensation and power factor correction using STATCOM.
LAB 11: Implementation of TCR and TSC for SVC operation.

EPT443: Energy Management

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

Energy management is very crucial in today's scenario when global energy demand is surging and the supply to meet these demands are limited. This course comprises of fundamentals of energy and types of energy that can be harnessed for various applications. Also, principle of energy management and energy conservation for suitable utilization is discussed. It also includes discussion on importance of energy audit and its mechanism. The various types of energy audit techniques are also vividly discussed. The tools and methodology used to in each type of energy audit are explained. It also discusses the methodology and techniques of evaluating energy performance. The benchmarking methods of energy performance evaluation against international standards is also presented. Data collection and analysis mechanism is presented to perform optimum energy management. The instruments used for energy audits and materials required are discussed. Significance of process flow chart for energy auditing and its preparation techniques are also discussed. Types of energy management systems are presented. An overview of their targeting and monitoring method is presented. Thermal, electrical, and building energy management is also discussed. Discussion on life cycle cost (LCC) and life cycle assessment (LCA) is also presented. Economic analysis and project planning techniques are also presented.

References

Kumar, A., Prakash, O., & Chauhan, P. S. (2020). Energy management: Conservation and audits. CRC Press.
“Lecture-1 Introduction to Energy Management and Audit.” Www.youtube.com, www.youtube.com/watch?v=WwBquDjDGOA. Accessed 28 Sept. 2022.
NPTEL :: Electrical Engineering - Energy Management Systems and SCADA.” Archive.nptel.ac.in, archive.nptel.ac.in/courses/108/106/108106022/. Accessed 26 Sept. 2022.
“Free Online Training - My Energy University.” Www.se.com, www.se.com/au/en/work/services/training/energy-university/energy-university-free-online-training.jsp. Accessed 19 Oct. 2022.
“Introduction to Energy Management Powered by RETScreen.” EdX, www.edx.org/course/energy-management-powered-by-retscreen. Accessed 19 Oct. 2022.
Kini, P. Giridhar. Energy Management Systems. Www.intechopen.com, 1 Aug. 2011, www.intechopen.com/books/214. Accessed 19 Oct. 2022.

Learning Outcomes

CLO 1: Compare the types of energy management systems for energy economy and conservation.
CLO 2: Assess energy performance using acquired data to optimize energy usage.
CLO 3: Create energy balance sheets for appropriate management of energy.
CLO 4: Formulate strategies for energy conservation, working in teams.

EPT444: Industerial Networks

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

This Learning Module covers the following law, principle, rule: Concept of distributed control and networks. Control panels and advanced mimic diagrams. SCADA systems and security. PLC networks. Master / slave control.Field bus techniques. Electrical diagrams for network installation.

Examples of industrial networks. Industrial data communications. Industrial communication protocols. Fibre optics. TCP/IP and Ethernet networks. Radio & Telemetry Systems for Industry. Local area networks. Mobile Radio Systems for Industry. Network management and standards. Risk and assessment analysis. Safety factors in networks operations. WLANs IEEE 802.11. WiMax IEEE 802.16.Networks and safety issues.

Learning Outcomes

CLO 1: Identify the hardware and software components in the industrial network.
CLO 2: Recognize the control solution using PLC network.
CLO 3: Apply the concept of advanced automation using field bus.
CLO 4: Apply the communication protocols for industrial networks.
CLO 5: Recognize the security requirements for industrial networks.

EPT451: Operation and control of Power Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

Types of power plants, Modeling of economic operation for power plants (thermal and hydro), Economic dispatch in power systems, Unit commitment problem, Hydro-thermal coordination, Supervisory and control functions, Automatic load frequency Control (ALFC) in Single area and multi area systems models, Automatic Voltage Regulators (AVR) Modeling and control.

References

https://www.engineeringonline.ncsu.edu/course/ece-550-power-system-operation-and-control/

Learning Outcomes

CLO 1: Develop equivalent circuits for a given power system for power flow analysis,
CLO 2: Develop computer programs to perform power flow analysis on a power system,
CLO 3: Define automatic generation control scheme on a power system and analyze generation control on a power system using simulation tools,
CLO 4: Define generation dispatching on a power system and develop generation dispatching schemes using analysis packages,
CLO 5: Define real time monitoring requirements on a power system,
CLO 6: Define State Estimation problem and analyze state estimation of a power system using analysis programs,
CLO 7: Define contingency analysis on a power system and perform contingency studies using a power flow analysis program.

EPT452: Power System Protection & Switchgear

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

The functioning of a power system depends significantly on efficient and reliable protection schemes and learning the principles of electric fault detection is necessary to minimize damage, repair costs, and human casualties. The power system consists of transformer, generators, transmission, and distribution lines which can cause damage if proper protection equipment like relays and circuit breakers is not provided. This course examines the protection of power system scenarios with various protection relays and studies the various types of circuit breakers. This course covers the protection system and its attributes, system transducers, duties of switchgear, various power system elements that needs protection; types, ratings and characteristics, construction, and application of HRC fuses, limitations and application of fuses, Introduction to MCBs; theory of arc formation and its extinction (AC and DC); re-striking and recovery voltage. The topics include current chopping, circuit breakers: specifications of circuit breakers, different types of circuit breakers like oil, air, vacuum and SF6, earthing requirements, earthing practices, earth resistivity and earth gradient, neutral shift, functions, constructional and operating principles of electromagnetic type like over-current, directional, differential and distance relays, characteristics, general equation. The student learns basic principles of static relaying, phase and amplitude comparator, differential protection, transformer protection, bus bar protection, generator protection, and induction motor protection. This course provides Lectures, theoretical assignments, and presentations.

References

Badri, R. (2017). Power System Protection and Switchgear, (2nd edition) McGraw Hill Education.
https://nptel.ac.in/courses/108104048
https://cds.cern.ch/record/1005044/files/p113.pdf
https://www.mv.helsinki.fi/home/tpaulin/Text/hveng.pdf

Learning Outcomes

CLO 1: Design power system protection using fuses, relays, and circuit breakers.
CLO 2: Select fuses, circuit breakers and relays of correct specifications
CLO 3: Design the earthing circuit for residential and industrial complexes
CLO 4: Evaluate the given specifications of power system protection devices used with a transmission line against overcurrent and overvoltage.
CLO 5: Design suitable protection scheme for given industrial power system equipment and present, working in teams.

Tutorials

WEEK 1: Study of Overcurrent protection
WEEK 2: Experiment on Relay based on current and Time settings
WEEK 3: Characteristics of three phase differential protection.
WEEK 4: Study of Distance protection relays
WEEK 5: Phase and Ground distance protection
WEEK 6: Direction and Non-Directional phase over current protection.
WEEK 7: Direction and Non-Directional Earth fault protection.
WEEK 8: Experiment on Thermal overload protection
WEEK 9: Experiment on Numerical differential protection relay.
WEEK 10: Experiment on Reverse power protection relay.
WEEK 11: Differential protection of generators using electrostatic relays
WEEK 12: Experiment of feeder management relays.
WEEK 13: Experiment to demonstrate over current relays in parallel feeder
WEEK 14: Numerical relays for protection of three phase induction motors.
WEEK 15: Differential protection of transformer using Numerical relays.

EPT453: Selected Topic in Electrical Power I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

EPT454: Electrical Drives Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

Dynamics of Electric Drives, Fundamental torque equations, speed-torque conventions and multi-quadrant operation, Nature and classification of load torques, steadystate stability, load equalization, close loop configurations of drives. DC Drives: Speed torque curves, torque and power limitation in armature voltage and field control, Starting, Braking: Regenerative Braking, dynamic braking and plugging. Speed Control-Controlled Rectifier fed DC drives, Chopper Controlled DC drives. Induction Motor Drives: Starting, Braking- Regenerative braking, plugging and dynamic braking.Speed Control: Stator voltage control, variable frequency control from voltage source, Voltage Source Inverter (VSI) Control. Cycloconverter Control, Static rotor resistance control, Slip Power Recovery- Stator Scherbius drive, Static Kramer drive. Synchronous Motor Drive:Control of Synchronous Motor-Separately Controlled and VSI fed Self-Controlled Synchronous Motor Drives.

Learning Outcomes

CLO 1. Be able to model and analyse the basic principles and operation of DC drives.
CLO 2. Be able to model and analyse the principles and operation of AC drives.
CLO 3. Be able to apply different problem solving techniques for DC and AC drives applications.
CLO 4. Be able to differentiate between drive faults, motor faults and power faults.
CLO 5. Be able to correctly configure, operate and monitor drive systems.
CLO 6. Be able to determine and analyse speed-time curves for a variety of applications.

Tutorials

Connection methods between power electronics converters, electric motors and loads.
Control of DC motor using chopper (DC-DC converters) or controlled converters. The field and armature currents are controlled for regulating the motor speed and torque. Measure field/armature current and rotor speed and draw current/speed or torque/speed curve.
Stator voltage control of three phase motor using DC-AC converter to control the motor speed under rated speed. Measure stator voltage, current, torque and rotor speed. Draw torque/speed curve.
Stator frequency control of three phase motor using DC-AC converter to control motor speed above rated speed. Measure stator voltage, current, torque and rotor speed. Draw torque/speed curve and frequency/speed curve.
Stator voltage and frequency control to regulate the motor speed from zero rpm to maximum rpm. Measure stator voltage, current, torque and rotor speed. Draw torque/speed curve and frequency/speed curve.
Vector control of three phase motor. Measure stator voltage, current, torque and rotor speed. Draw torque/speed curve and frequency/speed curve.
Control of three phase motors using closed loop control. Change reference values of motor or current speed and measure actual speed.

EPT455: Electrical Installations and Energy Utilization

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

Course Description

Codes and standards of electrical installations, Installation of electrical components, Electrical hazards, Inspection and testing, Electrical maintenance, Earth leakage detection, Installation planning, Electromagnetic field compatibility, Illumination technologies, Industrial heating; Conduction, Convection, Forced Convection and radiation, resistance, arc, dielectric, induction, H.F eddy current heating. Ventilation.

References

Calculate electric loads given a selection of appliances in a home or a commercial installation.
Design distribution panels for a given load scheme in accordance with international standards like IEC.
Identify and differentiate between various schemes of distribution systems.
Calculate voltage drop over a distribution network.
Design a simple earthing system for a given installation.
Identify the appropriate earthing configuration required for a domestic or a commercial installation.
Perform energy conservation analysis for domestic or a commercial installation.
Design an energy-friendly distribution system for a domestic or a commercial installation
Design illumination schemes for indoor and/or outdoor domestic or a commercial installation.
Identify and differentiate between available types of lamps and recognize their optimal illumination applications.
Troubleshoot basic faults of household appliances like fans, refrigerators, electric oven…etc.
Can maintain a selection of household appliances like fans, refrigerators, electric oven…etc.

Learning Outcomes

Be able to develop basic skills in load estimation and identify different components of a distribution system.
Be able to determine and analyse the design of distribution boards and feeding systems.
Be able to determine and analyse the design of emergency and earthing systems.
Be able to identify and analyse energy management techniques.
Be able to model and analyse simple lighting systems for indoor and outdoor places.
Be able to apply basics of troubleshooting and maintenance of household appliances

EPT456: High Voltage Engineering

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: EET211 AND EPT342

Course Description

This course aims to prepare students with the detailed analysis of occurrence of breakdown in gaseous, liquids and solid dielectrics and provide information about generation and measurement of high voltage and current. This course covers the electric field stresses, gas / vacuum as insulator, liquid dielectrics, solids and composites, estimation and control of electric stress, numerical methods for electric field computation, surge voltages, their distribution and control, applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings. It also covers the breakdown in solid liquid and gaseous dielectrics. It includes gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's 20 law, liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids; intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, breakdown in composite dielectrics, solid dielectrics used in practice; measurement of high direct current voltages, measurement of high voltages alternating and impulse; measurement of high currents-direct, alternating and Impulse; oscilloscope for impulse voltage and current measurements. It also discusses the over voltage protection lightning phenomenon; overvoltage due to switching surges, system faults and other abnormal conditions; principles of insulation coordination on high voltage and extra High Voltage power systems. It covers the high voltage testing of electrical apparatus like measurement of D.C resistivity; measurement of dielectric constant and loss factor; partial discharge measurements. Testing of Insulators and bushings, testing of isolators and circuit breakers, testing of cables; testing of transformers, testing of surge arresters, radio interference measurements.

References

J.Kuffel, E.Kuffel, W.S. Zaengl (2016). High Voltage Engineering Fundamentals, Newnes Publication, Kindle Edition.
p113.pdf (cern.ch)
hveng.pdf (helsinki.fi)
[PDF] High Voltage Engineering Fundamentals By E. Kuffel and Zaengl Free Download – Learnengineering.in

Learning Outcomes

CLO 1: Compare the various methods implemented to generate high voltages
CLO 2: Analyze methods to calculate and grade electrostatic fields and the mechanisms of partial discharges and breakdown of dielectrics,
CLO 3: Evaluate the propagation of transients on transmission lines.
CLO 4: Formulate methods to measure dielectric constants and test high voltage equipment

Tutorials

LAB 1: Experiment to generate and measure of High AC Voltage.
LAB 2. Experiments to generate and measure DC Voltage.
LAB 3. Experiments to generate and measure Impulse Voltages.
LAB 4: Experiments on insulating liquids.
LAB 5: Experiments of Partial Discharge and Corona
LAB 6: Experiments on PD and Gliding Discharges.
LAB 7: Power frequency and impulse voltage tests on power transformer.
LAB 8: Experiment on Breakdown of Gases
LAB 9: Open Control, Multi-control and Real Time Control of parameters. Proportional, integral, derivative parameters are changed in real time to control the parameters.
LAB 10: Real Industrial simulation of High Voltage using computer control system SCADA.
LAB 11: Study of air insulation capacity at different pressure conditions.
LAB 12: Sustained low frequency test on a specimen of insulating material to determine and ensure, dielectric strength, dielectric losses of the insulating material.
LAB 13: Stress test using impulse voltages that simulate lightning strokes and switching surges
LAB 14: Advanced impulse testing systems to analyze the response of high voltage systems
LAB 15: Advanced AC and DC High Voltage testing systems to analyze the response of high voltage systems

EPT457: Power Systems Analysis & Stability

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	60	15	25

Requisites

- Prerequisites: GEN113 AND EET211 AND EPT342

Course Description

The stability of power systems ensures they can function normally upon being subject to different disturbances. The students will learn to apply techniques for power flow analysis and conduct short circuit studies on power systems. The course also enables the students to acquire knowledge of the dynamic behavior of the power system small and large disturbances and learn techniques to enhance the stability of power system. This course covers the need for system planning and operational studies, components representation, single line diagram, per unit quantities, impedance diagram, reactance diagram, network graph, bus incidence matrix, primitive parameters, bus admittance matrix from primitive parameters; representation of off-nominal transformer, bus classification, formulation of power flow problem in polar coordinates. The topics include power flow solution using Gauss-Seidel method, handling of voltage controlled buses, power flow solution by Newton Raphson method; assumptions in short circuit analysis - symmetrical short circuit analysis using Thevenin's theorem; bus Impedance matrix building algorithm (without mutual coupling) – symmetrical fault analysis through bus impedance matrix; post fault bus voltages, fault level, symmetrical components - sequence impedances - sequence networks. It also covers the analysis of unsymmetrical faults at generator terminals, LG, LL, and LLG, an unsymmetrical fault occurring at any point in a power system, classification of power system stability, rotor angle stability, swing equation, swing curve power-angle equation, equal area criterion, critical clearing angle, and time. This course provides Lectures, theoretical assignments, and presentations.

References

Grainger, B. W. J. S. (2020). Power System Analysis by Grainger (1994-07-30). McGraw Hill Education.
https://sites.google.com/site/eeenotes2u/courses/power-system-analysis-stability
(PDF) Power-Systems-Control-and-Stability-2nd-Ed-by-P-M-Anderson-a-a-Fouad.pdf | Rocío Venegas - Academia.edu
BCAD.INFO PDF free online compression - COMPRESS-PDF.BCAD.INFO

Learning Outcomes

CLO 1: Design the model for power system under steady state operating condition and understand iterative techniques for power flow analysis
CLO 2: Make short circuit studies on power system, stability problems in power system
CLO 3: Distinguish Fault analysis, various power system components and conduct power flow, short circuit, and stability studies.
CLO 4: Evaluate behavior of synchronous generator for different disturbances.

EPT458: Selected Topic in Electrical Power II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	60	15	25

EPT491: EPT Project III

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	4	240			75	0	25

Requisites

- Prerequisites: EPT292 AND EPT292

Course Description

This course enables the students to exercise some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. Further, they do market surveys about raw materials, components or finished products and identify the ethical societal and environmental issues related to the project (if there are any). The student also develops the ability to design, implement and test systems, hardware, or software. This course includes planning the tasks to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. Through this course, the student develops creativity, initiative, and capacity to perform. The leadership, supervisory, planning, and organizational skills are integrated into the learning objectives of this course. The projects has a detailed project proposal, which is executed or implemented within the time allocated, simultaneously maintaining a logbook, periodically monitored by the professor mentor. Projects are chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is to be prepared as the project progresses, which is to be submitted after the project is over. The student acquires the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1: Assess the impact of the project on society (if there is any)
CLO 2: Conduct Feasibility studies, Design projects, and Market surveys about raw materials, components or finished products
CLO 3: Design, plan and propose a project according to user requirements.
CLO 4: Apply project development methodologies appropriate to the project
CLO 5: Collaborate with team members to develop the prototype of the Application
CLO 6: Identify the ethical societal and environmental issues related to the project (if there are any)
CLO 7: Communicate project ideas and current work achievements clearly through technical report and presentations.

EPT492: EPT Project IV

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	4	240			75	0	25

Requisites

- Prerequisites: EPT491 AND EPT491

Course Description

This course enables the students to exercise some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. In this course, the students apply the knowledge gained during the program to design and prototype a software application that meets user needs and expectations. Further, they evaluate the impact of the product or system or process on society and draw conclusions. This course includes planning the tasks which are to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. Through this course, the student develops creativity, initiative, and capacity to perform. The student develops leadership and supervision skills which are integrated into the learning objectives of this course. The projects have a detailed project proposal, which is executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the professor mentor. Projects are chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is prepared as the project progresses, which is submitted after the project is over. The students acquire the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1: Demonstrate the ability to apply the knowledge to design and prototype a software/hardware application that meets user needs and expectations.
CLO 2: Design the project acquiring and applying new knowledge through literature review.
CLO 3: Design computing/hardware solutions considering economical, environmental, cultural, global impact and technical aspects.
CLO 4: Assess the impact of technical and system constraints to select optimal solutions.
CLO 5: Evaluate the impact of the product or system or process on society and draw conclusions.
CLO 6: Demonstrate teamwork through regular formal team meetings, project management, class presentations, and a final design presentation.
CLO 7: Assess the ethical and legal impact of the implemented product or system or process.
CLO 8: Write a technical report in a standard format and give an oral presentation.
CLO 9: Design and implement the project with modern engineering tools and software.

Basic Engineering Science

GEN011: Mathematics 0

Contact Time				CH	SWL	Exams Time		Marks		

LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	0	120		60	40	20	40

Course Description

Provide basic math knowledge like: Basic algebra, including solving equations, inequalities. Geometry, including the properties of shapes and figures. Trigonometry, including the relationships between angles and sides of triangles. Probability and statistics, including the basics of probability theory and how to collect and analyze data.

GEN111: Applied Mathematics I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	120	0	300	4	150	90	120	40	20	40

Requisites

- Prerequisites: GEN011

Course Description

An introductory level Mathematics course that is essential for all Engineering programs as it provides students quantitative and analytic skills in a science and engineering context. This course introduces the theory and techniques of single variable differential and integral calculus. The emphasis is on problem solving in a science and engineering context. Topics include functions and their limits, continuity, limits involving infinity, asymptotes, derivatives and rate of change, computation of derivatives: power rule, product rule, quotient rule, chain rule, derivatives of trigonometric functions, derivatives of algebraic, logarithmic, and exponential functions. The techniques of integration, indefinite and definite integrals, integration by simple substitution, area between curves, integration by parts, integration by trigonometric substitution, and integration by partial fractional decoposition.

References

J. Stewart, Calculus Early Transcendentals, 8th Edition.G. B. Thomas, Thomas Calculus, 14th Edition, Pearson.

Learning Outcomes

CLO 1: Solve equations and inequalities including absolute value operator. CLO 2: Recognize the notion of functions, graph some basic functions, and find the domain and range. CLO 3: Use graphical and algebraic methods to determine the limits and continuity of a function to solve related problems.
CLO 4: Define the derivative of a function and apply the techniques of differentiation to solve engineering-related problems.
CLO 5: Apply fundamental single variable techniques of integration to evaluate integrals using integration by parts, trigonometric substitution, partial fractional decomopsition to solve engineering problems.
CLO 6: Apply concepts in solving area problems in engineering-related fields.

GEN112: Applied Discrete Mathematics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	40	20	40

Course Description

Five important themes - mathematical reasoning, combinatorial analysis, discrete structures, algorithmic thinking and modeling - are needed in Computer Science and Information Technology. Students learn the fundamentals of logic, Fundamental principles of counting, set theory, relations and functions, graphs, trees and sorting, shortest path, and minimal spanning trees algorithms. The topics include the foundations: logic and proofs, basic structures, sets, functions, sequences, sums, Venn diagram, Cartesian product of two sets, Distributive law, De Morgan law. The course covers basic structures: matrices, submatrix, types of matrices (symmetric, square, diagonal matrices, singular and non-singular matrix), matrix operations, and rank of matrix. The topics include algorithms and growth of functions, number theory and cryptography, induction and recursion, the basics of counting and pigeonhole principle, permutations and combinations, discrete probability, recurrence relations, n-ary relations and their applications, Graph theory, graph, multi-Graph, complete Graph, bi Graph, degree, isomorphic graph, Euler graph, Hamiltonian graph, bipartite graph. The course further includes introduction and applications of trees, introduction and applications of trees, Boolean functions and logic gates; basic Concepts, propositions or statements, truth table, connectives and compound Propositions, implication, bi-conditional of connectives, converse, inverse and contra positive of an implication, tautology, logical equivalence, switching circuits, group and subgroup; binary operations, properties of binary operations, semi group, monoid, group, subgroups and other groups. Basics of data analysis are also covered in this course. The topics include data and statistical Data, frequency distribution, graphical representation, measure of the central tendency, measure of dispersion, kurtosis, skewness. Lectures, theoretical assignments, in-class discussions, seminars, practical software labs are used to deliver the course.

References

Kenneth Rosen, (2019) Discrete Mathematics and Its Applications, McGraw-Hill Higher
Susanna S. Epp, (2019) Discrete Mathematics with Applications, Cengage Learning.
Jenkyns, Tom A., Stephenson, Benjamin David, (2018) Fundamentals
https://www.youtube.com/watch?v=p2b2Vb-cYCs&list=PLBlnK6fEyqRhqJPDXcvYlLfXPh37L89g3
https://www.youtube.com/watch?v=tyDKR4FG3Yw
https://www.youtube.com/watch?v=96fLrtyAiD8&list=PL6dL3ACWCL8fIB2l-UQNQbqhANl8g3avL

Learning Outcomes

CLO 1: Identify and describe the problems of set theory to differentiate between functions and relations. CLO 2: Explain abstract algebra, posets, lattices, Boolean algebra and their application in computer science. CLO 3: Apply mathematical logically valid forms of arguments, to avoid logical errors. CLO 4: Describe the concepts of simple and strong mathematical induction, pigeonhole principle and permutations and combinations. CLO 5: Explain the basics of Data analysis.

Tutorials

LAB 1: Introduction to R software and learn how to create vectors, lists, matrices, arrays, factors, and data frames in R.
LAB 2: A. Write a program to prove that sqrt (2) is irrational. B. Write a program to check if the given number is prime or not. C. Write a program to check if the given year is a leap year or not.
LAB 3: A. Write a program to find the count of digits in a number. B. Write a program to find the sum of the digits of a number until the sum is reduced to a single digit. C. Write a program to find Armstrong numbers.
LAB 4: A. Write a program to swap elements of an array. B. Write a program to find the sum and average the elements of an array. C. Write a program to remove duplicate elements from array.
LAB 5: A. Write a program to find the union of A = {2, 3, 4} and B = {3, 4, 5}. B. Write a program to find the intersection of A = {6, 7, 8} and B = {7, 8, 9}. C. Write a program to prove that A = {1, 3, 5, 7, 9} and B = {2, 4, 6, 8} are disjoint sets.
LAB 6: A. Write a program to add, subtract and multiply two 3 X3 matrices. B. Write a program to find the determinant of a 3 X 3 matric. C. Write a program to find the inverse of a 3 X 3 matric.
LAB 7: A. Write a program to find GCD and HCF of two numbers. B. Write a function that takes two parameters n and k and returns the value of Binomial Coefficient C(n, k). For example, your function should return 6 for n = 4 and k = 2, and it should return 10 for n = 5 and k = 2. C. Write a program to find count of all sub-arrays whose sum is divisible by K?
LAB 8: A. Write a program to reverse a given list. B. Write a program to find the nth term of the Fibonacci series. C. Write a program to find the factorial of a given number by using recursion.
LAB 9: A. Write a program to find the length of longest subsequence present in given two sequences. B. Write a program to print the longest repeating subsequence in a given string. C. Write a program to find the length of the longest subsequence of a given sequence.
LAB 10: Write programs for: A. In how many ways can we select a team of 4 students from a given choice of 15? B. In how many ways can a group of 5 members be formed by selecting 3 boys out of 6 boys and 2 girls out of 5 girls? C. How many words can be formed by using 3 letters from the word “DUBAI”?
LAB 11: A. Write a program to generate random numbers. B. Write a program to generate random numbers in a range. C. Write a program to generate random numbers using Probability Distribution Function.
LAB 12: A. Write a program to find nth term of given recurrence relation. B. Write a program to find nth term of the series 5, 2, 13 41. C. Write a program to compute combinations using recurrence relation for nCr
LAB 13: A. Write a program to create a binary tree. B. Write a program to read the elements of a tree. C. Write a program to count the number of elements in a tree.
LAB 14: A. Write a program to implement AND gate through product method. B. Write a program to implement OR gate using + operator. C. Write a program to implement NOT and NAND gate using if-else statement.
LAB 15: LAB Final Exam

GEN113: Applied Mathematics II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	120	0	300	4	150	90	120	40	20	40

Requisites

- Prerequisites: GEN111

Course Description

A fundamental course in mathematics that develops students' quantitative and analytical abilities in the context of science and engineering. The course includes vectors, lines, and planes in three dimensional spaces. The course includes matrices and their properties. The course covers determinant, matrix inverse, solving a system of linear equations, eigenvalues, eigenvectors, linear transformation, and solving linear recurrence relations. The course covers separable, homogeneous, exact, linear, and Bernoulli's differential equations of first order. The course also covers solutions of higher order linear differential equations with constant coefficients and their applications. In addition, the course includes properties of Laplace transform and solutions of differential equations by Laplace transform. Further topics include first shifting theorems, change of scale property, Laplace transform of derivative and integrals, multiplication by integer powers of t, division by t, evaluating integrals using Laplace transform, Inverse Laplace transform, convolution theorem, and Laplace transform of periodic functions.

References

Kreyszig, E. (2020). Advanced Engineering Mathematics. Wiley. Edwards, C. H., Penney, D. E., Calvis, D., & Penney, D. E. (2018). Differential equations & linear algebra. Pearson Prentice Hall.

Learning Outcomes

CLO 1: Identify vectors, lines, and planes in three dimensional spaces.
CLO 2: How to deal with matrices and apply their properties.
CLO 3: Solve a system of linear equations
CLO 4: Find the eigenvalues and eigenvectors of square matrices.
CLO 5: Apply linear transformation to engineering-related applications and solve linear recurrence relations. CLO 6: Introduce the definition and main properties of differential equations.
CLO 7: Solve basic types of first order ordinary differential equations [separable, homogeneous, exact, linear, and Bernoulli's].
CLO 8: Find solutions of non-homogeneous second order differential equations with constant coefficients. CLO 9: Use Laplace transform to solve differential equations and some engineering-related problems
CLO 10: Use the necessary skills required to find the complete solution of higher order differential equations to solve engineering-related problems.

GEN121: Physics for Electrical Engineering

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	120	360	4	180	90	120	40	20	40

Course Description

A Physics course that is essential for all Engineering programs as it provides students with quantitative and analytic skills for solving problems and analyzing data in all technical areas. This course covers the units and dimensions for different physical quantities, converting units, standards, and the SI system. It also covers wave and oscillations, simple harmonic motion (SHM), object attached to a spring, time period, frequency, phase, energy of SHM, simple pendulum; concepts of damped and forced harmonic oscillations; quality factor, resonance. Further the course covers the law of conservation of electric charge, the distinction between insulators, semiconductors, and conductors, solving problems involving Coulomb's law and vectors. The course also aims to understand the concept of electric field lines and apply Gauss' law, understand the relation between electric potential and electric field, evaluate the electric potential due to point charges, understand the meaning of capacitance and dielectric constant, evaluate the electric energy stored in a capacitor, understand the notion of electric battery, electric current, Ohm's law, resistance, resistivity, conductivity, electric power, power in household circuits, alternating current, ammeters, and voltmeters. In addition, the course aims to understand the notion of magnets and magnetic fields, evaluate the force on a current -carrying wire in a megnetic field and the force on an electric charge moving in a megnetic field, evaluate the magnetic field due to a current-carrying long straight wire and the force between two current-carrying long straight wires. Another important part in the course is the notion of solenoids and electromagnets, applying Ampere's law, evaluating the torgue on a current loop placed in an external magnetic field, understanding the notion of Faraday's law of induction, the electromotive force induced in a moving conductor in the presence of a uniform magnetic field, electric generators, transformers, and power transmission lines, mutual and self inductance, and energy stored in the magnetic field.

References

D. C. Giancoli, Physics: Priciples with Applications, 6th ed. Pearson.

Learning Outcomes

CLO 1: Learn units and dimensions for different physical quantities, converting units, standards, and the SI system.
CLO 2: Understand dampled and undamped simple harmonic motion (SHM) and differentiate between transverse and longitodinal waves.
CLO 3: Understand the meaning of energy transported by a wave and intensity of a wave, reflection and transmission of waves, interference and superposition, standing waves, resonance, and modes.
CLO 4: Understand the law of conservation of electric charge.
CLO 5: Differentiate between insulators, semiconductors, and conductors. CLO 6: Solve problems involving Coulomb's law and vectors.

CLO 7: Understand the concept of electric field lines and apply Gauss' law. CLO 8: Understand the relation between electric potential and electric field and evaluate the electric potential due to point charges.
CLO 9: Understand the meaning of capacitance and dielectric constant and evaluate the electric energy stored in a capacitor. CLO 10: Understand the notion of electric battery, electric current, Ohm's law, resistance, resistivity, conductivity, electric power, power in household circuits, alternating current, ammeters, and voltmeters. CLO 11: Understand the notion of magnets and magnetic fields and evaluate the force on a current-carrying wire in a megnetic field and the force on an electric charge moving in a megnetic field. CLO 12: Evaluate the magnetic field due to a current-carrying long straight wire and the force between two current-carrying long straight wires. CLO 13: Understand the notion of solenoids and electromagnets, apply Ampere's law, and evaluate the torgue on a current loop placed in an external magnetic field. CLO 14: Understand the notion of Faraday's law of induction, the electromotive force induced in a moving conductor in the presence of a uniform magnetic field, electric generators, transformers, and power transmission lines. CLO 15: Understand mutual and self inductance and energy stored in the magnetic field.
CLO 16: Explain physical measurement equipment, perform experiments, interpret data and draw results and conclusions.
CLO 17: Write lab reports and present results.

Tutorials

LAB 1: Lab Induction, error analysis, significant figures, least count and introduction to instruments, course policies, and reports.
LAB 2: Determine the density of material of the given wire.
LAB 3: Determine the frequency of AC mains. LAB 4: Determine the frequency of an electrically maintained tuning fork by Melde’s method.
LAB 5: Determine the value of acceleration due to gravity (“g”) in the laboratory using bar pendulum.
LAB 6: Determine the value of acceleration due to gravity (“g”) in the laboratory by Kater’s reversible pendulum. LAB 7: Study Hook’s law and simple harmonic motion.
LAB 8: Parallel-plate capacitor (determination of the dielectric constant of its dielectric material).
LAB 9: Plot graph showing the variation of magnetic field with distance along the axis of a circular coil-carrying current, and hence estimate the radius of the coil.
LAB 10: Determine the charge-to-mass ratio for the electron by Thomson’s method using bar magnets
LAB 11: LAB Final Exam

GEN122: Principles of Physics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	40	20	40

Course Description

An introductory level Physics course analyzing science pedagogy and practices for developing formative assessments.After providing the necessary mathematical foundation, students are introduced to the fundamental principles, laws, and concepts of mechanics (kinematics, 1-D, 2-D motion, work, and energy with applications). The topics include Introduction of mathematical tools, SI units, Dimensional analysis. Motion in one dimension, position, and displacement. Average, instantaneous speed and velocity, Uniform acceleration, equations of motion, free-fall acceleration equations. Vectors and scalars definition, unit vector, Resolution of vectors, addition, and subtraction of vectors geometrically and analytically. Scalar and vector product of two vectors. Applications. Motion in two dimensions, Inertial and non- inertial Frame of reference, Newton’s Laws of motion, Projectile motion description and equations. Applications. Concept of work, energy and Power, Work-energy theorem, work done by variable and non-variable forces, Conservative and non-conservative forces. Hooks law, spring forces, determination of elastic potential energy. It also covers Wave and Oscillations, Simple harmonic motion (SHM), Object attached to a spring, time period, frequency, phase, energy of SHM, Simple pendulum. Concepts of damped and forced harmonic oscillations. Quality factor, resonance, Photoelectric effect, Wave particle duality, De-Broglie matter waves, Heisenberg uncertainty principle, Applications of uncertainty principle, Applications, Basic elements of Semiconductor Physics are also introduced such as Intrinsic and Extrinsic Semiconductors, p-n junction diode, V-I characteristics of p-n junction diode, Zener Diode. This is attributed to the use of existing theories to solve problems. Additionally, students are expected to draw valid conclusions from lab experiments conducted.

References

Halliday D, Resnick R and Walker J. (2018), Fundamentals of Physics, John Wiley, and Sons
Young & Freedman, (2019) University Physics with Modern Physics, Pearson Education (US)
Alan Giambattista (2019) College Physics with an Integrated approach to forces and kinematics, McGraw-Hill
Joel R. Hass, Christopher E. Heil, Maurice D. Weir. (2018) Thomas' Calculus, 14th edition, Pearson
https://www.youtube.com/watch?v=KOKnWaLiL8w
https://www.powershow.com/viewht/639099-MjM2Y/Halliday_Resnick_Walker_Fundamentals_of_Physics_8th_edition_powerpoint_ppt_presentation
https://www.youtube.com/watch?v=8kcvyoHsXrw

Learning Outcomes

CLO 1: Explain basic physics laws in mechanics and find solutions for one-dimensional and two -dimensional problems and communicate the results.

CLO 2: Calculate the work related to kinetic energy, potential energy, and mechanical power to solve related problems and communicate the results orally/written in a team.
CLO 3: Explain the concepts of modern physics and use basic knowledge of wave mechanics to solve problems
CLO 4: Review the various applications of semiconductors and P-N junction diode
CLO 5: Explain physical measurement equipment, perform experiments, interpret data, and draw results and conclusions.
CLO 6: Write lab reports and present experimental results.

Tutorials

LAB 1: Lab Induction, error analysis, significant figures, least count and introduction to instruments, course policies, reports
LAB 2: Determine the moment of inertia of a flywheel about its own axis of rotation and the density of the material of a given wire.
LAB 3: Determine the frequency of AC mains.
LAB 4: Determine the frequency of an electrically maintained tuning fork by Melde's method.
LAB 5: Determine the value of acceleration due to gravity ("g") in the laboratory using bar pendulum and by Kater's reversible pendulum.
LAB 6: Study Hook's law and simple harmonic motion (SHM).
LAB 7: Parallel-plate capacitor (determination of the dielectric constant of its dielectric material).
LAB 8: Plot graph showing the variation of magnetic field with distance along the axis of a circular coil-carrying current, and hence estimate the radius of the coil.
LAB 9: Determine the charge-to-mass ratio for the electron by Thomson's method using bar magnets.
LAB 10: LAB Final Exam.

GEN123: Heat Transfer and Thermodynamics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	0	240	3	120	90	120	40	20	40

Course Description

The first part of the course is concerned with the atomic theory of matter, temperature, thermometers, thermal equilibrium, the zeroth law of thermodynamics, thermal expansion, absolute temperature, the ideal gas law, and in terms of molecules, the kinetic theory, and the molecular interpretation of temperature. The second part of the course covers the meaning of heat as energy transfer, internal energy, specific heat, calorimetry, latent heat, and heat transfer by conduction, convection, and radiation. The third part of the course includes the first law of thermodynamics, thermodynamic processes as related to the first law of thermodynamics, the notion the second law of thermodynamics, heat engines, refrigerators, air conditioners, heat pumps, and entropy as related to the second law of thermodynamics.

References

D. C. Giancoli, Physics: Priciples with Applications, 6th ed. Pearson.

Learning Outcomes

CLO 1: Understand the atomic theory of matter and identify temperature and thermometers.
CLO 2: Understand thermal equilibrium, the zeroth law of thermodynamics, thermal expansion, absolute temperature, the ideal gas law, and in terms of molecules, the kinetic theory, and the molecular interpretation of temperature.
CLO 3: Understand the meaning of heat as energy transfer, internal energy, specific heat, calorimetry, latent heat, and heat transfer by conduction, convection, and radiation.
CLO 4: Understand the first law of thermodynamics and thermodynamic processes as related to the first law of thermodynamics.
CLO 5: Understand the notion the second law of thermodynamics, heat engines, refrigerators, air conditioners, heat pumps, and entropy and the second law of thermodynamics.

GEN131: Principle of Chemistry & Material Science

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	120	300	4	150	90	120	40	20	40

Course Description

This course offers a comprehensive exploration of the fundamental principles of chemistry and materials science. The course is organized into three modules. The first module introduces fundamental principles of chemistry, covering topics such as atomic structure, chemical bonding, thermodynamics, and chemical kinetics. This section provides an exploration of atomic configurations, molecular behavior, and the factors influencing chemical reactions. Key concepts include equilibrium, entropy, and reaction rates. In the second module, the focus shifts to materials science. Here, crystal lattices, mechanical properties of metals and alloys, and the characteristics of ceramics, glasses, and polymers are investigated. Practical examples are used to illustrate material structures and properties. Students also learn about state diagrams, heat treatments, and surface treatments, enhancing their comprehension of material behavior under various conditions. The final module explores the practical applications of different materials in engineering and industry, with a particular emphasis on energy materials. This section examines how these materials are utilized in alternative energy systems, such as hydrogen production, electrochemical generators, and photovoltaic modules.

References

J.M. Smith, H.C. Van Ness, M.M. Abbott, Introduction to Chemical Engineering Thermodynamics, Publisher: McGraw-Hill, Year of Publication: 2005, ISBN: 978-0-07-124708-5; R.M. Felder, R.W. Rousseau, Elementary Principles of Chemical Processes, Publisher: Wiley, Year of Publication: 2000; Callister, W. D., & Rethwisch, D. G. (2022a). Fundamentals of Materials Science and Engineering: An integrated approach. John Wiley & Sons, Inc ; Askeland, D. R., Wright, W. J., Bhattacharya, D. K., & Chhabra, R. P. (2022). The Science and Engineering of Materials. Cengage.

Learning Outcomes

CLO 1: Demonstrate an understanding of fundamental chemical principles, including atomic structure, chemical bonding, and molecular interactions.
CLO 2: Describe the properties and behavior of different elements, compounds, and chemical reactions
CLO 3: Demonstrate an understanding of the fundamental principles of material science, including atomic structure, crystallography, and phase transitions.
CLO 4: Identify the properties and behavior of different classes of materials, such as metals, polymers, ceramics, and composites.
CLO 5: Explain the relationship between material structure, properties, processing methods, and performance.
CLO 6: Apply chemical principles to solve basic problems in stoichiometry, chemical equilibrium, and thermodynamics.
CLO 7: Apply material science concepts to analyze and solve basic engineering problems related to material selection, design, and processing.
CLO 8: Perform laboratory experiments safely and accurately, following proper procedures and techniques.
CLO 9: Analyze experimental data and draw conclusions based on chemical principles and empirical evidence.

Tutorials

TUT 1: Hands on exercises on chemical bounding
TUT2: Hands on exercises on balancing chemical equations
TUT 3: hands on exercises on chemical kinetics, Reaction rates.

Laboratories

LAB1: Fundamental Principles of Chemistry Acid-base reaction CBIN30-CBIN31-47A-E-BC-0.pdf (elettronicaveneta.com).
LAB 2: Practical experiments on PH, Ph control PHCBP-26D-E-PC-0.pdf (elettronicaveneta.com).
LAB3: Le Chatelier's principle. Avogadro’s number and atomic mass CBIN61-47A-E-BC-0.pdf (elettronicaveneta.com).
LAB 4: Atomic Spectroscopy and Identifying Elements CAV46-47A-E-AC-0.pdf (elettronicaveneta.com)
LAB 5: Investigating Thermochemical Properties; LAB 6: Chemical Bonding and Molecular Modeling
LAB 7: Crystal Structure Determination
LAB 8: Characterization of Ceramics and Polymers.

GEN211: Probability & Statistics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	60	300	3	150	90	120	40	20	40

Requisites

- Prerequisites: GEN111

Course Description

Knowledge of statistics is essential for all engineers and technologists in order to draw conclusions while dealing with large data like results obtained from testing various samples, information obtained after conducting large scale surveys etc. Students study basic concepts of statistics, probability, probability distribution, curve fitting, measures of dispersion, theory of sampling, testing of hypothesis etc. This course contains the following topics: average, descriptive statistics, probability and statistics, conditional probability, Bayes theorem and its applications, expected value of a random variable, probability and density functions, Binomial distributions, expected values of Binomial distribution, Poisson distributions, normal Distributions.

The student learning includes various measures of dispersion, minimal property of mean deviation, root mean square deviation, variance and standard deviation, moments about mean, origin and any point; skew, kurtosis, Pearson's β and γ – coefficients, curve fitting, method of least squares.
The course covers fitting of straight lines, fitting of second-degree parabola, fitting of a polynomial of kth degree, change of origin, selection of type of curve to be fitted, significance of measuring correlation, types of correlation, methods of measuring correlation, regression analysis, lines of regression, standard error of estimate census and sampling method.
The students also studies merits and limitation of sampling, sampling and non-sampling errors, reliability of samples, central limit theorem, normal test (Z test), t – test for single mean and difference of means, Chi- Square Test, F- test. Lectures and solving multiple numerical practical problems, practical software labs are key learning aids of this course.

References

Balakrishnan, N., Koutras, M.V. and Politis, K.G. (2019) Introduction to Probability: Models and Applications, Wiley Publications, New York, USA.
Meyer, M.C. (2019) Probability and Mathematical Statistics: Theory, Applications, and Practice in R, Society for Industrial and Applied Mathematics, Philadelphia, Pennsylvania, United States of America.
https://www.youtube.com/watch?v=uhxtUt_-GyM&list=PL1328115D3D8A2566
https://www.youtube.com/watch?v=dkpk5iPsiYM&list=PL3nE1Yo1b4CpcEOgS3s80YUys7nGRqVPM

Learning Outcomes

CLO 1: Explain various concepts related to probability and probability distributions like binomial, Poisson and normal distributions including conditional probabilities.
CLO 2: Apply the concept of correlation to study the relationship between two or more variables.
CLO 3: Relate the concept of sampling theory and testing of hypothesis to study various practical problems.
CLO 4: Analyze various measures of dispersion like range, mean deviation, quartile deviation and standard deviation including correlation and regression analysis.

GEN241: Engineering Mechanics: Static and Dynamics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	60	60	300	4	180	90	120	40	20	40

Course Description

This course provides a comprehensive overview of mechanical engineering principles. The first module focuses on statics, where single beam systems are taken as practical examples to demonstrate the concepts. Concepts of deformation, stress, and constitutive relationships are introduced in general terms, with practical examples prioritized over rigorous derivation of analytical expressions. Notions of strength verification and equilibrium stability are discussed with an emphasis on practical applications. The second module focuses on dynamics, covering topics such as kinematics and dynamics of material points, rigid bodies, and systems of rigid bodies. The course topics include constraints, reaction forces, power balance, and forces exchanged between solids, including friction and rolling resistance. Additionally, fluid-solid interaction forces, aerodynamic forces, and an overview of hydrostatic and hydrodynamic lubrication are explored. The module also covers dynamics of single-degree-of-freedom machines, gear transmissions, flexible transmissions, and vibrations of single-degree-of-freedom systems, including free and forced motion.

References

K. J. Waldron, G. L. Kinzel, Kinematics, Dynamics, and Design of Machinery, Editore: Wiley & Sons

Learning Outcomes

CLO 1: Understand principles of static and dynamic mechanics, including equilibrium, force analysis, and motion.
CLO 2: Describe the characteristics of various types of forces and their effects on rigid bodies and particles.
CLO 3: Explain the principles governing the motion of particles and rigid bodies in both linear and angular motion.
CLO 4: Understand deformation, stress, and constitutive relationships in real-world contexts.
CLO 5: Analyze forces and reactions between solids, considering friction and rolling resistance.
CLO 6: Recognize fluid-solid interaction and aerodynamic forces, and principles of lubrication.
CLO 7: Comprehend dynamics of machines, gear transmissions, and vibrations in mechanical systems
CLO 8: Apply static equilibrium principles to analyze and solve engineering problems involving forces acting on structures and mechanisms.
CLO 9: Apply dynamic principles to analyze the motion of particles and rigid bodies subjected to forces and moments.
CLO 10: Use mathematical modeling and computational tools to predict the behavior of mechanical systems under various loading conditions.
CLO 11: Evaluate the stability and structural integrity of engineering systems by analyzing internal and external forces and moments.

Tutorials

TUT 1: Numerical exercises on static single beam systems: TUT 2: Numerical exercises on stress and deformation; TUT 3: Numerical exercises on point dynamics; TUT 4: Numerical exercises on rigid body dynamics; TUT 5: Hands-on exploration of single-degree-of-freedom machines (belts and gears).

Laboratories

LAB 1: Practical experiments on material stress and deformation; LAB 2: Statics of Beams - Load Testing and Deflection Measurement; LAB 3: Stress-Strain Relationship and Material Testing; LAB 4: Kinematics and Dynamics of a Simple Pendulum.

GEN311: Applied Mathematics III

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	120	0	300	4	150	90	120	40	20	40

Requisites

- Prerequisites: GEN113

Course Description

The course aims to study real functions of several variables and some important engineering applications (linearization, directional derivatives, Lagrange's multiplier optimization, and spherical and cylindrical coordinates). Also, the course inlcludes vector functions of a real variable or several real variables and some important engineering applications (line and surface integrals of scalar fields and Stoke's, Gauss' theorems, and Maxwell's equations). The course also includes an introduction to complex numbers and its properties, Taylor and Laurent series, Cauchy integral theorem, singularity and residue theorem and using the theorem in evaluating different Integrals, and conformal mapping. The course also includes solving equations numerically (bisection method –fixed point iteration–Newton's method –secant method), systems of equations (Gaussian elimination –LU factorization–sources of errors –PA=LU factorization, and iterative methods –non linear system of equations), interpolation (interpolating functions –interpolation error), and fitting data by least squares.

References

J. Stewart, Calculus Early Transcendentals, 8th Edition. C. A. Balanis, Advanced Engineering Electromagnetics, 2nd ed. Hoboken.
NJ, USA: Wiley, 2012.Erwin Kreyszig " Advanced Engineering Mathematics" John Wiley Publisher, 2011. Numerical Analysis, 2nd edition, by Timothy Sauer.

Learning Outcomes

CLO 1: Study real functions of several variables and some important engineering applications. CLO 2: Understand vector functions of a real variable or several real variables and some important engineering applications. CLO 3: Study complex numbers and its properties, Taylor and Laurent series, Cauchy integral theorem, singularity and residue theorem and using the theorem in evaluating different Integrals, and conformal mapping. CLO 4: Study complex numbers and its properties, Taylor and Laurent series, Cauchy integral theorem, singularity and residue theorem and using the theorem in evaluating different Integrals, and conformal mapping. CLO 5: Learn how to solve equations numerically using bisection method, fixed point iteration, Newton's method, and secant method. CLO 6: Solve systems of equations using Gaussian elimination and LU factorization, understand sources of errors (ill conditioning and swamping), identify the condition number, use partial pivoting to solve the swamping problem, and apply the PA=LU factorization to solve a linear system of equations. CLO 7: Apply iterative numerical methods to solve linear system of equations (Jacobi, Gauss-Seidel, and successive over relaxation methods) and multivariable Newton's method to solve a system of non-linear equations. CLO 8: Learn interpollating functions, interpolation error, and fitting data by least squares.

GEN312: Game Mathematics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	180		360	4	120	90	120	40	20	40

Requisites

- Prerequisites: GEN113

Course Description

This course focuses on specialized mathematics for game development. Students explore quaternions for smooth 3D rotations (e.g., camera or character orientation), avoiding gimbal lock issues common with Euler angles. Linear algebra is deepened, covering vector spaces, eigenvalues, and projections, applied to graphics (e.g., shadow mapping) and physics (e.g., collision normals). Geometry topics include parametric curves (e.g., Bézier curves for paths) and intersection tests (e.g., ray-sphere for picking). Labs involve implementing these concepts in a game engine, such as a quaternion-driven camera system or a raycasting demo in Unity/C++. Lectures use examples like "Super Mario Galaxy" (spherical geometry) or "DOOM" (raycasting) to illustrate practical applications.

References

Dunn, F., & Parberry, I. (2011). *3D Math Primer for Graphics and Game Development* (2nd ed.). CRC Press.
Lengyel, E. (2011). *Mathematics for 3D Game Programming and Computer Graphics* (3rd ed.). Cengage.

GEN321: Game Physics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	180		360	4	120	90	120	40	20	40

Requisites

- Prerequisites: GEN122

Course Description

This course explores physics simulation for games, blending theory with practical implementation. Students study kinematics (position, velocity, acceleration) and dynamics (forces, mass, momentum), applying them to game objects like falling platforms or projectiles. Collision detection and resolution are covered in depth, including bounding box and circle collisions, with response techniques like impulse-based reactions for realistic bounces. The course introduces rigid body dynamics, teaching students to simulate rotation (e.g., spinning objects) using torque and angular momentum. Lectures use examples from games like "Angry Birds" or "Portal" to illustrate concepts. Labs involve implementing physics in a game engine (e.g., Unity with C- or a custom C++ engine), creating demos like a ball rolling down a ramp with friction or a car with suspension. Optimization techniques, such as fixed timestep updates and spatial partitioning, ensure smooth performance.

References

Eberly, D. H. (2010). *Game Physics* (2nd ed.). CRC Press.
Bourg, D. M. (2001). *Physics for Game Developers*. O'Reilly.

Humanities Courses

CET151: Orientation to Field and Studies

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120			120	2	60	90	120	40	20	40

Course Description

This foundational course immerses students in the world of game programming and computer engineering technology. It begins with a detailed exploration of the history of video games, from early arcade systems to modern AAA titles, highlighting pivotal technological advancements (e.g., transition from 2D to 3D graphics). Students examine current industry trends, such as the rise of indie games, mobile gaming, and esports, alongside emerging technologies like virtual reality (VR) and cloud gaming. The course introduces the interdisciplinary nature of game development, covering the roles of programmers, designers, artists, and sound engineers, and how these collaborate in a studio environment. Lectures include case studies of successful games (e.g., "The Legend of Zelda," "Among Us") to illustrate development processes. Practical labs provide hands-on experience with beginner-friendly tools like Unity or Godot, where students create simple interactive scenes (e.g., a moving character or basic UI). Additional workshops cover academic skills, such as time management and research techniques, tailored to the game programming curriculum, preparing students for both technical and professional success.

HUM011: English 0

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	0	120		60	40	20	40

Course Description

The course provides a full package of basic vocabulary and grammatical rules at levels A1 and A2. The fundamental rules of pronunciation of vowels, diphthongs, and consonants are briefly overviewed. The course enables students to communicate confidently and effectively in different daily situations. Students will also be able to express themselves in small talks. Authentic materials are used in delivering the units along with critical thinking activities, problem solving, group discussions, projects, reflection, evaluation, and other activities.

References

Eales, F. & Oakes, S. (2015). Speakout Elementary 2nd edition. Pearson Education Limited.
Lambert, J, Latham-Koenig, C., Oxenden, C., and Seligson, P. (2018). English File Pre-Intermediate. Oxford University Press.

Learning Outcomes

CLO 1: To recognize everyday expressions and basic vocabulary in different situations.
CLO 2: To recognize very short reading texts such as notices, posters, ads, catalogues, menus, timetables, and brochures.
CLO 3: To develop fundamental writing skills such as writing short sentences, postcards, informal emails, and filling in forms of personal details.
CLO 4. To interact at a simple level by asking and answering questions on very familiar topics.
CLO 5: To introduce the fundamentals of English pronunciation such as the vowels, diphthongs, and consonants. CLO 6: Distinguish common words, phrases, and standard speech in listening to English conversations. CLO 7: To manage basic grammatical rules and structures such as articles, tenses, adjectives, and adverbs.

Lectures

Week 1: Greetings and introduce yourself: Ss learn how to communicate in short simple situations such as greeting others, introducing themselves and their friends, and learning vocabulary of countries, nationalities, jobs, and other personal details. (LO1,3, 4,5,7)
Week 2: Grammar & Pronunciation: practicing verb to 'be', indefinite articles, plural forms. Ss learn the difference between vowels, diphthongs, and consonants in general. (LO5, 7)
Week 3: Jobs and workplace: Ss write short sentences about jobs, workplace, family, and friends. (LO3, 7)
Week 4: Shopping and prices: Ss learn how to communicate in department stores and how to speak about material, size, colors, and prices of shopping stuff. (LO1, 4, 7)
Week 5: Daily routine & leisure time: introducing vocabulary and phrases describing daily routine and leisure time activities. Ss listen to people talking about their routines and hobbies. Ss write short sentences about their daily routine and hobbies. (LO1, 3, 7)
Week 6: At the restaurant / café: Ss do Role-play at the restaurant and café to manage conversations in this situation. Ss read online ads about hotels, restaurants, cafes and the meus of different restaurants. (LO1, 2, 4, 6)
Week 7: Revision & Oral Presentation (LO4)
Week 8: Mid-Term Exam
Week 9: On holiday: Ss write postcards and informal emails to their family and friends describing what they are doing on their holiday. (LO3, 7)
Week 10: Weekend plans: Ss listen to people talking about their weekend plans and discuss such plans. Ss write short sentences about their plans. Ss read timetables and ads about travel agencies. (LO1, 2, 4, 6, 7)
Week 11: At the hospital: Ss learn names of illnesses and describe health problems. They do Role-play to interact with doctors and nurses at a hospital. Ss learn how to ask for and give advice. (LO1, 4, 6, 7)
Week 12: Childhood and past events: using the Past Simple Tense to describe actions and habits in the past. Ss listen to people talking about their childhood, and then they write simple sentences to describe their childhood. (LO1, 4,6,7)
Week 13: Telephone calls and invitations: Ss learn how to make phone calls in English and make, accept, and refuse invitations. (LO3, 4, 6)
Week 14: Revision & Oral Presentation (LO4)
Week 15: Final Exam

HUM111: English Language I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Requisites

- Prerequisites: HUM011

Course Description

The units cover topics relevant to all domains of technology. Authentic materials are used in delivering the units along with critical thinking activities, problem solving, group discussions, projects, reflection, evaluation, and other activities. Printed-out booklets are handed in to students, and online forums are created for sustaining students' engagement as well. Supplementary materials are also available in case of more practice for developing students. Students' achievements are regularly assessed through formative evaluation techniques (weekly quizzes, oral discussions, online forums, reflection forms). Summative assessments are also conducted through mid-term and final exams.

References

Gandrabura, A. (2021). English for TECH.
Glendinning, E.H. (2207). Oxford English for Careers: Technology 1.
Lambert, J, Latham-Koenig, C., Oxenden, C., and Seligson, P. (2018). English File Pre-Intermediate. Oxford University Press.

Learning Outcomes

CLO 1: To recognize vocabulary and the jargon of different technological professions. CLO 2:To describe problems and offer solutions in technical and everyday language. CLO 3: To reflect on academic and technical learning process in English. CLO 4: To develop basic communicative writing skills. CLO 5: To conduct oral presentations about topics relevant to their academic studies and everyday situations reflecting conversational skills. CLO 6: To manage basic reading skills such as skimming and scanning. CLO 7: To practice active listening skills in English. CLO 8: To manage basic grammatical rules and structures required for students' academic and technical studies.

Lectures

WEEK 1: Introduction: Ss introduce themselves and recognize their new university in English. Oral conversations, written paragraphs, and online discussions are created.
Materials: Video, Pdf References, PPT, Authentic materials: exploring the university website and reading about the concept of Polytechnic education. Grammar: The Present Simple Tense (Los 1, 3, 4, 5, 8)
WEEK 2: Trending Technology: Ss. Read and listen to short texts about different technologies. Materials: Pdf References, PPT. Grammar: Future Tenses (LO1, LO6, LO7, LO8)
WEEK 3: Writing: Creating a professional Linkedin Profile. Materials: Pdf, PPT, (LO4)
WEEK 4: Programming Languages Technology: Ss read and have group discussions about the advantages and disadvantages of different programming languages. Using the online forum, students reflect on the topic and how it is presented in the classroom (LO3, LO5)
WEEK 5: Chatting in Tech.: Ss. Read tweets and chats about technology and ethics online. Grammar: Conditional IF 1st & 2nd. (LO6, LO8)
WEEK 6: Small Talk & Rapport: Ss. Have discussions and conversations to practice small talk in different situations and how to build a good rapport. (LO5)
WEEK 7: Revision & Oral Presentation & Online reflection (LO3, LO5)
WEEK 8: Mid-Term Exam
WEEK 9: Everyday Writing: Ss. Write formal and informal emails embedding steps, instructions, describing components. Materials: Pdf reference: Oxford English for Engineering. Authentic Materials: online websites. (LO4)
WEEK 10: English Listening Podcasts: Ss. Learn what podcasts are. They also listen to English podcasts of everyday matters and interests. Materials: Authentic English Podcasts on Telegram. (LO 7)
WEEK 11: Giving Advice: Ss. Are exposed to different problems and issues they may encounter every day. They learn how to express their opinions and give advice about solving such problems. Materials: Video, Pdf, PPT, (LO2)
WEEK 12: Academic writing: Ss. Write descriptive paragraphs and process paragraphs. Materials: Pdf reference: Effective Academic Writing 1. (LO4)
WEEK 13: There must be something wrong: Ss. are exposed to different tech. tools that are not working. They learn how to express problems and explain how to solve them. Authentic material: real objects or tools. PPT and video (LO2)
WEEK 14: Revision & Oral Presentation (LO3, LO5)
WEEK 15: Final Exam

HUM112: Safety

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60	0	120	180	2	90	90	120	40	20	40

Course Description

This course includes study of electric safety and prevention, hazards due to high voltage and current, probability analysis of getting shocked due to flash and spark, accident prevent mechanisms, primary and secondary shocks, medical analysis due to shock, safety precaution and prevention of shocks. It also includes the safety organization, its policy, procedure for auditing. Further the course covers safety measure for residential, agriculture pump installations, wiring and fitting for domestic applications, hazardous zones based on the equipment types, specifications, study of corona discharges, spark, and flashovers in equipment. The topics include personal protective equipment, issuing of clearance notice, safeguard procedures for operators to prevent the danger are discussed. The student learning includes risk of plant and equipment, its safety documentation, and the preliminary preparations followed. The student learns the fundamentals for fire initiation, fire alarm detection systems and installations, types of fire extinguishers, execution techniques. This course also includes the type of electrical faults like overload, short circuits, overcurrent in circuit Some introductions are given to the electrical safety organization like OSHA, IEEE, NRTL. This course introduces earth fault protection, earthing standards, and earth leakage circuit breakers. Lectures, theoretical assignments, exams, quizzes are used in this course.

References

John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, 'Electrical Safety Handbook, McGraw-Hill, New York, USA, 2005.
https://www.tutorialspoint.com/electrical_safety/index.htm
https://www.tutorialspoint.com/electrical_safety/electrical_safety_tutorial.pdf
https://www.tutorialspoint.com/electrical_safety/electrical_safety_tutorial.pdf

Learning Outcomes

CLO 1: Describe the electrical rules, safety followed in commercial, residential building and Industries.
CLO 2: Analyze the safety protocol followed in industry during installation and testing.
CLO 3: Examine the different hazardous zones based on the equipment specifications.
CLO 4: Distinguish the types of fire extinguisher and its applications.
CLO 5: Compare the various organizations like OSHA and determine the role in safety.

HUM113: German Language

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

HUM113: German Language is an introductory course designed for students with no prior knowledge of German. Through a dynamic and engaging curriculum, this course equips students with the foundational skills to navigate everyday situations in German. Students will develop proficiency in all four language skills: speaking, listening, reading, and writing.
The course emphasizes practical communication, allowing students to introduce themselves, ask for directions, express needs, and discuss daily routines. Beyond language acquisition, students will gain basic cultural awareness of German customs and traditions. By the end of the course, students will be able to hold simple conversations in German and possess a strong foundation for further language study.

Learning Outcomes

CLO 1: Recognize and understand basic German greetings, introductions, and everyday expressions.
CLO 2: Pronounce German sounds accurately and speak in short sentences about themselves, their families, and their daily routines.
CLO 3: Comprehend short spoken dialogues and announcements related to everyday situations.
CLO 4: Read and understand simple German texts focusing on familiar topics like greetings, numbers, and personal information.
CLO 5: Write basic sentences and short paragraphs about themselves, their families, and their daily activities.
CLO 6: Identify and use essential grammar structures like verb conjugations, basic sentence structure, and common prepositions.
CLO 7: Develop basic cultural awareness of German customs and traditions.

HUM114: Italian Language

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

HUM114: Italian Language is an introductory course designed for students with no prior knowledge of Italian. Through a combination of engaging activities, authentic materials, and interactive exercises, this course equips students with the fundamental skills to navigate everyday situations in Italian. Students will develop proficiency in all four language skills: speaking, listening, reading, and writing.
The course emphasizes practical communication skills, allowing students to introduce themselves, order food at a restaurant, ask for directions, and discuss their daily routines. In addition to language acquisition, students will gain basic cultural awareness of Italian customs and traditions. By the end of the course, students will be able to hold basic conversations in Italian and have a solid foundation for further language study.

Learning Outcomes

CLO 1: Recognize and understand basic Italian greetings, introductions, and everyday expressions.

CLO 2: Pronounce Italian sounds accurately and speak in short sentences about themselves, their families, and their daily routines.
CLO 3: Comprehend short spoken dialogues and announcements related to everyday situations.
CLO 4: Read and understand simple Italian texts focusing on familiar topics like greetings, numbers, and personal information.
CLO 5: Write basic sentences and short paragraphs about themselves, their families, and their daily activities.
CLO 6: Identify and use essential grammar structures like verb conjugations, basic sentence structure, and common prepositions.
CLO 7: Develop basic cultural awareness of Italian customs and traditions.

HUM115: German Basics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120			120	2	60	90	120	40	20	40

HUM121: Principles of Law, Human Rights & Ethics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

The knowledge of the principles of law and human rights as well as ethics is essential for a student of any discipline and further in his/her profession. Through this course, students will gain a basic understanding of what law is, what are the principles of law, what are human rights and what is the relevance of ethics. Through lectures, class discussions and group activities, students learn to apply the legal principles, human rights norms, and ethics in a local or global context.

References

Clapham, A. (2016). Human Rights: A Very Short Introduction (Very Short Introductions), 2nd Edition. London: Oxford University Press.
Mizzoni, J. (2017). Ethics: The Basics, 2nd Edition: Wiley-Blackwell.
Introduction to Law and Legal Systems, https://saylordotorg.github.io/text_legal-aspects-of-marketing-and-sales/s04-introduction-to-law-and-legal-.html

Learning Outcomes

CLO 1: Differentiate between various legal systems and kinds of law
CLO 2: Identify different sources of law
CLO 3: Discuss the importance of human rights in the present world
CLO 4: Develop an understanding of the several aspects of human rights
CLO 5: Explain the role of ethics in society

Lectures

WEEK 1: Meaning and Functions of Law
WEEK 2: Schools of Legal Thought
WEEK 3: Sources of Law + Quiz
WEEK 4: Different Legal Systems: Common Law, Civil law & other systems
WEEK 5: Divisions of Law: Substantive & Procedural, Civil & Criminal, Administrative
WEEK 6: Elements of Law
WEEK 7: Types of Law: Property, torts, and contracts
WEEK 8: History of Human Rights + Midterm Exam
WEEK 9: Civil and Political Rights
WEEK 10: Economic, Social and Cultural Rights
WEEK 11: Understanding Discrimination and Equality
WEEK 12: Ethics: Concepts, theories, and traditions + Assignment
WEEK 13: Ethical Principles
WEEK 14: Natural Law Ethics
WEEK 15: Final Exams

HUM131: Innovation & Entrepreneurship

Contact Time	CH	SWL	Exams Time	Marks

LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

Around the world, the importance, movement and need for business and economic development are driven by adopting innovative and entrepreneurial policies and practices that transcend business size and industry. This course is designed to help students evaluate the relationship between creativity, innovation and entrepreneurship and then be able to apply this learning to any enterprise or organization from New Venture Creation, Start-Ups to SMEs (Small Medium Enterprise) and large multinational corporations. Throughout this course students will develop and demonstrate the ability to discover and consider creativity, innovation and entrepreneurial concepts, entrepreneurial models and entrepreneurial mindsets, teamwork, taking responsibility, ethical decision making and critical thinking skills - to be able to evaluate business problems, develop their career path and upgrade their soft skills portfolio and so enhancing their 21st-century skills for future personal and professional development. Students explore the relationship between creativity, innovation and entrepreneurship using techniques and concepts such as the lean canvas, design thinking, MVP (minimum viable product) ideation, incubation and the acceleration of business ideas and concepts. Through a combination of case studies, research, group projects, interactive discussions, tutorials, activities and role-play the students develop the ability to recognize, create and deliver innovative entrepreneurial solutions to a complex global market. Around the world the importance, movement and need for business and economic development is driven by adopting innovative and entrepreneurial policies and practices that transcend business size and industry.

References

Zacharakis, Andrew., Bygrave, William D., Corbett, Andrew C. (2021) Entrepreneurship (5th Edition) Wiley ISBN-13: 978-1119563228
Barringer, Bruce R., Ireland, R. Duane. (2021) Entrepreneurship: Successfully Launching New Ventures (6th Edition) Pearson ISBN-13: 9781292402826
Entrepreneur Middle East - https://www.entrepreneur.com/
The Economist - https://www.economist.com/
Forbes - https://www.forbes.com/entrepreneurs/#405a16fe3035
Forbes - https://www.forbes.com/innovation/#25bade156834
Under 30 CEO - https://www.under30ceo.com/
Design Sponge/ Biz Ladies - http://www.designsponge.com/category/biz-ladies

Learning Outcomes

CLO 1: Evaluate the significance of innovation and entrepreneurship in the global ecosystem.
CLO 2: Interpret different phases of ideation, incubation and acceleration of entrepreneurial business ideas and concepts.
CLO 3: Assess the tools and techniques used by entrepreneurs to create innovative solutions.
CLO 4: Determine the different phases of ideation, incubation and the acceleration of entrepreneurial business ideas and concepts.
CLO 5: Validate case studies of entrepreneurial ventures to highlight their role in promoting innovation in a complex global market.

Lectures

WEEK 1: Creativity & Ideation
WEEK 2: Innovation
WEEK 3: Entrepreneurship
WEEK 4: Entrepreneurship
WEEK 5: Sustainability
WEEK 6: The Lean Canvas
WEEK 7: The Lean Canvas
WEEK 8: MID-TERM EXAM
WEEK 9 & WEEK 10: Design Thinking
WEEK 11: Risk Taking
WEEK 12: Problem Solving: MVP (Minimum Viable Product)
WEEK 13: 21st Century Skills
WEEK 14: Emerging Technologies
WEEK 15: FINAL EXAM

HUM132: Management and Leadership Skills

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

This course provides an overview of the essential skills and knowledge needed to be an effective manager and leader. Topics covered include:

Leadership styles and theories. Communication and interpersonal skills. Team building and motivation. Decision making and problem solving. Strategic planning and change management. Time management and stress management.

Learning Outcomes

LO1: Understand the different leadership styles and theories
LO2: Communicate effectively with employees, colleagues, and customers
LO3: Build and motivate high-performing teams
LO4: Make sound decisions and solve problems
LO5: Develop and implement strategic plans
LO7: Manage time effectively and cope with stress

HUM133: Communication and Negotiation Skills

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60	0	120	180	2	90	90	120	40	20	40

Course Description

This course will introduce students to the essential skills of communication and negotiation. Topics will include active listening, clear and concise communication, empathy, assertiveness, problem-solving, and negotiation strategies. Students will learn how to apply these skills in a variety of contexts, including business, personal, and intercultural communication.

Learning Outcomes

LO1: Identify and understand the different elements of effective communication
LO2: Apply active listening skills to build rapport and understanding
LO3: Communicate clearly and concisely, both orally and in writing
LO4: Demonstrate empathy and assertiveness in communication
LO5: Solve problems effectively through negotiation
LO6: Understand the different negotiation strategies and styles
LO7: Apply negotiation skills in a variety of contexts

HUM141: Principles of Economics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

This course is designed to introduce students to the basics of both microeconomics and macroeconomics theory. Microeconomics covers the analysis of choices made by individual firms. The use of trade-offs and choices model will be considered in comparison of the costs and benefits of actions. Topics include production and cost of market structure, which will be examined at the firm level, elasticity, government action in market, market failures, utility concept, and the model of monopoly, and oligopoly. Macroeconomics will look at the analysis of the economy as a whole, Topics include the business cycle; aggregate demand and supply, calculation of Gross Domestic Product (GDP), consumption, saving and investment interest rates, the international trade banking system, problems of unemployment and inflation, and the use of fiscal policy and monetary policies in stabilizing the economy.

References

Parkin, M. (2018). Economics (19th ed.). Pearson.
Case, K., & Fair, R. (2017). Principles of microeconomics (12th ed.). Pearson.
Parkin, M. (2015). Economics (19th ed.). Pearson.
Samuelson, P., & Nordhaus, W. (2011). Economics (19th ed.). Boston: McGraw-Hill.
http://hepg.awl.com/parkin/econ100
http://rfe.wustl.edu/EconFAQ.html (Resources for Economists on the Internet)
http://www.progress.org/Economlink/ (Economic Links)
http://www.helsinki.fi/WebEc (WWW Resources in Economics
Beveridge, T., Case, K., Fair, R., & Oster, S. (2019). Principles of macroeconomics (13th ed.). Pearson.
Arnold, R. (2018). Principles of macroeconomics (13th ed.). Cengage Learning.

Ben Bernanke, R. (2015). Principles of macroeconomics (2nd ed.). Graw Hill
http://hepg.awl.com/parkin/econ100
http://rfe.wustl.edu/EconFAQ.html (Resources for Economists on the Internet)
http://www.progress.org/Economlink/ (Economic Links)
http://www.helsinki.fi/WebEc (WWW Resources in Economics)
https://www.youtube.com/watch?v=INPhEyH_gH0
https://www.youtube.com/watch?v=em5Wqg1IVp8
https://www.youtube.com/watch?v=mjJmo5mN5yA
https://www.youtube.com/watch?v=N9VIsauE0RA

Learning Outcomes

CLO 1: Explain the role and scope of microeconomic and macroeconomic theory, Determinants of demand and supply in the market, and how they formulate a pricing strategy in the economy.
CLO 2: Calculate elasticity of demand and supply in the competitive world of monopoly,and oligopoly.
CLO 3: Apply various conceptual approaches to national income accounting, and implementation of monetary and fiscal policies.
CLO 4: Illustrate aggregate demand, aggregate supply concept, and macroeconomic equilibrium.
CLO 5: Analyze business cycles and economic growth models.
CLO 6: Interpret a nation’s economic performance indicators such as: economic growth, unemployment, inflation and international trade, and their impact from a macroeconomic perspective.

Lectures

WEEK 1: Definition and Scope of Microeconomics .Law of Demand; Determinants of Demand
WEEK 2: Law of Supply; Determinants of supply
WEEK 3: Price, cross and Income Elasticity of Demand and supply
WEEK 4: Marginal Utility theory of Consumer’s Equilibrium
WEEK 5: Applications of Indifference Curve in fiscal theory and business
WEEK 6: Price determination under imperfect competition - Monopoly and Oligopoly
WEEK 7 & WEEK 8: The Aggregate Demand/Aggregate Supply Model
WEEK 9: Circular flow of income in four sector economy. Various Concepts of national income
WEEK 10: GDP Various Approaches to Measurement of national income,
WEEK 11: Component of GDP; consumption ,saving and Investment
WEEK 12: Multiplier , Inflation and Unemployment
WEEK 13 Money, and the Banking System
WEEK 14 & Week 15: International Trade

HUM151: History of Engineering & Technology

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

This course introduces students to the history of engineering and technology, focusing on the development and practices of engineering and technology at the global, regional, and local levels, with a particular emphasis on Egypt. The aim of the course is to present to the student a general view of the history of engineering and technology and emphasize the evidences of engineering and technology advances through different centuries, especially the industrial revolution. A central theme of this course will be the mutual shaping of engineering, technology, and society. At each moment in history, the practice of engineering and technology reflects the values, cultures, and institutions of society. The topic Covers including history and advances of engineering and technology through the centuries, industrialization development in modern Egypt, industrial revolution, engineering profession, engineering and society, and technological development in Egypt.

References

Tom Jackson (Editor) and Tom Jackson (2016) Engineering: An Illustrated History from Ancient Craft to Modern Technology (100 Ponderables), Jenson Books Inc
M. Solodky,(2006) The Technology of Ancient Egypt
The Technology of the Ancient World, The Rosen Publishing Group, Inc.
Paul T. Nicholson, Ian Shaw, (2009) Ancient Egyptian Materials and Technology
Bryan H. Bunch (Author), Alexander Hellemans (Editor)The History of Science and Technology: A Browser's Guide to the Great Discoveries, Inventions, and the People Who Made Them from the Dawn of Time to Today
Thomas S. Kuhn, (2012)The Structure of Scientific Revolutions, 4th ed. University of Chicago Press
George Basalla, The Evolution of Technology (New York: Cambridge University Press, 1988).

Learning Outcomes

CLO 1: Describe the differential terminologies used in the engineering branch.
CLO 2: Outline and identify historical milestones in the development of engineering and its connections to social and cultural contexts
CLO 3: State the circumstances affecting engineering and technology development.
CLO 4: List the different engineering specifications and their corresponding field of activity.
CLO 5: Discuss the role of Egypt in developing the engineering civilization
CLO 6: Compare between the different engineering disciplines

Lectures

WEEK 1: Introduction: definition of engineering- science- art and the relations, and differences between them.
WEEK 2: History of engineering: The engineering in the ancient civilizations.
WEEK 3: Evidences on the advances of engineering through centuries.
WEEK 4: Development and practices of engineering and technology at the global, regional, and local levels, with a particular emphasis on Egypt.
WEEK 5: Engineering and technology advances through different centuries, especially the industrial revolution.
WEEK 6: The industrialization development in modern Egypt.
WEEK 7: Industrial revolution and its effects.
WEEK 8: Different effects of the Industrial revolution, political, social, economic effects.
WEEK 9: Engineer- the engineering profession: branches of the engineering profession, engineering occupations etc.
WEEK 10: Classification of engineering occupations, Characteristics of successful engineer.
WEEK 11: Engineering and society effect of engineering on society along different ages.
WEEK 12: Technological development in Egypt.
WEEK 13: Requirements of science and technology, technology transfer.
WEEK 14: Beginning of the industrialization development in modern Egypt.
WEEK 15: Egypt's most important industrial projects to date.

HUM152: History of Art & Architecture

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

The course explores the history of art and architecture analyzed in a chronological order at a global, regional, and local level. The study includes pre-historic civilization to, Roman period, European movements of Gothic, Renaissance, Baroque, and Rococo to Modern, Bauhaus to contemporary period. The aim of this course is to enhance the students' knowledge of different styles flourishing in different places in a given time period, analyze, understand, and relate the characteristics: elements, spatial organization, scale and proportion, structural and construction systems. Understand the roles of culture, socio-economic and its impact on the art and architectural characteristics of a given place at a global, regional, and local level. Students shall be able to comprehend and compare the styles, influences, materials, and construction techniques evolved over the period of time analyzed with examples using images and graphical representation across the timeline.

References

Fletcher, B., & Fraser, M. (2019). Sir Banister Fletcher's global history of architecture. London; New York. MS bury Publishing 21st Edition
Glancey, J. (2021). Architecture: A visual history. DK Publishing
Cumming, R. (2020). Art, Second Edition: A Visual History. DK Publishing

Learning Outcomes

CLO 1: Describe the influence social, cultural, and economic factors on art & architecture across the world.
CLO 2: Compare the origin of design styles, techniques, and its evolution to current age.
CLO 3: Examine the chronology art and architecture with examples working in teams.
CLO 4: Discuss the materials & construction techniques based on the time and context.

HUM153: The Character of Egypt

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

This course aims to establish, explain, and clarify Egypt's geographical character and the ability to think strategically through an integrated strategic vision of the overall components of each geographical, human, and civilizational formation. It analyzes events and places them within a broader and more comprehensive context with a profound future dimension, enabling students to develop a keen ability to anticipate the future, armed with an understanding of historical facts and a distinct awareness of the realities of the present. This course combines geography, history, politics, and other natural, human, and applied sciences through four axes:
The first axis: Egypt's natural character, where the course presents topics related to Egyptian geology, geography, and the Egyptian deserts. The second axis: Egypt's human character, where it highlights the features of the natural, material, civilizational, human, and urban homogeneity of the Egyptian character. The third axis: Egypt's integrated personality, which includes a presentation of the economic aspects of the Egyptian personality. The fourth axis: Egypt's civilizational personality, which studies Egyptian society as a structure and link within the Egyptian social map.
The course also aims to develop students' knowledge and skills based on innovative foundations that advance learning outcomes, support the development process, and build an integrated economic system based on knowledge that enhances the country's superiority and global leadership.

References

The Personality of Egypt: A Study in the Genius of Place, Gamal Hamdan, Alam Al-Kutub, 1980, ISBN 9777352085, 9789777352086
Traits of the Egyptian Personality Between Stability and Change, Ahmed Zayed, Publication Date: 2009, Publisher: Development Partners for Research, Consulting, and Training
The Arab Family in a Changing World, Ahmed Zayed, Publication Date: 2010, Publisher: Center for Social Research and Studies
The Art of Ancient Egypt

Learning Outcomes

شرح وتوضيح شخصية مصر الجغرافية و القدرة على التفكير الاستراتيجي
القدرة على استشراف المستقبل متسلحا بفهم لحقائق التاريخ
شرح شخصية مصر الطبيعية و البشرية و التكاملية و الحضارية
تطوير المعارف والمهارات على أسس استباقية علمية وفكرية وثقافية
تقييم شخصية مصر الحضارية وعلاقتها بجيرانها في الشرق الاوسط و العالم اجمع

Lectures

1 مقدمة عن المساق
2 شخصية مصر الطبيعية: أرض مصر
3 شخصية مصر الطبيعية: تاريخ حياة نهر وتغيرات النيل التاريخية
4 شخصية مصر الطبيعية: وجه مصر الطبيعي
5 شخصية مصر البشرية - التجانس الطبيعي – التجانس المادي
6 شخصية مصر البشرية - التجانس السكاني- التجانس العمراني
7 شخصية مصر التكاملية - شخصية مصر الاقتصادية
8 امتحان منتصف الفصل امتحان منتصف الفصل
9 شخصية مصر التكاملية - صنع في مصر
10 شخصية مصر التكاملية - ثروتنا المعدنية وصناعة التعدين
11 شخصية مصر الحضارية - سكان مصر بين المشكلة والحل
12 شخصية مصر الحضارية - آفاق الزمان وأبعاد المكان
13 شخصية مصر الحضارية - مصر والعرب و العالم (نظرة مستقبلية)
14 مراجعة شاملة و عروض المشروع الجماعي
15 الامتحان النهائي الامتحان النهائي

HUM154: Arabic Language

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

The Arabic language is distinguished by its rich vocabulary, structures, and concepts, and by many characteristics that set it apart from other languages. Based on this, this course includes a set of texts and information aimed at strengthening the student's Arabic language skills, empowering them with its basics and grammar, and developing their abilities necessary to master linguistic skills and achieve quality and soundness of the language in both spoken and written form, in addition to facilitating confident communication and interaction with others. The course content includes parts of speech, inflection and structure, abrogation, nominative and accusative cases, some grammatical methods, dependents and rules of number, derivatives of nouns, selections of texts for reading, and report writing.

References

Al-Attiyah, A. (latest edition), Arabic Language: Education and Skills, first edition, Dar Al-Kotob Al-Ilmiyyah, Beirut, Lebanon.
Al-Nadwi, A. (2003), Mature Reading for Teaching Arabic Language and Islamic Culture, Islamic Academy, Leicester, UK.
Golden Necklaces in Arabic Grammar

Learning Outcomes

يلم بقواعد اللغة العربية وأصولها وما تحويه من مفردات وجُمَل وتراكيب.
يوظّف قواعد اللغة في تعزيز مهارات التواصل لديه من قراءة وكتابة ومحادثة.
فهم النصوص ويقيّم الأفكار المستمدة منها بشكل نقدي ويستخدمها بفاعلية فيما يتعلق بمواقف الحياة اليومية.
يلتزم بمعايير اللغة في العلاقات الثقافية والاجتماعية من أجل التواصل والتفاعل بشكل صحيح.

Lectures

الأسبوع 1: المهارات اللغوية
الاسبوع 2: أقسام الكلام + مختارات من النصوص للقراءة
الأسبوع 3: الإعراب والبناء + مختارات من النصوص للقراءة
الأسبوع 4: النواسخ (كان وأخوتها، إن وأخواتها) + مختارات من النصوص للقراءة + اختبار قصير
الأسبوع 5: المرفوعات والمنصوبات + مختارات من النصوص للقراءة
الأسبوع 6: المنصوبات + مختارات من النصوص للقراءة
الأسبوع 7: أساليب نحوية (الاستثناء والنداء) + مختارات من النصوص للقراءة
الأسبوع 8: امتحان نصف الفصل الدراسي
الأسبوع 9: التوابع (التوكيد، البدل، النعت) + مختارات من النصوص للقراءة
الأسبوع 10: أحكام العدد + مختارات من النصوص للقراءة
الأسبوع 11: المشتقات + مختارات من النصوص للقراءة
الأسبوع 12: كتابة التقارير
الأسبوع 13: كتابة التقارير + تسليم المشروع
الأسبوع 14: مراجعة
الأسبوع 15: امتحان نهاية الفصل الدراسي

HUM161: Sustainability for Entrepreneurship

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

This course dives into the essential factors that fuel success in new entrepreneurial ventures, with a special emphasis on sustainable entrepreneurship—a must in high-cost economies where businesses are expected to generate economic, social, and environmental value. We'll guide you in shaping a compelling business idea and encourage you to elevate it by participating in both national and international business plan competitions available in Norway and globally.

HUM162: Sustainability for Employment

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

The course focuses on theoretical and practical aspects of individual career development through the lens of a psychological perspective of sustainability. This means that changes of how occupational career paths are chosen and may change over the course of occupational life are discussed, contrasting traditional trajectories of upwards mobility with modern career paths that oftentimes include career mobility vertically but also horizontally, career breaks, career reorientations and even involuntary events such as spells of unemployment.

HUM163: Health and Safety

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

This Occupational Health and Safety course provides a comprehensive overview of key principles and practices for maintaining a safe and healthy work environment. Students will explore hazard identification and risk assessment methodologies, learn about relevant legislation and regulations, and develop skills in implementing effective control measures. The course covers a range of topics, including workplace safety procedures, emergency response protocols, the use of personal protective equipment (PPE), and the prevention of common workplace injuries and illnesses. Emphasis is placed on fostering a proactive safety culture and empowering individuals to identify and mitigate potential hazards, contributing to a safer and more productive workplace.

HUM164: Social Responsibility

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

This course introduces students to the relevance and importance of ethics and social responsibility in business. Important learning objectives are to increase students' awareness and understanding of ethical issues in business, and to provide students with useful conceptual tools to guide analysis and decisions. The ultimate intent of the course is to leave students better equipped to identify, think critically about, and resolve ethical issues that are encountered in one's working life at the individual, organizational, and societal levels.

HUM171: Preparing Technical Reports

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120			120	2		90	120	40	20	40

HUM172: Scientific Research & Critical Thinking

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120			120	2		90	120	40	20	40

HUM231: Presentation Skills and Technical Writing

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Requisites

- Prerequisites: HUM111

Course Description

Technical Writing Course develops written communication in internal workplace, external business-to-business (B2B) writings, and business-to-customers writings. The course provides sufficient practice of presentational skills, the use of visuals in both written and oral communications and writing professionally on social media. Students learn how to write whitepaper, process documents, project requirements development, instructions, and friendly-user technical manuals. They also learn how to pitch their products and projects on the written and spoken levels.

References

Hering, H, 2018, How to Write Technical Reports, Springer, e-book.

Learning Outcomes

CLO 1: To distinguish different types of technical reports.
CLO 2: To compose process documents, whitepaper, and project requirements documents.
CLO 3: To create visuals for report writing and presentation illustrations.
CLO 4: To develop persuasive writing for pitching projects and products.
CLO 5: To design written technical manuals and instructions.

Lectures

WEEK 1: To give an insight into the communication process and its importance in the workplace. Communication: definition, process, importance
WEEK 2: To give practical hints to make one's writing more effective and scientific Choice of words, phrases, and sentences. Word order, sentence construction and length.
WEEK 3: To define technical reports and their characteristics
WEEK 4: Introduce various types of reports Routine reports, pre-printed reports
WEEK 5: Discuss various steps involved in Report writing, planning, preparation and completing Preparatory Steps
WEEK 6: Preparing an outline Report Structure
WEEK 7: Sources and methods of data collection Data Collection
WEEK 8: Understand the structural elements of report: front matter, main body, back matter. Report structure
WEEK 9: Give insight into data analysis with the help of illustrations
WEEK 10: Give insights into interpreting data through illustrations Use of illustrations
WEEK 11: Provide practice in writing reports Report writing
WEEK 12: Practice in writing informative reports Informative reports
WEEK 13: Practice in writing analytical reports Analytical reports
WEEK 14: Practice Feedback/ Evaluation
WEEK 15: Final exam

HUM251: Safety and risk

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	0	120	2	60	90	120	40	20	40

Course Description

This course focuses on the fundamentals of workplace safety regulations, insurance, and emergency response. A first module covers health and safety regulations, emphasizing promoting correct behavior and preventive measures. A second module covers insurance aspects and the procedures for handling insurance in case of an accident. Finally, a third module focuses on managing emergencies with practical drills on health emergencies, fire emergencies, and evacuation drills.

References

SUT Statute and internal regulation.
National Legislation for workplaces.
International standards.

Learning Outcomes

CLO 1: Understand which are the insurance mechanisms connected to work activity.
CLO 2: Understand the condition under which emergencies at work are managed.
CLO 3: Be exposed to the basic procedures to face occasional dangers that could arise during a work activity.
CLO 4: Acquire a basic health emergency preparedness.
CLO 5: Apply emergency procedures.
CLO 6: Apply procedures for health emergency rescue.

HUM311: English Language II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	40	20	40

Requisites

- Prerequisites: HUM111

Course Description

English Language II is highly specialized for students of technology at B2 level. It develops upper-intermediate English communication skills for technological and academic domains. The course considerably focuses on different writing skills required of a technology graduate including CV and Bio writing, types of emails, types of essays, reports, manuals, and recommendation for future action. The units also cover topics relevant to academic skills such as note-taking, summarizing, and research outline. Significant speaking skills are developed through group discussions, role plays, and other active learning activities. Students practice speaking in job interviews, meetings, negotiations, and presentations. Listening and reading skills are also developed through practicing reading and listening to different technological topics. Vocabulary and grammar will be practiced through assignment and feedback. Critical thinking skills, problem solving, authentic materials along with academic references are all available and applied during implementing the course.

References

Savage, A. & Mayer, P. (2015). Effective Academic Writing 2. Oxford University Press.
Bailey, 2015, Academic Writing; a handbook for international students, Routledge. UK.
Butler, L. (2014).Longman Academic Writing Series 1 Sentences to Paragraphs. Pearson.
English, A and Monahon, L. (2017). NorthStar Fourth Edition Reading and Writing 4. Pearson.
Shafie, L. Yahaya, M. Mansor, M. and Osman, N. (2018). English for Academic Writing, Oxford University Press. Malaysia.
Hogue, A. (2014). .Longman Academic Writing Series 2 Paragraphs. Pearson.

Learning Outcomes

CLO 1: To use technical jargon for making presentations about technological devices, tools, process, and other topics.
CLO 2: To use primary data to create visual representations of information (pie charts, graphs, etc.) for writing reports.
CLO 3: To manage writing skills in different types of essays, manuals, CVs, and research outline.
CLO 4: Evaluate technological topics found in authenticated readings and listening audios.
CLO 5: Successfully communicate in specialized situations such as job description and job interviews, describing technological processes and applications, and business meetings.

Lectures

WEEK 1: INTRODUCE COURSE SYLLABUS AND OUTCOMES DOCUMENT: the purpose of academic writing, Common types. Format, Features.
WEEK 2: READING: Finding suitable sources: Developing reading methods, Assessing Internet sources critically.
WEEK 3: WRITING: Types of sentences. Developing paragraphs: Linking paragraphs, Cohesion and coherence, Punctuation, Vocabulary.
WEEK 4: NOTE-MAKING METHODS: What is plagiarism? Avoiding plagiarism, Paraphrasing, Summarizing, References, and quotations.
WEEK 5: PROOFREADING AND EDITING: Reformulating.
WEEK 6: ELEMENTS OF WRITING: Argumentation and discussion, Language of discussion, Counter arguments, Providing evidence.
WEEK 7: USING EXAMPLES: Phrases to introduce examples, Restatement, Using and building on, generalizations, The language of cause and effect, Forms of comparison, Simple and complex definitions
WEEK 8: READING: Extracting and interpreting visual information, from graphs, pie charts, tables, etc., Primary research, Compiling and creating visual information from primary research
WEEK 9: PROCESS OF ACADEMIC WRITING: Pre-writing, Funneling, Brainstorming, Clustering, Free writing
WEEK 10: THE WRITING PROCESS: Introduce class project- prompt for academic essay, Planning, Making, sublists, rough outline, Outlining, Thesis statement
WEEK 11: WRITING FIRST DRAFT: Polishing, Revising, Editing
WEEK 12: INSERTING INTERNAL CITATIONS: Using APA , writing an abstract, Writing a reference list
WEEK 13: WRITING FINAL DRAFT
WEEK 14: REVISION
WEEK 15: FINAL EXAM

HUM431: Project Management

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	0	120	240	3	120	90	120	40	20	40

Course Description

Project management imparts the basic knowledge and skills required by the engineering professional while developing management solutions in a variety of situations. It fosters the knowledge of appropriate theories, concepts, and principles of management used in project management.

This course enables the provider to provide an overview of the components of project management in general, including an introduction to engineering project management, components of the project environment, business, ecosystem, challenges and opportunities, stakeholder engagement, and the project lifecycle. It accustoms in-depth understanding of project scope, cost management, project planning and control methodologies. The course contains a wide scope of topics relevant to stakeholder management, Furthermore, it appraises the overall process within which projects are conceived, designed, and executed and evaluates the problems that are encountered at each stage. It encompasses project appraisal techniques for project evaluation, project auditing, project auditing phases, project closure reports, and closeout report guidelines. The course focuses on human resource management and introduces students to the concepts of leadership organizational structures and team building in a project environment. Furthermore, the course embraces current project management practices such as Agile project management, including an overview of core agile concepts, the agile approach, agile methodologies and frameworks, and the importance of all stakeholders sharing an agile perspective. Moreover, the scrum methodology elements and terminology overview, project (product; release) initiation, scrum planning, scrum sprint planning, and executing are introduced. Other agile principles and best practices, XP principles and best practices, lean software development principles and best practices, lean-agile software development portfolio management, and incorporating scrum and agile practices into the organization are covered in depth in the course. The course incorporates case study discussions, and reviews of project management reports and expert lectures, conference, and exhibition visits to acquire skills to pursue a career in project management.

References

Project Management Institute. (2021, August 1). A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Seventh Edition and The Standard for Project Management (ENGLISH) (Seventh edition).
Kerzner, H. (2022, March 2). Project Management: A Systems Approach to Planning, Scheduling, and Controlling (13th ed.). Wiley.
Highsmith, J. A. (2022, October 20). Agile Project Management: Creating Innovative Products. Addison-Wesley Professional.
https://www.apm.org.uk/resources/
https://www.invensislearning.com/blog/project-management-resources/
https://projectmanagementacademy.net/resources/blog/agile-for-all/

Learning Outcomes

CLO 1: Examine the stages in the project lifecycle and the activities that are carried out to implement the project.
CLO 2: Analyze the methodologies from the concepts and theories of project management and its application in the engineering project.
CLO 3: Use of multilevel communication methods among project stakeholders and demonstrate good leadership qualities for efficient project management.
CLO 4: Evaluate project management methodologies and systems to address the challenges posed by organizational cultures and management styles.
CLO 5: Review the procedures needed to monitor, control and report upon the development of the engineering project.
CLO 6: Recommend management solutions and strategies to deal with common project management problems.

Department of Energy Engineering Technology

ENT111: Energy, Development and Environment

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	60	60	300	4	180	90	120	60	15	25

Course Description

The main goal of the course is to introduce the students to the fundamental structure of the supply chain in the energy sector and the linkages with sustainable development and the climate challenges and the role energy technologies may play into them. The course is divided into three main parts. The first part of the course is devoted to a general overview of the energy sector at national and regional scale, analysing energy flows and their transformations from primary resources to final energy products. The Energy supply chain will be introduced, and the global and national energy accounting will be explained and used by the students to get familiarity with the energy balances at national scale in different region of the world. The main challenges in the energy sector for future decades are also highlighted thus giving constrains and opportunities for energy technology development. In the second part of the course the main principle of sustainability is introduced from an economic, environmental and social perspective. The 2030 Agenda and the Agenda 2063 are introduced keeping a focus on the role of energy into them. At the same time the global climate commitment will be understood, and the National Determined commitment explained so that the students are able to link them to the national energy sector. In the last practical part of the course, a project work is developed by the students who will work on a country of interest to highlight the main energy challenges of the country from the national energy accounting, SDG7 and the national determined commitment. Key extensive and intensive indicators will be introduced and used to evaluate the status of the country and making comparisons across countries.

References

Michael J. Moran, Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, Wiley & Sons

IEA statistics database: IEA – International Energy Agency - IEA

Learning Outcomes

CLO 1: The students will learn the trends of the global energy challenge and the methodological approach to the national energy balance.
CLO 2: They will learn the foundation of national energy accounting and statistics.
CLO 3: The will learn the main principle of Sustainable development and the meaning of the SDGs and the role of Energy into it.
CLO 4: The student will be able to evaluate and design the energy balance at country level.
CLO 5: the students will learn how to evaluate the energy economy of countries and make some consideration on their compliance with the National determined commitment.
CLO 6: The students will work in team and will learn how to prepare effective presentation.

Tutorials

TUT 1: Numerical exercises on national energy accounting. TUT 2: Numerical exercises on country comparisons.

Laboratories

LAB1: Practical execution of the assignment as project work (country study and country comparisons). The Lab will be conducted along the semester and will commit the students every week.

ENT191: ENT Internship I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
0	0	360	360	3	180			50	0	50

Course Description

Internship provides an opportunity to practice and/or apply knowledge and skills in professional environments and gain valuable work experience. Through the Internship students get exposure to the industrial environment which cannot be simulated in the classroom. During the internship, students understand and sharpen the real-time technical/managerial skills required at the job(s). Further, they understand the social, economic, and administrative considerations that influence the working environment of industrial organizations. Student learning includes overall professional development of students, required problem-solving, communication, human development, and relationship-building skills. Further, the students develop awareness of the organizational department structure and their roles, responsibilities, and function. Students select the internship field in consultation with an industry mentor and faculty guide in terms of the academic requirements. The student is expected to produce a joining letter and a successful completion certificate. once the internship is over. Internship evaluation can be based on the quality of projects completed as part of the internship activities. Faculty Member(s) evaluate(s) the performance of students once by visiting the industry/organization and submit the evaluation report of the students with the consent of Industry persons/ mentor. The students are exposed to the industry environment for 6 to 8 weeks duration to understand the operation of the industrial facility.

References

https://www.youtube.com/watch?v=jpf9J2TUJVg
https://www.youtube.com/watch?v=KqIshDsg494
https://www.youtube.com/watch?v=E1UcIHW5rSc
https://www.youtube.com/watch?v=EhnfOUrFgxM

Learning Outcomes

CLO 1: Understand the industrial standards and recognize the requirement of these standards with the industrial scenario.
CLO 2: Examine a specific project related to energy engineering at an existing job.
CLO 3: Communicate effectively through the technical presentation.
CLO 4: Demonstrate individual confidence to handle various engineering assignments during the internship.
CLO 6: Expose themselves to acquire life skills to meet societal challenges
CLO 7: Relate the engineer’s responsibilities and ethics while handling various engineering assignments during the internship.

ENT211: Energy Systems I

Contact Time				CH	SWL	Exams Time		Marks		

LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

The course provides a comprehensive overview of various energy conversion technologies to equip the students with the knowledge and the competence to understand inherently and design preliminarily (i.e. employing only paper, pencil and a calculator), conventional and unconventional power plants from energetic, economic, environmental and technical perspectives. The course covers electricity generation in power plants, focusing in particular on the inherent relation among working fluids, thermodynamic cycles and main equipment. Thermodynamic and technical aspects are addressed in detail, whereas economic, management, environmental, and strategic aspects are presented as necessary. The developed concepts can be applied either to fossil fuel-fired power plants or to waste-heat-recovery systems, renewable sources like biomass, biogas, biomethane and concentrated solar, as well as to generic industrial processes. More in detail, in order to complement EPT 431 the course will focus on: (i) Advanced gas turbines and combined cycle. Historical evolution and state-of-the-art of gas turbines; second-law analysis and future developments; (ii) Advanced steam power plants. Historical evolution of pulverized-coal power plants; focus on ultra-supercritical power plants; second-law analysis; control logics, plant governing, and emission abetment; future developments; (iii) Principle of Turbomachinery: One-dimension analysis. Geometries and definitions; stage optimization by way of free variable, objective functions and constraints; velocity triangles.

References

M.J. Moran, H.N. Shapiro, D.D. Boettner, M.B. Bailey, Principles of Engineering Thermodynamics, 8th Edition SI Version, Editor: John Wiley & Sons, 2015, ISBN: 978-1-118-96088-2
W.C. Reynolds, P. Colonna, Thermodynamics - Fundamentals and Engineering Applications, Editor: Cambridge University Press, 2018, ISBN: 9780521862738
P. Kiameh, Power Generation Handbook. 2nd Edition Editor: McGraw-Hill, 2011

Learning Outcomes

CLO 1: Describe the modelling approaches for the working fluids, the main equipment (like heat exchangers and turbomachines) and the single as well as overall process.
CLO 2: Describe the pro and cons of different energy conversion systems.
CLO 3: Explain the typical choices of the design parameters for working fluids, operating conditions, main equipment, and processes.
CLO 4: Read and understand generic industrial process flow diagrams other than power plants.
CLO 5: Read and understand the layout and process flow diagrams of the main equipment (like heat exchangers and turbomachines).
CLO 6: Select the most promising plant layouts for diverse hot sources and/or cold sinks.
CLO 7: Sketch the cycles and the processes on selected thermodynamic charts as well as on the process flow diagrams (also referred to as layouts).
CLO 8: Compute and comment the typical performances and efficiency of the main equipment and processes.

Tutorials

TUT 1: Hands on exercises on performance calculation for a generic conventional power plants, TUT2: Hands on exercises on performance calculation for a biomass power plants, TUT3 Hands on exercises on performance calculation for a generic industrial plant.

Laboratories

LAB 1: Impact of Intercooling and Reheating on Gas Turbine Efficiency: LAB 2: Second-Law Analysis of a Combined Cycle Power Plant; LAB3: Thermodynamic Modelling of a Supercritical Steam Cycle; LAB 4: Control System Simulation for Load Following in a Steam Plant.

ENT212: Thermal Engineering

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: GEN123

Course Description

This course deepens the topics of GEN123 on two perspectives. On one side, starting form the principles of thermodynamics it deepens thermodynamic machines and cycles, and on the other it deepens the three mechanisms of heat transfer. Both the parts will have an applicative

perspective, introducing the students to the main real technologies and processes associated with the principles of thermal engineering.
In the first part, the focus is on thermal engineering applied to energy conversion. Starting from the ideal Carnot cycle, the course will deal with the thermodynamics cycles at the base of the main conversion technologies: Rankine, Brayton, Otto, and Diesel cycles showing the main associated applications.
In the second part, heat transfer mechanisms, namely conduction, convection and radiation will be introduced together with their most relevant application for energy engineering, addressing particularly the combinations (conduction-convection, conduction-radiation, convection-radiation) most frequently occurring in both civil and industrial contexts.
All along the course the concept of energy conversion efficiency will represent a cross-cutting argument. First and second law efficiency will be introduced and used to achieve the optimum in thermodynamic design.

References

Moran, M.J., Shapiro, H.N., Fundamentals of Engineering Thermodynamics, Wiley
Yunus Cengel, Michael Boles and Mehmet Kanoglu thermodynamics: An Engineering Approach ISBN10: 1266664483 | ISBN13: 9781266664489
Lienhard, A Heat Transfer Textbook

Learning Outcomes

CLO 1: Describe the principles of thermodynamics and their application in energy conversion processes.
CLO 2: Identify the limitations to which all real processes are subject and to understand the main engineering implications of the principles of Thermodynamics.
CLO 3: Describe the main heat transfer phenomena associated to specific energy engineering components.
CLO 4: Apply and solve mass, energy and entropy balances.
CLO 5: Calculate the efficiency of thermodynamic cycle.
CLO 6: Examine thermodynamic systems and processes of medium complexity.
CLO 7: Rate and size basic heat transfer equipment.

Tutorials

TUT 1: Numerical exercises on thermodynamic principles. TUT 2: Numerical exercises on energy conversion (Rankine, Brayton, Otto, and Diesel cycles). TUT 3: Numerical exercises on heat exchange mechanisms. TUT 4: Practical experiments on heat exchange investigating heat transfer rates in different materials. TUT 5: Practical experiments on heat exchange analyzing heat exchange efficiency in various systems. TUT 6. Numerical Analysis of the Carnot Cycle Efficiency and its Limitations.

Laboratories

LAB 1: Measuring Thermal Conductivity of Different Materials FCONDT-45A-E-TD-6-1.pdf (elettronicaveneta.com); LAB 2: Investigating Natural Convection Heat Transfer in Air or Water TE6H-42A-E-TH-1.pdf (elettronicaveneta.com); LAB 3: Exploring Forced Convection Heat Transfer with Fan or Pump TE6H-42A-E-TH-1.pdf (elettronicaveneta.com); LAB 4: Analyzing Combined Heat Transfer (Conduction-Convection) in a Composite Wall; LAB 5: Studying Radiation Heat Transfer between Surfaces.

ENT213: Energy Storage and Transmission

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

This course provides students with a foundational understanding of energy storage and transmission technologies. Through lectures, tutorials, and laboratory sessions, students will explore the various methods of storing and transmitting electrical energy, including their principles, operation, design considerations, and applications with the following specific contents:
1. Fundamentals of Energy Storage and Transmission: this module will cover basic concepts like energy and power, different forms of energy storage (mechanical, electrochemical, chemical, etc.), and an overview of power transmission systems (AC vs. DC transmission, transmission line components).
2. Energy Storage Technologies: this module will delve deeper into specific energy storage technologies, such as pumped hydroelectric storage, electrochemical energy storage systems (batteries), compressed air energy storage, and flywheel energy storage. Students will explore their operating principles, design considerations, applications, and limitations.
3. Power Transmission Systems: this module will focus on the technical aspects of power transmission systems, including transmission line parameters, power flow analysis, power system stability, and reactive power control. Students will learn about different types of transmission lines, transformers, and FACTS devices used in power transmission.

References

R.A. Huggins, Energy Storage: Fundamentals, Materials and Applications, 2nd ed., Editore: Springer, Anno edizione: 2016, ISBN: 978-3-319-21238-8;
J.Duncan Glover, Mulukutla S. Sarma, Thomas Overbye, Power Systems Analysis and Design, Editore: Cengage, ISBN: 978-8131516355
John J. Grainger, William D. Stevenson, Power System Analysis, Editore: Mcgraw Hill Book Co, ISBN: 978-0070612938
Roberto Marconato, Electric power systems, Editore: CEI, ISBN: 978-8843200252
Prabha Kundur, Power System Stability and Control, Editore: McGraw Hill, ISBN: 0-07-035958-X
M.Eremia and M. Shahidehpour Editors, Handbook of Electrical Power System Dynamics, Editore: IEEE Press - Wiley, Anno edizione: 2013, ISBN: 978-1118497173

Learning Outcomes

CLO 1: Explain the fundamental concepts of energy storage and transmission systems.
CLO 2: Identify different types of energy storage technologies and their applications.
CLO 3: Analyze the performance characteristics of energy storage systems.
CLO 4: Describe the components and operation of power transmission systems.
CLO 5: Perform basic calculations related to energy storage and transmission.
CLO 6: Design a simple energy storage or transmission system for a specific application.

Tutorials

TUT1: Hands on session on pumped hydro, CAES and flywheel; TUT2: hands on session on battery storage applications; TUT3. Work on practice problems related to power flow analysis.

Laboratories

LAB 1 Labs on pumped hydro simulations or case studies; LAB 2 Experiments on battery storage or CAES / flywheel systems characteristics and behaviour; Experimental flywheel 23C-E rel C13.indd (elettronicaveneta.com); LAB 3 Labs on power flow analysis simulations or case studies.

ENT291: ENT Project I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	2	120			75	0	25

Course Description

This course enables the students to exercise some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. The student is expected to design a project that provides students with the experience of designing, building, and integrating modular software applications/ electronic system comprising analog, digital and computer subsystems. The student mostly implements design and tests the system. This course includes planning the tasks which are to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. By studying this course. The student develops creativity, initiative, and capacity to perform. Leadership development and supervision skills are also integrated into the learning objectives of this course. The project will have a detailed proposal, which must be executed or implemented within the time allocated while maintaining a logbook periodically monitored by the professor mentor. Projects should be chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is to be prepared as the project progresses, which has to be submitted after the project is over. The students acquire the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1: Define the tasks and scope of the project independently and/or collaboratively

CLO 2: Identify relevant information pertaining to project needs from a variety of resources.
CLO 3: Acquire knowledge on advanced topics in a chosen subject area
CLO 4: Summarize the information and draw a logical conclusion to the problem/task of the project
CLO 5: Outline the details of hardware and software required for the completion of the project
CLO 6: Prepare project proposals with an action plan and time duration scientifically.
CLO 7: Communicate project ideas and current work achievements clearly through technical report and presentations.

ENT292: ENT Project II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	4	240			75	0	25

Course Description

This course enables the students to apply some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. Project II provides students with the experience of designing and building simple software and hardware applications. Further students can learn how to integrate it into a modular electronic system or computer subsystems. This course builds on the knowledge and skills built in Project I. The student mostly implements design and tests the system. This course includes planning the tasks which are to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. Through this course, the student develops creativity, initiative, and capacity to perform. The student develops interpersonal, teamwork, planning and organizing skills. The projects will have a detailed project proposal, which must be executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the teacher. Projects should be chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is to be prepared as the project progresses, which has to be submitted after the project is over. The students acquire the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1. Choose the relevant possible solutions from available alternatives
CLO 2. Conduct feasibility studies about hardware and software parts used in the project.
CLO 3. Design a simple software and hardware application taking into consideration various real-life constraints.
CLO 4. Investigate the important legal and ethical issues in the design project
CLO 5. Collaborate with team members, managers, and clients to design and prototype a product/service that meets user needs and expectations.
CLO 6. Conduct the theoretical study in detail and compare them on the basis of cost/ energy conservation/impact on environment/technology used etc.
CLO 7. Communicate project ideas and current work achievements clearly through technical report and presentations.

ENT311: Energy systems II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	150	90	120	60	15	25

Requisites

- Prerequisites: ENT211

Course Description

The course, built upon the knowledge acquired in Energy Systems 1, explores more complex energy systems, focusing on advanced methods for generating decarbonized energy vectors, primarily electricity and hydrogen.
Key topics covered in the course include:
• Hydrogen Production from Fossil Fuels: Examination of extraction processes, including steam reforming and IGCC technologies, with

discussions on challenges and opportunities.
• Carbon Capture and Sequestration (CCS) Technologies: Study of methods for mitigating CO2 emissions, exploring capture techniques, storage options, and environmental considerations.
• Waste-to-Energy Conversion: Overview of technologies for harnessing energy from waste materials, with focus on environmental impacts and resource recovery.
• Nuclear Power Plants: Introduction to nuclear energy production, including reactor types, safety considerations, waste management, and the role of nuclear power in decarbonization efforts.

References

P. Kiameh, Power Generation Handbook. 2nd EditionPower Generation Handbook. 2nd Edition, Editor: McGraw-Hill, 2011
Christopher Higman and Maarten van der Burgt, Gasification (Second Edition), Editor: Gulf Publishing, 2008, ISBN: 978-0-7506-8528-3

Learning Outcomes

CLO 1: Demonstrate a comprehensive understanding of various energy conversion methodologies, including fluidized bed combustion, hydrogen production, carbon capture, gas microturbines, waste-to-energy conversion, alternative fuels, and nuclear power plants.
CLO 2: Explain the underlying principles, efficiency factors, and technological advancements associated with each energy conversion process.
CLO 3: Apply knowledge of turbomachinery, heat exchangers, and other key components to conduct techno-economic assessments of energy conversion technologies
CLO 4: Utilize quantitative methods to analyze the efficiency and performance of complex energy systems.
CLO 5: Utilize quantitative methods to assess the viability and sustainability of alternative fuels for transportation, considering their potential to reduce greenhouse gas emissions.
CLO 6: The students will work in team and will learn how to prepare effective presentation.

Tutorials

TUT1: Hands on exercises on performance calculation for a generic conventional power plants using CCS technology. TUT2: Hands on exercises on performance calculation for a waste-to-energy power plant.
TUT3: Hands on exercises on calculating greenhouse gas emissions of different alternative fuel options.
TUT4: Hands on exercises on performance calculation for a nuclear power plant.

ENT312: Innovative Energy Technologies

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	150	90	120	60	15	25

Course Description

This course explores innovative energy technologies, with a focus on technologies operating with renewable energy sources.
Key topics covered in the course include:
• Concentrated Solar Power: Examination of different configurations of concentrated solar power systems, such as parabolic troughs, solar towers, and dish/engine systems, for efficient solar energy conversion.
• Wave Energy: Study of technologies that harness wave energy to generate electricity, including oscillating water columns, point absorbers, and attenuators, and their potential applications in renewable energy production.
• Green hydrogen generation: Investigation into the utilization of renewable energy and the production of hydrogen and related conversion into thermal and electric energy for residential and industrial uses.

References

Concentrating Solar Power Technology: Principles, Developments, and Applications (Woodhead Publishing Series in Energy) 2nd Edition by Keith Lovegrove (Editor), Wes Stein (Editor) ISBN-10 : 0128199709
Fundamentals of Ocean Renewable Energy Generating Electricity from the Sea 1st Edition - June 12, 2018 Authors: Simon P. Neill, M Reza Hashemi, Language: English Paperback ISBN: 9780128104484 9 7 8 - 0 - 1 2 - 8 1 0 4 4 8 – 4 eBook ISBN: 9780128104491
Solar-Driven Green Hydrogen Generation and Storage, Rohit Srivastava (Curatore), Jayeeta Chattopadhyay (Curatore) Elsevier - Health Sciences Division, 2023

Learning Outcomes

CLO 1: Develop a comprehensive understanding of innovative energy technologies.
CLO 2: Apply critical thinking skills to evaluate the technical and economic feasibility of innovative energy technologies, considering factors such as resource availability and technological advancements.

Tutorials

TUT1: Hands on exercises on performance calculation for a concentrated solar power plant using a solar tower and molten salt energy storage.
TUT2: Hands exercises on technologies based on wave energy.
TUT3: Hands on exercises on performance of a generic power plant fueled by renewable energy with production of hydrogen and related conversion to thermal and electric energy.

ENT313: Fluid Machines

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	150	90	120	60	15	25

Course Description

This course provides a comprehensive overview of fluid machines, covering fundamental principles of fluid mechanics and the design and operation of various fluid machinery. The first introductory module covers the basics of fluid mechanics, including physical properties of fluids, hydrostatics, ideal fluid models, and mechanics of real fluids in different regimes. The second module comprehensively covers the most common turbomachines, a first section focuses on hydraulic fluid machines such as hydraulic pumps and turbines, a second section focuses on thermal fluid machines such as steam and gas turbines. Finally, the third module covers volumetric fluid machines, specifically focusing on internal combustion engines.

References

Y. A. Cengel, J.M. Cimbala, Fluid Mechanics Fundamentals and Applications, McGraw-Hill Education, 2013.
Dixon S.L., Hall C., Fluid Mechanics and Thermodynamics of Turbomachinery, Editore: Butterworth-Heinemann
E.A. Baskharone, Principles of turbomachinery in air breathing engines, Editore: cambridge university press, Anno edizione: 2014, ISBN: 978-1-107-41740-3

Learning Outcomes

CLO 1: Demonstrate comprehension of fundamental principles of fluid mechanics, including the physical properties of fluids, hydrostatics, and ideal fluid models.
CLO 2: Identify and differentiate between different types of fluid machinery, including hydraulic, thermal, and volumetric machines, along with their respective components and operating principles.
CLO 3: Apply theoretical knowledge to analyze and solve problems related to fluid mechanics and fluid machinery.

Tutorials

TUT1: Hands on exercises on hydraulic machines.
TUT2: Hands on exercises on thermal machines.
TUT3: Hands on exercises on internal combustion engines.

Laboratories

LAB1: Set up experiments to measure the flow rate, pressure, and efficiency of hydraulic pumps (BCP-49A-E-IF-0.pdf (elettronicaveneta.com)) and turbines (STG-49A-E-CF-2.pdf (elettronicaveneta.com)) under different operating conditions.
LAB2: Introduce students to the software required for component modelling (Matlab, AutoCad).
LAB3: Guide students through the process of designing components.
LAB4: Conduct tests on designed components in the laboratory to validate their performance and functionality.

ENT314: Principles of Ecology

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	120	360	4	180	90	120	60	15	25

Course Description

This course provides an overview of ecological principles, covering fundamental concepts from biology, physical geography, and climatology. A first module introduces the basics of ecological processes such as photosynthesis, respiration, and decomposition along with energy and matter flows and biogeochemical cycles. In a second module the concepts of ecotoxicology, population dynamics, and carrying capacity, including demographic projections at local and global levels, are discussed. A third module addresses sustainable development and indicators of sustainability, such as carbon, water, and ecological footprints, as well as the human development index. Finally, a fourth module covers sustainable biomass extraction, bio-economics of renewable resources, and the relationship between ecosystems and human health.

References

Ayres, R.U., Ayres, L.W., A Handbook of Industrial Ecology.
Ricklefs, R.E., The Economy of Nature.
Smith, T.M., Smith, R.L., Elements of Ecology.
Socolow, R., Andrews, C., Berkhout, F., Thomas, V., Industrial Ecology and Global Change.

Learning Outcomes

CLO 1: Understand the basics of ecological processes.
CLO 2: Demonstrate comprehension of the concepts of ecotoxicology, population dynamics, and carrying capacity.
CLO 3: Understand sustainability indexes.
CLO 4: Apply ecological concepts to analyze real-world environmental issues and propose solutions for sustainable management.
CLO 5: Use quantitative methods to assess environmental impacts, including the calculation of carbon, water, and ecological footprints.
CLO 6: Evaluate demographic projections and indicators of sustainability to assess the environmental and social implications of human activities.
CLO 7: the students will learn how to evaluate energy solution from a technological and social perspective commitment.

Tutorials

TUT1: Hands-on numerical exercises on pollutant emission and environmental impact.
TUT2: Numerical exercises on calculating indicators of sustainability.
TUT3: Analyzing data and making conclusions using indicators of sustainability.

ENT315: Operation and maintenance

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	150	90	120	60	15	25

Course Description

The course is designed to equip students with the fundamental knowledge and skills necessary for the correct operation and maintenance of conventional power plants. The course will cover the basics of operational procedures needed to ensure the efficient and safe functioning of power generation facilities. Topics covered include equipment operation, troubleshooting techniques, preventive maintenance practices, safety protocols, and regulatory compliance.

References

Refer to national operation and maintenance protocols for power plants.

Learning Outcomes

CLO 1: Acquire knowledge of the fundamental principles and procedures involved in the correct operation and maintenance of conventional power plants, including safety protocols, equipment handling techniques, and emergency response measures.
CLO 2: Develop hands-on skills in performing operation and maintenance tasks on energy technologies commonly found in conventional power plants.

Laboratories

LAB1: Overview of safety protocols essential for working with energy technologies, emphasizing hazard identification, emergency response, and safety inspections. Based on National and International safety protocols.
LAB2: hands-on maintenance training on energy technologies focusing on equipment handling skills. Based on Power Systems Lab (e.g. transmission line training system).

LAB3: developing troubleshooting skills for identifying and resolving issues in energy technologies. Students practice diagnosing non-working energy technologies. Based on Power Systems Lab (e.g. transmission line training system).

ENT316: Measurements and diagnostics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	120	360	4	180	90	120	60	15	25

Course Description

The course aims to provide a comprehensive understanding of metrology fundamentals and the operation of key measuring devices employed in industrial contexts. Students will learn to independently verify and experimentally measure typical phenomena encountered in energy-related measurements. They will also develop skills in diagnosing measurement results to ensure proper functionality and performance assessment, including understanding diagnostic criteria and thresholds for determining the reliability and accuracy of measurement systems.

References

Doebelin, E. O., & Manik, D. N. (2007). Measurement Systems: Application and Design. Tata-McGraw Hill Education PVT. Ltd.

Learning Outcomes

CLO 1: Demonstrate comprehension of metrology fundamentals and the principles underlying key measuring devices used in industrial and building contexts.
CLO 2: Understanding diagnostic criteria to identify anomalies.
CLO 3: Ability to accurately and effectively use measurement instruments.
CLO 4: Capability to identify and address anomalies arising from measurements.

Tutorials

TUT1: Overview of common measurement instruments used in industrial and building contexts, such as thermocouples, flow meters, and pressure sensors.
TUT2: Analyzing real-world measurement data from industrial and building applications and identifying potential issues or anomalies.

Laboratories

LAB1: Hands-on practice in setting up measurement instruments for specific measurement tasks, such as temperature measurement with thermocouples or flow rate measurement with flow meters, using the instruments available in the Digital Electronics Lab (e.g. Pressure Transducers Test Bench, Flow Rate Measurement, Temperature Transducer).

ENT391: ENT Internship II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
0	0	360	360	3	180			50	0	50

Course Description

Internship provides an opportunity to practice and/or apply knowledge and skills in professional environments and gain valuable work experience. Through the Internship students get exposure to the industrial environment which cannot be simulated in the classroom. During the internship, students have to understand and sharpen the real-time technical/managerial skills required at the job(s). Further, they have to Understand the social, economic, and administrative considerations that influence the working environment of industrial organizations. Overall professional development of students required problem-solving, communication, human development, and relationship-building skills. Students select the internship field in consultation with an industry mentor and faculty guide in terms of the academic requirements. The student is supposed to produce a joining letter and a successful completion certificate. once the internship is over. Internship evaluation can be based on the quality of projects completed as part of the internship activities. Faculty Member(s) has to evaluate(s) the performance of students once by visiting the Industry/Organization and the Evaluation Report of the students' needs to submit in the department office with the consent of Industry persons/ mentor. The students will be exposed to the industry environment for a minimum period of 08 weeks duration to understand the operation of the industrial facility.

References

https://www.youtube.com/watch?v=jpf9J2TUJVg
https://www.youtube.com/watch?v=KqIshDsg494
https://www.youtube.com/watch?v=E1UcIHW5rSc
https://www.youtube.com/watch?v=EhnfOUrFgxM

Learning Outcomes

CLO 1: Analyze the assigned task and solve it by applying critical thinking and problem-solving skills.
CLO 2: Collaborate and communicate effectively with different professionals in the work environment.
CLO 3: Communicate effectively through the technical presentation.
CLO 4: Design solutions with contextual constraints, acquiring and applying new knowledge.
CLO 5: Recommend solutions for improved processes and optimal use of resources.
CLO 6: Evaluate career options by considering opportunities in industry and higher education and sharpen the real-time technical/managerial skills required at the job(s) during the internship.
CLO 7: Demonstrate ethical and professional behavior in the work environment.

ENT421: Heat and Mass Transfer Equipment I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	150	90	120	60	15	25

Course Description

Through a combination of theoretical instruction and practical exercises, the course aims to provide the necessary knowledge and skills to analyze, design, and optimize heat and mass transfer processes in a variety of equipment applications. Topics covered include radiative transfer principles, heat conduction phenomena, mass diffusion processes, and convective heat and mass transfer mechanisms. Emphasis will be placed on the application of these principles in the design and optimization of equipment components such as heat exchangers, insulation systems, and fluid flow systems.

References

J.H. Lienhard, A heat Transfer Textbook http://web.mit.edu/lienhard/www/ahtt.html
A. Bejan, Heat Transfer, Editore: John Wiley & Sons
H.D. Baehr, K. Stephan, Heat and Mass Transfer, Editore: Springer
Bergman T.L., Lavine A.S., Incropera F.P., DeWitt D.P., Fundamentals of Heat and Mass Transfer, Editore: John Wiley and Sons

Learning Outcomes

CLO 1: Demonstrate a comprehensive understanding of the fundamental principles governing heat and mass transfer phenomena in engineering systems.
CLO 2: Identify and describe the mechanisms of heat conduction, convection, and radiation, as well as mass diffusion processes.
CLO 3: Demonstrate an understanding of how heat and mass transfer equipment operates and its role in engineering applications.
CLO 4: Apply theoretical concepts to analyze and solve practical engineering problems related to heat and mass transfer in various equipment and systems.
CLO 5: Design heat exchangers, insulated pipelines, and other engineering components using principles of heat and mass transfer.

Tutorials

TUT1: Hands-on exercises on heat exchangers.
TUT2: Hands-on exercises on heat loss in insulated pipes.
TUT3: Hands-on exercises on evaporators.

Laboratories

LAB1: Observing different insulation materials and their properties.
LAB2: Designing insulated pipelines for hot fluid transport.
LAB3: Testing heat exchanger performance. Based on SCT-24B-E-HE-0.pdf (elettronicaveneta.com)

ENT422: Energy Scenario and Modelling

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	120	360	4	180	90	120	60	15	25

Course Description

The course focuses on tackling both current and future challenges within the energy sector, offering strategies for effective planning and resolution. A first module provides an overview of the current challenges facing the energy sector at a global scale. It explores the classification, reservoirs, and potential of various energy resources focusing on their current status and future forecasts. Students will learn to conduct Country Energy Balances and assess primary energy consumption for goods and services at the country level. Following, a second module focuses on energy modeling, covering its definition, principles, and approaches (simulation/optimization). Students will learn the fundamentals of linear programming models and apply them to a simple reference Energy System. Practical applications to real case studies using open-source code will also be explored.

References

IEA statistics database: IEA – International Energy Agency - IEA
FREDERICK S. HILLIER, GERALD J. LIEBERMAN Late of, INTRODUCTION TO OPERATIONS RESEARCH, Editore: Mc Graw Hill Education, ISBN: 978-0-07-352345-3

Learning Outcomes

CLO 1: Understand the trends of the global energy challenge and the methodological approach to the national energy balance.
CLO 2: Understand the basic of Energy Modelling from the theoretical perspective of linear programming and optimization approaches.
CLO 3: Ability to evaluate and design the energy balance at country level.
CLO 4: Ability to apply the fundamentals of linear programming models to a basic reference Energy System.
CLO 5: Ability to evaluate the energy economy of countries by using a proper set of indicators.
CLO 6: Ability to perform scenario analysis based on the Reference energy system at country level and evaluate the effect of a different technological pathways for reducing the overall consumption of primary energy or reducing emissions and pollutants.
CLO 7: The students will present their project work based on a given format, amount of time and audience.

Tutorials

TUT1: Reviewing data tables for country energy balances.
TUT2: Performing numerical exercises on country energy balances.

Laboratories

LAB1: Introduction to energy modelling tools (e.g., Excel).
LAB2: Practical exercises using the tool.
LAB3: Modelling a basic reference energy system using the tool.
LAB4: Defining and executing energy scenarios with the modelling tool.

ENT423: Multiphase flow

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	150	90	120	60	15	25

Course Description

The course focuses on understanding the physics of multi-phase systems to develop analysis and design tools for the most significant technologies in the energy sector. Principles of multi-phase thermo-fluid dynamics are applied to the discussion of case studies involving the design of evaporators and condensers for energy conversion plants and process industries, as well as pipelines for hydrocarbon and slurry transport, fluidized beds, and phase change materials for energy storage. Experimental laboratories complement theoretical lectures to facilitate a deeper understanding of modeling approaches through experimental validation.

References

Clayton T. Crowe, Multiphase Flow Handbook, Editore: CRC Taylor & Francis, Anno edizione: 2006, ISBN: 0-8493-1280-9
http://www.crcnetbase.com/isbn/9780849312809
Greg F. Naterer, Heat Transfer in Single and Multiphase Systems, Editore: CRC Press, Anno edizione: 2003, ISBN: 0-8493-1032-6
http://www.crcnetbase.com/isbn/9780849310324

Learning Outcomes

CLO 1: Develop a comprehensive understanding of the physics underlying multi-phase flow systems, including the principles of thermo-fluid dynamics.
CLO 2: Acquire knowledge of the design considerations and methodologies involved in setting up test sections for experimental analysis of multi-phase flows.
CLO 3: Apply critical thinking skills to plan and execute experimental runs of multi-phase flow phenomena .
CLO 4: Acquire proficiency in processing empirical data obtained from experimental runs using appropriate software tools and techniques.

Tutorials

TUT1: Calculation of pressure drop and pumping power for two-phase gas-liquid, liquid-liquid, solid-gas flows.
TUT2: Calculation of the heat transfer coefficient for evaporating/condensing flows.
TUT3: Thermal design of a variety of evaporators and condensers for both power and HVAC plants.
TUT4: Performance evaluation of phase change materials for energy storage.

Laboratories

LAB1: Designing and setting up appropriate test sections.
LAB2: Planning and executing experimental runs on liquid-liquid-gas adiabatic flows or forced convective boiling/condensation heat transfer. Based on TPST-24B-E-OG-1.pdf (elettronicaveneta.com)
LAB3: Processing empirical data.

ENT424: Industrial Plants I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

The course covers the fundamentals of planning and operating industrial facilities. A first module focuses a comprehensive description of different production system such as job shop, assembly shop, cellular manufacturing, and flow production. A second module convers cost classifications, various cost analysis techniques, and strategies for cost optimization within plant operations. Finally, a third module covers the basics of plant management, focusing on inventory management, production scheduling, and the role of Manufacturing Execution Systems (MES).

References

Marco Garetti, Design and Management of Production Systems: tutorials and case studies, Editore: FrancoAngeli, ISBN: 978-88-568-3450-5

Learning Outcomes

CLO 1: Demonstrate a comprehensive understanding of different production systems.
CLO 2: Understand the principles of cost management in industrial plant operations, including cost classification, cost analysis techniques, and cost optimization strategies.
CLO 3: Evaluate process plant performance metrics and identify areas for improvement in terms of output, efficiency, and capacity utilization.
CLO 4: Identify cost drivers and analyze cost structures to make informed decisions regarding resource allocation, budgeting, and cost reduction initiatives.
CLO 5: Utilize inventory management techniques and production scheduling tools to optimize inventory levels and improve production efficiency.

Tutorials

TUT1: Overview of different production systems with practical examples: job shop, assembly shop, cellular manufacturing, and flow production.
TUT2: Comparative analysis of different production systems using real-world examples.

TUT3: Practical exercises on calculating production costs and optimizing cost structures.

Laboratories

LAB1: Preliminary design of a production system, including production costs and optimized cost structures

ENT425: Sustainable Development and SDGs interlinkages

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	120	360	4	180	90	120	60	15	25

Course Description

The course provides a comprehensive overview of sustainable development concepts, focusing on understanding global challenges and applying theoretical knowledge and modeling skills to tackle them effectively. A first module centers on defining sustainable development and introducing the Sustainable Development Goals (SDGs), specifically focusing on SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). A second module focuses on system dynamics, exploring its principles and applications. Students engage in hands-on activities to model dynamic systems, analyze feedback loops, and simulate scenarios to understand the complex interactions within sustainable development frameworks. Finally, students apply their knowledge to realize a project work utilizing system dynamics to develop strategies for implementing sustainable development goals at the national level.

References

Sachs, Jeffrey D, The age of sustainable development., Editore: Columbia University, Anno edizione: 2015
Kreme, M., P. van Lieshout, and R. Went., Doing Good or Doing Better: Development Policies in a Globalizing World. , Editore: 2010
Nilsson, M., et al., A guide to SDG interactions: From science to implementation, Editore: Internatioanl council of Science, Anno edizione: 2017
Thürer, Matthias, et al., A Systematic Review of the Literature on Integrating Sustainability into Engineering Curricula, Editore: Journal of Cleaner Production, Anno edizione: 2017

Learning Outcomes

CLO 1: Understand and learn the history of sustainable development and the paradigms adopted from the 50s.
CLO 2: Analyze and understand the SDGs goals, especially the 6th, the 7th, the 11th, the 12th, and the 13th, their specific targets and indicators.
CLO 3: Understand the concept of Community Integration for setting sustainable strategies at firm level.
CLO 4: Approach to long-term simulation-based tools.
CLO 5: Apply modelling tools for the sustainable planning of resources at country level.
CLO 6: Understand and model the complexities and interrelations between the different SDGs.
CLO 7: Make autonomous choices for identifying and selecting the appropriate planning strategy for solving the same problem.
CLO 8: Prepare an action plan outlining the synergetic strategies to achieve country-specific development scenarios.
CLO 9: Identify and learn the modelling approaches suitable to analyze and tackle the main challenges of SD.
CLO 10: Argue personal judgments about the topics covered in class.
CLO 11: Deal with other colleagues’ opinion and arguments.
CLO 12: Present and communicate the work given in certain amount of time and to ab audience.

Laboratories

LAB1: System dynamics model to develop strategies for implementing SDGs at the national level.

ENT426: HVAC and Cooling Technologies

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

HVAC systems play a crucial role in maintaining thermal comfort and indoor air quality in residential, commercial, and industrial buildings. This course provides a comprehensive foundation in HVAC principles, covering various heating and cooling technologies, system design

considerations, and practical skills for technicians. Students will gain expertise in:
• Fundamentals of thermodynamics and psychrometrics relevant to HVAC systems
• Different types of heating and cooling equipment (furnaces, boilers, air conditioners, heat pumps)
• Air distribution systems and components (ducts, vents, dampers)
• Refrigeration cycles and vapor compression systems
• Controls and automation in HVAC systems
• Maintenance procedures and troubleshooting techniques
• Safety regulations and industry standards

Learning Outcomes

CLO1: Explain the basic principles of thermodynamics and psychrometrics as they apply to HVAC systems.
CLO2: Identify and differentiate between various types of heating and cooling equipment.
CLO3: Describe the functions of different components in air distribution systems.
CLO4: Analyze the operation of refrigeration cycles used in air conditioning systems.
CLO5: Explain the use of controls and automation in regulating HVAC system performance.
CLO6: Perform basic maintenance procedures on HVAC equipment.
CLO7: Troubleshoot common HVAC system problems.
CLO8: Apply safety regulations and industry standards when working with HVAC systems.
CLO9: Read and interpret technical diagrams and schematics related to HVAC systems.

Lectures

LEC1-2: Introduction to HVAC Systems & Importance of Thermal Comfort.
LEC3-4: Fundamentals of Thermodynamics & Psychrometrics for HVAC Applications.
LEC5-6: Classifications of HVAC Systems (Centralized, Distributed) & Components.
LEC7: Midterm Exam Review.
LEC8-9: Heating Technologies: Furnaces, Boilers, Electric Resistance Heating.
LEC10-11: Cooling Equipment: Air Conditioners, Heat Pumps, Evaporative Coolers.
LEC12-13: Air Distribution Systems (Ducted, Ductless) & Components.
LEC14: Control Systems & Automation in HVAC (Thermostats, Sensors, BMS).

Tutorials

TUT1-2: Analyze factors affecting thermal comfort in buildings and HVAC system design.
TUT3-4: Solve problems applying thermodynamic principles to calculate heat transfer in buildings.
TUT5-6: Discuss case studies on selecting appropriate HVAC systems for different building types.
TUT7: Practice problems and review for midterm exam.
TUT8-9: Analyze case studies on factors influencing furnace efficiency and selection criteria.
TUT10-11: Discuss case studies on applying air conditioning principles to calculate cooling loads.
TUT12-13: Analyze case studies on designing air distribution systems for specific building layouts.
TUT14: Discuss case studies on using control systems to optimize HVAC system performance.

Laboratories

LAB1-2: Hands-on experience with measuring temperature, humidity, and airflow using instruments.
LAB3-4: Labs on simulating and analyzing performance of different heating systems (furnaces).
LAB5-6: Project work on designing a basic heating system layout for a chosen building scenario.
LAB7: Midterm Exam (no labs).
LAB8-9: Labs on simulating and analyzing performance of different cooling systems (air conditioners).
LAB10-11: Project work on designing an air distribution system with components for a chosen building scenario.
LAB12-13: Labs on practicing troubleshooting techniques for common HVAC system problems (simulated scenarios).
LAB14: Finalize lab projects and presentations on designed heating system and troubleshooting procedures.

ENT427: Advanced Heat and Mass Transfer Processes

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: ENT421

Course Description

This course builds upon the foundation of Heat and Mass Transfer Equipment I, delving deeper into complex heat and mass transfer phenomena and their applications in advanced energy systems. It emphasizes modeling, simulation, and optimization techniques.
Course Objectives:
Master advanced heat and mass transfer concepts like multiphase flow, turbulence, and non-equilibrium processes.
Develop proficiency in computational tools for heat and mass transfer analysis.
Apply advanced knowledge to design and optimize high-performance heat and mass transfer equipment.

Learning Outcomes

CLO 1: Analyze multiphase flow regimes, turbulence models, and non-equilibrium effects in heat and mass transfer.
CLO 2: Critically evaluate the limitations of basic heat transfer models.
CLO 3: Understand the fundamentals of computational fluid dynamics (CFD) for heat and mass transfer applications.
CLO 4: Formulate and solve complex heat and mass transfer problems using advanced analytical and computational techniques.
CLO 5: Design and optimize high-performance heat exchangers, reactors, and other advanced energy conversion devices.
CLO 6: Utilize CFD software to simulate and analyze heat and mass transfer processes.
CLO 7: Effectively communicate complex heat and mass transfer concepts through technical reports and presentations.
CLO 8: Critically evaluate research findings and select appropriate modeling approaches for specific applications.

Lectures

LEC1: Multiphase flow in heat and mass transfer processes.
LEC2: Turbulent heat and mass transfer.
LEC3: Non-equilibrium thermodynamics and mass transfer.
LEC4: Advanced heat exchanger design and optimization.
LEC5: Computational fluid dynamics (CFD) for heat and mass transfer.
LEC6: Emerging heat and mass transfer technologies in energy systems.

Tutorials

TUT1: CFD modeling of heat transfer in a heat exchanger (using software).
TUT2: Multiphase flow simulation in a reactor (using software).
TUT3: Optimization of a heat and mass transfer process using numerical methods.

Laboratories

LAB1: Experimental investigation of multiphase flow in a pipe loop.
LAB2: Validation of CFD simulations with experimental heat transfer data.
LAB3: Design project: Design, model, and analyze a novel heat and mass transfer device using CFD software.

ENT431: Sustainability and the Built environment

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	120	360	4	180	90	120	60	15	25

Course Description

The course aims to introduce fundamental knowledge related to sustainability, climate change and sustainable development.
In particular, the following topics will be addressed.
· The SDGs' challenges: human development, sustainability and international cooperation.
· Anthropogenic impacts on the ecosystem, energy consumption and greenhouse emissions.
· Environmental sustainability and climate change.
· International regulatory framework about sustainability.
· Sustainability of urban territories.
· Sustainable energy management.
· Sustainable mobility.
· Recycling, life cycle assessment (LCA) and circular economy.
· Sustainable water management.
· Sustainable consumption: changes in consumer choices.

References

Sustainable Development Strategies: Engineering, Culture and Economics, Elsevier, 2020.
Handbook of Sustainable Development, Edwar Elgar, 2014.

Learning Outcomes

CLO 1: Demonstrate a comprehensive understanding of the fundamental principles of sustainable development.
CLO 2: Identify the main strategies to ensure sustainability in the built environment.
CLO 3: Apply theoretical concepts to identify effective solutions for sustainable development.

Tutorials

TUT1: teamwork exercise concerning strategic choices for sustainable development.

ENT432: Technical design: theory and application

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	150	90	120	60	15	25

Course Description

The course aims to provide all the fundamental knowledge required to deal with the technical design process in construction.
In particular, the following topics will be covered.
· Technical regulations relating to the building and civil engineering design process.
· Introduction to the design process: objectives, project phases and documentation.
· Building and technical systems design principles.
· Typologies of graphic works and technical drawings.
· Techniques of graphic representation.
· Metric and estimative calculation (bill of quantities).

References

Manual of Engineering Drawing, British and International Standards, 2020
Introduction to Architectural and Technical Drawing: A Practical Handbook, 2020.

Learning Outcomes

CLO 1: Demonstrate a comprehensive understanding of the design process of building technologies and technical systems.
CLO 2: Demonstrate technical skills to properly understand design phases and documents.
CLO 3: Apply theoretical concepts to correctly interpret and prepare design documentation.

Tutorials

TUT1: Hands-on exercises on design documentation analysis.
TUT2: Hands-on exercises on design documentation preparation.

Laboratories

LAB1: Technical design and drawing lab.

ENT433: Building Physics

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	150	90	120	60	15	25

Course Description

The course provides the general knowledge of building physics and related energy use in their various forms, covering the following topics
Recalls of thermodynamics and of heat transfer.
· Building thermophysics.
· Hints of lighting engineering.
· Thermohygrometric, acoustic and visual comfort.
· Climate as a design element and principles of climate-responsive design.
· Building’s thermal balance.
· Basics of technical plant engineering
· Basic criteria for energy efficient building design.

References

Y. A. Cengel, Introduction to Thermodynamics and Heat Transfer, McGrow.Hill, 2010.
Handbook of Sustainable Building design for Africa, UN-HABITAT, 2023 (https://www.abc21.eu/publications/).

Learning Outcomes

CLO 1: Demonstrate the basic knowledge of building’s energy needs and balance.
CLO 2: Basic introduction to the application of technical installations in buildings
CLO 3: Apply theoretical concepts to properly calculate/simulate the energy balance of a building.
CLO 4: Conceptual design of energy efficient buildings.

Tutorials

TUT1: Hands-on exercises on heat transfer in buildings.
TUT2: Hands-on exercises on winter/summer heat load.
TUT3: Hands-on exercises on artificial lighting system sizing.

Laboratories

LAB1: Practical measurements on energy performances (e.g., thermal transmittance, mass, water permeability, etc.) of building construction materials.
LAB2: Building energy modelling and simulation.

ENT434: Building technical systems design and maintenance

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

The course aims to provide students with appropriate methods and tools for the design and maintenance process of the technical systems of a building. The different phases of the process will be presented, based on the main technical and legislative standards, the contents and methods of preparing project documents, graphic tables and technical specifications. The student, working on the design of a plant, will be guided to the concrete use of the knowledge acquired, from the definition of the project data, to the choice of the plant typology, to the sizing of the main components, to the graphic representation and drafting of the project documentation.
In particular, the following macro topics are planned:
· General regulations relating to the sizing and safety of civil technical systems.
· Definition of project conditions.
· Hydronic and aeraulic systems design principles.
· Electrical and lighting system design principles.
· Architecture of building's mechanical, plumbing and electrical systems, system choices and application of selection and sizing criteria.
· The design process and development of an organic design work.
· Plant operation and maintenance techniques.

References

ASHRAE Handbook - Fundamentals SI edition, 2013

HVAC Systems Design Handbook, McGraw-Hill Education, 2009
ASHRAE Greenguide - Design, Construction, and Operation of Sustainable Buildings, 2010
Handbook of Sustainable Building design for Africa, UN-HABITAT, 2023 (https://www.abc21.eu/publications/).

Learning Outcomes

CLO 1: Demonstrate a detailed knowledge about concepts and principles of building technical systems design.
CLO 2: Demonstrate a comprehensive understanding about building technical systems operation and maintenance techniques.
CLO 3: Apply theoretical concepts to properly size and design main building technical systems.

Tutorials

TUT1: Hands-on exercises on size parameters of mechanical, plumbing and electrical systems.

Laboratories

LAB1: Practical assembly and maintenance activities on key mechanical, plumbing and electrical systems subcomponents.

ENT435: Renewable energy systems for building integration

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120	120	360	4	180	90	120	60	15	25

Course Description

The course aims to provide the main concepts necessary for the selection and sizing of energy generation systems powered by renewable sources exploitable in a building context, addressing both technical and economic aspects. Key concepts regarding smart-grids, energy communities and energy storage systems will be also treated.
In detail, the course will cover the following topics.
· Introduction to renewable energy sources.
· Photovoltaic solar energy.
· Solar thermal energy.
· Wind energy (micro wind power plants).
· Low-enthalpy geothermal energy.
· Biomass and biofuels.
· Energy storage systems.
· Smart-grids and renewable energy communities.

References

The Renewable Energy Handbook, Aztext Press, 2009.
Renewable Energy: Challenges and Solutions, Springer, 2024.
Handbook of Sustainable Building design for Africa, UN-HABITAT, 2023 (https://www.abc21.eu/publications/).

Learning Outcomes

CLO 1: Demonstrate a comprehensive understanding about operating principles of main renewable energy sources.
CLO 2: Demonstrate a detailed knowledge about renewable energy plants sizing criteria.
CLO 3: Apply theoretical concepts to properly size and design energy generation systems powered by renewable sources applied at building scale.

Tutorials

TUT1: Hands-on exercises on renewable energy plants sizing.

Laboratories

LAB1: Practical experimental works on lab-size renewable energy systems.

ENT436: Energy Efficiency in the building sector

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

The course aims to provide advanced knowledge and appropriate tools for analysing the energy performance of buildings in the context of overall sustainability.
The course introduces the concept of building energy, environmental and economic sustainability and related assessment procedures. In particular, emphasis will be placed on understanding the definitions and concepts of operational and embodied energy, as well as related environmental impacts.
More in detail, the course will focus on the holistic optimisation of the building envelope and technical systems, studying the main design techniques and technologies in order to ensure maximum efficiency together with the achievement of significant indoor environmental quality.
Finally, the student will be introduced to the world of sustainability and energy certification of buildings, dealing with the main aspects of the relevant technical and legislative regulations.

References

ASHRAE Greenguide - Design, Construction, and Operation of Sustainable Buildings , 2018.
Kiber C.J., Sustainable Construction - Green Building Design and Delivery , Wiley, 2016
Kreider, J.F, Curtiss P.S., Rabl A., Heating and Cooling of Buildings - Design for efficiency, CRC Press, 2016.

Learning Outcomes

CLO 1: Demonstrate a comprehensive understanding about energy efficiency in the building sector.
CLO 2: Demonstrate a detailed knowledge about energy-efficient design techniques.
CLO 3: Apply theoretical concepts to properly design an energy-efficient building.

Tutorials

TUT1: Hands-on exercises about building energy rating and performance assessment.

ENT437: Energy diagnosis & implementation measures

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

The aim is to introduce and illustrate in an operational manner the methodologies and techniques of energy diagnosis of buildings and technical systems, in order to describe in detail their operating modes and energy performances, identify any criticalities and select/design energy efficiency measures to be implemented.
In detail, the following main topics will be addressed.
• International regulatory framework on the energy diagnosis of buildings.
• The main stages of energy diagnosis –collection/processing of consumption data and field measurements.
• Set up and modelling of building and technical systems.
• Definition of energy performance improvement measures/interventions.
• The evaluation of achievable results from an energy, economic and environmental point of view.

References

Handbook of Energy Audits, Ninth Edition, Routledge, 2012

Learning Outcomes

CLO 1: Demonstrate a comprehensive understanding about building energy diagnosis methodologies and techniques.
CLO 2: Demonstrate a detailed knowledge about energy performance improvement measures/interventions.

CLO 3: Apply theoretical concepts to properly conduct a building energy audit and propose energy retrofit interventions.

Tutorials

TUT1: Hands-on exercises on building energy audit.
TUT2: Hands-on exercises on the application of energy retrofit interventions.

Laboratories

LAB1: Practical experimental works of field measurements to collect energy consumption data and prepare an energy inventory.

ENT441: Solar Energy Technology

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

This course introduces students to the fundamentals of solar energy conversion and its applications. Through a combination of lectures, tutorials, laboratory sessions, and projects, students will gain knowledge about solar radiation, photovoltaic (PV) systems, solar thermal systems, and their design considerations, with the following specific contents:
1. Fundamentals of Solar Energy: This module will cover the basics of solar radiation, including its measurement and characteristics. Students will learn about the sun's energy spectrum and how it interacts with Earth's atmosphere.
2. Photovoltaic (PV) Systems: This module will delve deeper into the technology behind solar electricity generation. Students will explore the working principles of photovoltaic cells, factors affecting their performance, and different PV system configurations.
3. Solar Thermal Systems: This module will introduce students to solar thermal energy conversion technologies. They will learn about various solar collectors, their applications for heating water or air, and design considerations for solar thermal systems.

Learning Outcomes

CLO1: Explain the basic principles of solar radiation and its measurement.
CLO2: Describe the working principle and characteristics of photovoltaic cells.
CLO3: Analyze the performance of PV systems under different operating conditions.
CLO4: Identify different types of solar thermal systems and their applications.
CLO5: Design a basic solar energy system for a specific application.
CLO6: Perform basic calculations for sizing and selecting solar energy components.

Lectures

LEC1-2: Introduction to Solar Energy & Solar Radiation.
LEC3-4: Photovoltaic (PV) Cells & Working Principles.
LEC5-6: PV System Components & Design Considerations.
LEC7: Midterm Exam Review.
LEC8-9: Solar Thermal Systems & Collector Types.
LEC10-11: Applications of Solar Thermal Systems.
LEC12-13: Sizing & Selecting Solar Energy Systems.
LEC14: Course Review & Future of Solar Energy.

Tutorials

TUT1-2: Clarify concepts on solar radiation and measurement.
TUT3-4: Solve problems related to PV cell characteristics.
TUT5-6: Discuss case studies on PV system design projects.
TUT7: Practice problems and review for midterm exam.
TUT8-9: Analyze case studies on different solar thermal applications.
TUT10-11: Solve problems on solar thermal system sizing.
TUT12-13: Work on practice problems for selecting solar components.
TUT14: Course review and Q&A session.

Laboratories

LAB1-2: Experiments on measuring solar radiation.
LAB3-4: Experiments on PV cell characteristics & efficiency.
LAB5-6: Lab simulations or projects on designing a small PV system.
LAB7: Midterm Exam (no labs).
LAB8-9: Experiments on solar collector performance.
LAB10-11: Lab projects on designing a solar thermal system for specific applications.
LAB12-13: Labs on using software tools for solar energy system sizing.
LAB14: Finalize lab projects and presentations.

ENT442: Wind Energy Technology

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

This course provides students with a foundational understanding of wind energy conversion and its applications. Through lectures, tutorials, laboratory sessions, and projects, students will explore wind energy principles, wind turbine technologies, site assessment considerations, and wind energy integration into power systems, with the following specific contents:
1. Fundamentals of Wind Energy: This module will cover the core principles of wind energy conversion, including wind resource assessment techniques and their importance for successful wind farm development. Students will learn about wind characteristics, power extraction principles, and factors influencing wind power potential.
2. Wind Turbine Technologies: This module will delve deeper into the technology behind wind turbines. Students will explore different wind turbine types (horizontal axis, vertical axis), their components (blades, tower, nacelle), and operating principles. The course will also cover wind turbine performance characteristics and factors affecting their efficiency.
3. Wind Energy Integration and Applications: This module will focus on the broader aspects of wind energy utilization. Students will explore wind farm siting considerations, including environmental impact assessments. The course will cover the electrical aspects of integrating wind energy into power grids, including power conversion systems and grid stability challenges.

Learning Outcomes

CLO1: Explain the fundamental principles of wind energy conversion.
CLO2: Analyze wind resource characteristics and assessment techniques.
CLO3: Describe the components and operation of wind turbines.
CLO4: Assess wind farm siting considerations and potential environmental impacts.
CLO5: Explain the electrical aspects of wind energy integration into power grids.
CLO6: Perform basic calculations for wind power potential and wind turbine selection.

Lectures

LEC1-2: Introduction to Wind Energy & Wind Resource Assessment.
LEC3-4: Wind Turbine Technologies (Horizontal Axis).
LEC5-6: Wind Turbine Technologies (Vertical Axis) & Performance Characteristics.
LEC7: Midterm Exam Review.
LEC8-9: Wind Farm Siting & Environmental Considerations.
LEC10-11: Electrical Aspects of Wind Energy Integration.
LEC12-13: Wind Power Grid Integration Challenges & Solutions.
LEC14: Course Review & Future of Wind Energy.

Tutorials

TUT1-2: Analyze wind data and resource assessment methods.
TUT3-4: Solve problems on wind turbine blade aerodynamics.
TUT5-6: Discuss case studies on different wind turbine technologies.
TUT7: Practice problems and review for midterm exam.
TUT8-9: Analyze case studies on wind farm siting challenges.
TUT10-11: Solve problems on power conversion in wind energy systems.
TUT12-13: Work on practice problems for wind grid integration scenarios.
TUT14: Course review and Q&A session.

Laboratories

LAB1-2: Experiments on wind resource data analysis.

LAB3-4: Lab simulations on wind turbine blade performance.
LAB5-6: Project work on comparing wind turbine types for a specific site.
LAB7: Midterm Exam (no labs).
LAB8-9: Experiments on assessing environmental impacts of wind farms.
LAB10-11: Lab exercises on simulating wind power integration into grids.
LAB12-13: Projects on analyzing grid stability challenges with wind power.
LAB14: Finalize lab projects and presentations.

ENT451: Fuel and Energy Transmission

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

The global energy landscape demands efficient and reliable methods for transmitting fuels and energy. This course equips students with the knowledge and skills to analyze, design, and manage these critical transmission systems. Students will explore various aspects of fuel and energy transmission, including:
• Different fuels and energy forms requiring transmission (oil, gas, electricity, hydrogen)
• Pipeline systems for oil and gas transportation (onshore, offshore)
• Power transmission lines and substations for electricity grids
• Emerging technologies for energy transmission (e.g., hydrogen pipelines, HVDC transmission)
• Design considerations for efficient and reliable transmission systems
• Environmental impact assessments and regulations for transmission infrastructure
• Operation and maintenance of transmission systems

Learning Outcomes

CLO1: Classify different fuels and energy forms based on their transmission requirements.
CLO2: Explain the working principles of pipeline systems for oil and gas transportation.
CLO3: Describe the components and operation of power transmission lines and substations.
CLO4: Analyze the potential of emerging technologies for energy transmission (e.g., hydrogen pipelines).
CLO5: Apply engineering principles for designing efficient and reliable transmission systems.
CLO6: Evaluate environmental impacts associated with various transmission infrastructure projects.
CLO7: Discuss relevant regulations and safety considerations for fuel and energy transmission systems.
CLO8: Perform basic calculations related to energy flow and losses during transmission.

Lectures

LEC1-2: Introduction to Fuel & Energy Transmission & Global Energy Landscape.
LEC3-4: Different Fuels & Energy Forms Requiring Transmission (Oil, Gas, Electricity, Hydrogen).
LEC5-6: Fundamentals of Thermodynamics & Fluid Mechanics for Transmission Processes.
LEC7: Midterm Exam Review.
LEC8-9: Pipeline Systems for Oil & Gas Transportation (Onshore, Offshore).
LEC10-11: Power Transmission Lines & Substations in Electricity Grids.
LEC12-13: Environmental Impact Assessments & Regulations for Transmission Infrastructure.
LEC14: Course Review & Future of Fuel and Energy Transmission.

Tutorials

TUT1-2: Analyze energy consumption patterns and the need for efficient transmission.
TUT3-4: Discuss case studies on selecting appropriate transmission methods for different fuels and energy forms.
TUT5-6: Solve problems on applying thermodynamic principles to energy transmission calculations.
TUT7: Practice problems and review for midterm exam.
TUT8-9: Analyze case studies on design considerations for oil and gas pipelines.
TUT10-11: Work on problems related to power flow calculations in transmission lines.
TUT12-13: Discuss case studies on mitigating environmental impacts of transmission projects.
TUT14: Course review and Q&A session on future trends in transmission technologies.

Laboratories

LAB1-2: Simulations on energy flow and losses during transmission (various fuels/energy forms).
LAB3-4: Labs on analyzing data from existing pipeline infrastructure.

LAB5-6: Project work on designing a basic oil or gas pipeline for a chosen scenario.
LAB7: Midterm Exam (no labs).
LAB8-9: Experiments or simulations on power flow behavior in transmission lines.
LAB10-11: Lab simulations or demonstrations on substation operations.
LAB12-13: Projects on analyzing environmental impact assessments for a chosen transmission project.
LAB14: Finalize lab projects and presentations.

ENT452: Selected Topics in Petroleum and Energy Engineering

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

Petroleum Topics chosen from: Petroleum or Gas exploration, drilling production, simulation, recovery, and gas liquefaction. Field study including assessment, evaluation, feasibility and economic studies will be required.
Energy Topics chosen from: Alternative Energy resources including solar, wind, biomass, fuel cells, nuclear or geothermal energy. Field study including assessment, evaluation, feasibility and economic studies will be required.

ENT461: Electrical Chargers Technology

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

This course equips students with a comprehensive understanding of electrical charger technologies for various applications. Through a combination of lectures, tutorials, laboratory sessions, and projects, students will explore the working principles, design considerations, and functionalities of chargers for electric vehicles (EVs) of all sizes, ranging from personal electronics to drones and heavy-duty trucks, with the following specific contents:
1. Fundamentals of EV Charging: This module will cover the core concepts of electric vehicle charging, including different charging levels (AC/DC slow, fast charging), battery types used in EVs, and their charging requirements. Students will learn about the importance of charger compatibility and safety standards.
2. EV Charger Technologies: This module will delve deeper into the functionalities and designs of various EV charger types. Students will explore AC chargers, DC fast chargers, wireless charging systems, and their operating principles. The course will cover power electronics used in chargers, communication protocols, and user interfaces.
3. Charger Applications and Future Trends: This module will focus on selecting and designing chargers for specific applications. Students will explore considerations for charging personal electronics, electric cars, electric buses and trucks, and even drones. The course will touch upon emerging trends like ultra-fast charging technologies, battery swapping systems, and smart charging infrastructure.

Learning Outcomes

CLO1: Explain the fundamental concepts of electric vehicle charging and different charging levels.
CLO2: Analyze the operation and functionalities of various EV charger types (AC, DC, wireless).
CLO3: Identify key considerations for designing and selecting EV chargers for specific applications.
CLO4: Evaluate the technical aspects of fast charging technologies for high-power EVs.
CLO5: Discuss the emerging trends and future advancements in electrical charger technologies.
CLO6: Perform basic calculations and simulations related to EV charger performance.

Lectures

LEC1-2: Introduction to EV Charging & Charging Levels (AC/DC).
LEC3-4: EV Battery Technologies & Charging Requirements.
LEC5-6: AC Charger Operation & Functionalities.
LEC7: Midterm Exam Review.
LEC8-9: DC Fast Charger Technologies & Power Electronics.
LEC10-11: Wireless Charging Systems for EVs.
LEC12-13: Charger Selection for Different Applications (Cars, Buses, Drones).
LEC14: Future Trends: Ultra-Fast Charging & Smart Charging Infrastructure.

Tutorials

TUT1-2: Analyze compatibility between chargers and different EV battery types.
TUT3-4: Solve problems on power calculations for EV charging at different levels.
TUT5-6: Discuss case studies on functionalities of AC chargers for various applications.
TUT7: Practice problems and review for midterm exam.
TUT8-9: Analyze technical specifications of DC fast chargers.
TUT10-11: Work on problems related to efficiency calculations in wireless charging systems.
TUT12-13: Discuss case studies on selecting chargers for electric buses or trucks.
TUT14: Course review and Q&A session on future trends.

Laboratories

LAB1-2: Experiments on simulating AC charger operation.
LAB3-4: Labs on measuring charging efficiency at different power levels.
LAB5-6: Project work on designing a basic AC charger for a specific device.
LAB7: Midterm Exam (no labs).
LAB8-9: Experiments on analyzing power electronics components in DC fast chargers.
LAB10-11: Lab simulations or projects on wireless charging systems for EVs.
LAB12-13: Projects on selecting and simulating chargers for electric vehicle applications (chosen case study).
LAB14: Finalize lab projects and presentations.

ENT462: Electric Vehicles Technology

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

This course provides students with a comprehensive understanding of electric vehicles (EVs) and their core technologies. Through a combination of lectures, tutorials, laboratory sessions, and projects, students will explore EV drivetrains, battery technologies, charging infrastructure, and the environmental implications of electric transportation, with the following specific contents:
Fundamentals of Electric Vehicles (EVs): This module will cover the core concepts of EVs, including their advantages and disadvantages compared to conventional vehicles. Students will learn about different EV classifications (BEVs, PHEVs, HEVs), drivetrain components (motors, controllers, transmissions), and their functionalities. The course will explore energy storage options for EVs and their impact on vehicle range and performance.
Electric Vehicle Drivetrain Technologies: This module will delve deeper into the technical aspects of EV drivetrains. Students will explore different electric motor technologies (AC induction, permanent magnet synchronous) and their operating principles. The course will cover motor controllers, power electronics, and energy conversion within the EV drivetrain. Gearing systems and transmission options in EVs will also be discussed.
Battery Technologies and Charging Infrastructure: This module will focus on battery systems as the heart of EVs. Students will explore different battery types (lithium-ion, solid-state) and their characteristics relevant to EV applications. The course will cover battery management systems (BMS), charging and discharging cycles, and factors affecting battery performance and lifespan. Students will also learn about different EV charging infrastructure options (AC, DC fast charging, wireless charging) and their functionalities.

Learning Outcomes

CLO1: Explain the working principles of electric vehicle drivetrains (motors, controllers, transmissions).
CLO2: Analyze the characteristics and performance of different electric motor technologies used in EVs.
CLO3: Describe the operation and management of EV battery systems, including charging and discharging cycles.
CLO4: Evaluate the environmental benefits and challenges associated with electric vehicles.
CLO5: Identify key considerations for designing and selecting EV components for various applications.
CLO6: Perform basic calculations related to EV range, power consumption, and battery capacity.

Lectures

LEC1-2: Introduction to Electric Vehicles (EVs) & Classifications.
LEC3-4: EV Drivetrain Components & Functionalities.
LEC5-6: Energy Storage Options for EVs & Battery Impact.
LEC7: Midterm Exam Review.
LEC8-9: Electric Motor Technologies for EVs (AC Induction, PMSM).
LEC10-11: Power Electronics & Energy Conversion in EV Drivetrains.
LEC12-13: Gearing Systems & Transmission Options in EVs.
LEC14: Course Review & Future of Electric Vehicles.

Tutorials

TUT1-2: Analyze advantages & disadvantages of EVs compared to conventional vehicles.
TUT3-4: Solve problems on power and torque calculations in EV drivetrains.
TUT5-6: Discuss case studies on selecting battery types for different EV applications.
TUT7: Practice problems and review for midterm exam.
TUT8-9: Compare and contrast different electric motor technologies for EVs.
TUT10-11: Work on problems related to power electronics efficiency in EV drivetrains.
TUT12-13: Analyze case studies on selecting gear ratios for specific EV types.
TUT14: Course review and Q&A session on future trends.

Laboratories

LAB1-2: Experiments simulating EV drivetrain operation (motors, controllers).
LAB3-4: Labs on measuring battery performance characteristics.
LAB5-6: Project work on designing a basic EV drivetrain for a chosen application.
LAB7: Midterm Exam (no labs).
LAB8-9: Experiments on analyzing efficiency of different electric motor types.
LAB10-11: Lab simulations on power electronics components in EV drivetrains.
LAB12-13: Projects on selecting and simulating gear ratios for an EV application (based on chosen project).
LAB14: Finalize lab projects and presentations.

ENT471: Smart Buildings and Cities Platforms

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

The rise of smart buildings and smart cities necessitates powerful software platforms for integrating and managing complex systems. This course delves into the world of these platforms, exploring their functionalities, applications, and the role they play in creating intelligent and sustainable urban environments. Students will gain expertise in:
• Different types of smart building and smart city platforms
• Data management and analytics functionalities on these platforms
• Building automation and control systems integrated with platforms
• Smart city applications and platform-based solutions for urban challenges (e.g., energy management, traffic control)
• Cybersecurity considerations for smart building and smart city platforms
• Interoperability and data exchange between different platforms

Learning Outcomes

CLO1: Classify different types of platforms used for smart building and smart city applications.
CLO2: Explain the functionalities of data management and analytics tools on these platforms.
CLO3: Describe how building automation and control systems integrate with smart building platforms.
CLO4: Analyze potential smart city applications and identify suitable platform-based solutions.
CLO5: Discuss cybersecurity risks associated with smart building and smart city platforms.
CLO6: Explain the importance of interoperability and data exchange between different platforms for comprehensive smart city ecosystems.
CLO7: Develop and present a plan for utilizing a smart building or smart city platform for a chosen scenario.

Lectures

LEC1-2: Introduction to Smart Buildings & Cities & Role of Software Platforms.
LEC3-4: Different Types of Smart Building & Smart City Platforms (BMS, IWMS, UDPs, CMPs).
LEC5-6: Data Management Fundamentals on Smart Building & City Platforms.
LEC7: Midterm Exam Review.
LEC8-9: Data Analytics Tools & Applications on Smart Building & City Platforms.
LEC10-11: Building Automation & Control System Integration with Platforms.
LEC12-13: Smart City Applications Enabled by Smart Building & City Platforms.
LEC14: Course Review & Future of Smart Building & City Platforms.

Tutorials

TUT1-2: Analyze cost-benefit considerations of implementing smart building/city platforms.
TUT3-4: Discuss case studies on selecting appropriate platforms for different building types.
TUT5-6: Solve problems on data management tasks like data filtering and visualization on platforms.
TUT7: Practice problems and review for midterm exam.
TUT8-9: Analyze case studies on using data analytics tools for optimizing building energy efficiency.
TUT10-11: Discuss case studies on integrating specific building automation systems with platforms.
TUT12-13: Analyze case studies on smart city applications (e.g., traffic management) using platform functionalities.
TUT14: Course review and Q&A session on future trends in smart building/city platforms.

Laboratories

LAB1-2: Hands-on experience with user interfaces of real or simulated smart building/city platforms.
LAB3-4: Labs on using data analysis tools integrated with the platforms (focusing on chosen scenario).
LAB5-6: Project work on developing a plan for utilizing a platform to optimize energy use in a chosen smart building scenario.
LAB7: Midterm Exam (no labs).
LAB8-9: Labs on simulating smart city applications (e.g., traffic flow) using platform functionalities.
LAB10-11: Project work on designing a smart city application using a platform to address a specific challenge (based on chosen scenario).
LAB12-13: Presentations on initial project findings: data analysis and platform functionalities for chosen smart building/city applications.
LAB14: Finalize lab projects and presentations on comprehensive solutions using smart building/city platforms.

ENT472: Light Current and Digital Systems Technologies

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	60	60	240	3	120	90	120	60	15	25

Course Description

The convergence of light and digital technologies has revolutionized various fields like communication, computing, and sensor applications. This course provides a comprehensive foundation in light current technologies and digital systems, preparing students for careers in these exciting areas. Students will gain expertise in:
• Fundamentals of light and its interaction with matter (absorption, emission)
• Light-emitting diodes (LEDs), photodetectors, and optocouplers
• Digital logic gates (AND, OR, NOT) and combinational circuits
• Sequential circuits (flip-flops, counters) and state machines
• Digital-to-analog and analog-to-digital conversion
• Microcontrollers and interfacing with light current devices
• Applications of light current and digital systems technologies (communication, sensors)

Learning Outcomes

CLO1: Analyze the principles of light-matter interaction and explain the operation of optoelectronic devices.
CLO2: Design and analyze basic combinational circuits using digital logic gates.
CLO3: Understand the functionality of sequential circuits and implement state machines.
CLO4: Apply digital-to-analog and analog-to-digital conversion techniques in mixed-signal systems.
CLO5: Program microcontrollers for interfacing with light current devices.
CLO6: Analyze and design basic applications using light current and digital systems technologies.
CLO7: Troubleshoot and debug circuits using appropriate test equipment.
CLO8: Effectively communicate technical concepts through written reports and presentations.

Lectures

LEC1-2: Introduction to Light, Interaction with Matter (Absorption, Emission).
LEC3-4: Light-Emitting Diodes (LEDs): Operation & Characteristics.
LEC5-6: Photodetectors: Photodiodes, Phototransistors & Optocouplers.
LEC7: Midterm Exam Review.
LEC8-9: Introduction to Digital Systems: Binary Logic & Boolean Algebra.
LEC10-11: Digital Logic Gates (AND, OR, NOT): Truth Tables & Analysis.
LEC12-13: Combinational Circuits: Design, Analysis & Simplification Techniques (K-maps).

Tutorials

TUT1-2: Analyze case studies on applications of light-matter interaction in solar cells and optical sensors.
TUT3-4: Solve problems on calculating LED operating characteristics.

TUT5-6: Discuss the advantages and limitations of different types of photodetectors for specific applications.
TUT7: Practice problems and review for midterm exam.
TUT8-9: Analyze case studies on the role of digital logic in modern electronic devices.
TUT10-11: Solve problems on analyzing and simplifying combinational circuits using truth tables and K-maps.
TUT12-13: Discuss design considerations and challenges for complex combinational circuits.

Laboratories

LAB1-2: Hands-on experiments with LEDs: Measuring voltage-current characteristics & building basic circuits.
LAB3-4: Labs on simulating and analyzing circuits with photodetectors and light sources using software.
LAB5-6: Project work on designing and building a light-activated alarm circuit using LEDs and photodetectors.
LAB7: Midterm Exam (no labs).
LAB8-9: Labs on building and testing digital logic circuits with different types of gates (AND, OR, NOT).
LAB10-11: Project work on designing and building a combinational lock circuit using digital logic gates.
LAB12-13: Labs on simulating and analyzing sequential circuits (e.g., D flip-flop) using simulation software.
LAB14: Finalize lab projects and presentations on designed light-activated alarm and combinational lock circuits.

ENT491: ENT Project III

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	4	240			75	0	25

Course Description

This course enables the students to exercise some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. Further, they do market surveys about raw materials, components or finished products and identify the ethical societal and environmental issues related to the project (if there are any). The student also develops the ability to design, implement and test systems, hardware, or software. This course includes planning the tasks to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. Through this course, the student develops creativity, initiative, and capacity to perform. The leadership, supervisory, planning, and organizational skills are integrated into the learning objectives of this course. The projects has a detailed project proposal, which is executed or implemented within the time allocated, simultaneously maintaining a logbook, periodically monitored by the professor mentor. Projects are chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is to be prepared as the project progresses, which is to be submitted after the project is over. The student acquires the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1: Assess the impact of the project on society (if there is any)
CLO 2: Conduct Feasibility studies, Design projects, and Market surveys about raw materials, components or finished products
CLO 3: Design, plan and propose a project according to user requirements.
CLO 4: Apply project development methodologies appropriate to the project
CLO 5: Collaborate with team members to develop the prototype of the Application
CLO 6: Identify the ethical societal and environmental issues related to the project (if there are any)
CLO 7: Communicate project ideas and current work achievements clearly through technical report and presentations.

ENT492: ENT Project IV

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	4	240			75	0	25

Course Description

This course enables the students to exercise some of the knowledge and/or skills developed during the program in a new situation or problem for which there are number of engineering solutions. In this course, the students apply the knowledge gained during the program to design and prototype a software application that meets user needs and expectations. Further, they evaluate the impact of the product or system or process on society and draw conclusions. This course includes planning the tasks which are to be completed within the time allocated, and in turn, helps to develop the ability to plan, use, monitor, and control resources optimally and economically. Through this course, the student develops creativity, initiative, and capacity to perform. The student develops leadership and supervision skills which are integrated into the learning objectives of this course. The projects have a detailed project proposal, which is executed or implemented within the time allocated, simultaneously maintaining a logbook periodically monitored by the professor mentor. Projects are chosen so that they can be completed using students' problem-solving capabilities and depth of learning. A detailed project report is prepared as the project progresses, which is submitted after the project is over. The students acquire the basic background necessary to conduct research on advanced topics in a chosen subject area.

References

https://www.youtube.com/watch?v=AwH6drwfuAU
https://www.youtube.com/watch?v=GQVoxaucS44
https://www.youtube.com/watch?v=fsR8Cm5NBMg
https://www.youtube.com/watch?v=EjQYvCXaMG4
https://effectiveu.umn.edu/capstone/additional-resources

Learning Outcomes

CLO 1: Demonstrate the ability to apply the knowledge to design and prototype a software/hardware application that meets user needs and expectations.
CLO 2: Design the project acquiring and applying new knowledge through literature review.
CLO 3: Design computing/hardware solutions considering economical, environmental, cultural, global impact and technical aspects.
CLO 4: Assess the impact of technical and system constraints to select optimal solutions.
CLO 5: Evaluate the impact of the product or system or process on society and draw conclusions.
CLO 6: Demonstrate teamwork through regular formal team meetings, project management, class presentations, and a final design presentation.
CLO 7: Assess the ethical and legal impact of the implemented product or system or process.
CLO 8: Write a technical report in a standard format and give an oral presentation.
CLO 9: Design and implement the project with modern engineering tools and software.

Department of Water Engineering Technology

WET102: Introduction to Water Resources Management

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120		240	3	90	90	120	60	15	25

Course Description

This foundational course provides students with a comprehensive understanding of water resources management principles, integrating hydrology, water quality, environmental science, and policy perspectives. The course examines the complex interactions between water, land, and human activities, emphasizing sustainable management strategies for both surface and groundwater resources.
Students will explore fundamental hydrologic processes, water quality parameters, contaminant transport mechanisms, and the impacts of land use on water resources. The course addresses contemporary water management challenges at local, regional, and global scales, including water scarcity, pollution, climate change impacts, and competing water demands. Through case studies, modeling applications, and stakeholder analysis, students develop skills in problem identification, data interpretation, and management solution development.
The curriculum integrates technical knowledge with practical applications, covering water chemistry, microbiology, ecological indicators, and best management practices (BMPs). Students will learn to use modern tools including GIS applications and water quality models to analyze watersheds and evaluate management scenarios. The course emphasizes interdisciplinary approaches to water resources management, preparing students to work effectively with diverse stakeholders including government agencies, communities, and environmental organizations.

References

Grigg, N.S., 2023. Water Resources Management: Principles, Methods, and Tools. John Wiley & Sons.
Jain, S.K., Singh, V.P., 2023. Water Resources Systems Planning and Management. Elsevier.
Kasbohm, J., Grothe, S., Steingrube, W., Th, N., 2009. Integrated Water Resources Management (IWRM) - An Introduction.

Learning Outcomes

LO1. Analyze Hydrologic Systems: Explain the components of the hydrologic cycle, construct water budgets, and evaluate interactions between surface water and groundwater systems.
LO2. Identify Water Resource Challenges: Recognize and assess local, regional, and global water resource issues including scarcity, quality degradation, flooding, and climate change impacts.
LO3. Evaluate Water Quality Parameters: Characterize physical, chemical, and biological water quality indicators and interpret their significance for human and ecosystem health.
LO4. Assess Contaminant Transport: Analyze nitrogen, phosphorus, and sediment cycles, predict pollutant loading, and evaluate transport pathways in watersheds.
LO5. Apply Management Tools: Use GIS, hydrologic models, and water quality assessment tools to support decision-making in water resources management.
LO6. Design Management Solutions: Evaluate and recommend best management practices (BMPs) for water quality protection and improvement in various land use contexts.
LO7. Understand Stakeholder Perspectives: Analyze the roles of various agencies, organizations, and communities in water resources management and policy implementation.
LO8. Integrate Interdisciplinary Knowledge: Synthesize hydrologic, environmental, economic, and social factors to develop comprehensive water management strategies.
LO9. Communicate Technical Information: Present water resources data, analyses, and recommendations effectively to diverse audiences through written and oral formats.
LO10. Develop Research Skills: Identify water resources research needs, formulate management questions, and propose investigation approaches for real-world problems.

Lectures

Week 1: Hydrologic Processes: Components of the hydrologic cycle, Water budget development, Precipitation, infiltration, runoff, evapotranspiration, Surface-subsurface flow interactions.
Week 2: Environmental Problem Identification: Local water resource issues, Global water challenges, Sustainable Development Goals, Case study: Water scarcity regions
Week 3: Watershed Processes & Transport: Watershed delineation concepts, Nitrogen cycle: pools, processes, loading, Introduction to Web-GIS tools, Point vs. non-point source pollution.
Week 4: Nutrient Cycles & Sediment Transport: Phosphorus cycle and eutrophication, Sediment erosion and transport, Contaminant pathways, Agricultural impacts on water quality.
Week 5: Water Management Institutions: Government agency roles (EPA, state agencies), Water quality regulations, TMDL concepts, Guest speakers from regulatory agencies.
Week 6: Hydrologic Modeling Fundamentals: Model types and applications, Introduction to L-THIA, Model selection criteria, Uncertainty in predictions.
Week 7: Water Quality Modeling Applications: GRASIM model overview, BMP evaluation techniques, Model calibration concepts, Management scenario analysis
Week 8: Water Chemistry: Major ions and nutrients, pH, dissolved oxygen, conductivity, Water quality standards, Sampling and analysis principles.
Week 9: Water Microbiology: Pathogens and indicators, Public health implications, Treatment considerations, Monitoring strategies.
Week 10: Biological Indicators & Land Use, Ecosystem health assessment, Macroinvertebrate indices, Land use-water quality relationships, Urban vs. agricultural impacts.
Week 11: Best Management Practices, Structural and non-structural BMPs, Green infrastructure, Cost-benefit analysis, Implementation challenges.
Week 12: Soil & Groundwater Remediation, Contamination sources, Remediation technologies, Risk assessment, Case study: Industrial contamination.
Week 13: Integrated Water Management: IWRM principles, Climate change adaptation, Water-energy-food nexus, Future challenges.
Week 14: Student Presentations: Research proposal presentations, Peer review and discussion, Course synthesis, Future directions in water management.

Tutorials

Assignment #1: Water mass balance calculation for contrasting climates
Assignment #2: Global water issues analysis (2-page report)
Assignment #3: Watershed delineation exercise using Web-GIS
Case Study: Lake water quality management Wetland functions discussion
Assignment #4: Stakeholder analysis report
Assignment #5: L-THIA modeling exercise
Assignment #6: BMP evaluation using models
Assignment #7: Water quality data interpretation
Group Project: Water quality assessment proposal
Assignment #8: Statistical analysis of water quality data
Case Study: BMP selection for watershed
Assignment #9: Environmental issue investigation
Research Proposal: Identify water management research needs
Final presentations

WET103: WET Internship I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	4	90	90	120	60	15	25

Course Description

This intensive 8-week summer internship provides first-year students with foundational hands-on experience in irrigation and water management operations across Egypt's diverse agricultural systems through placements with the Ministry of Water Resources and Irrigation, irrigation districts, water user associations, research centers, or private companies. Students integrate classroom knowledge with practical field applications by observing and participating in daily operations of irrigation systems, water distribution networks, and agricultural water management practices, rotating through different departments to experience traditional surface irrigation in the Nile Valley to modern drip and sprinkler systems in newly reclaimed lands. Through structured supervision, daily logs, weekly reports, and final presentations, students develop professional skills, technical competencies, safety awareness, professional ethics, teamwork, and communication skills essential for careers in irrigation and water resources management while gaining real-world understanding of the irrigation sector's role in Egyptian agriculture.

Learning Outcomes

LO1. Apply Basic Technical Knowledge: Demonstrate practical application of mathematics, physics, and computer skills learned in Year 1 to real irrigation and water management situations.
LO2. Understand Irrigation Systems: Identify and describe different irrigation methods used in Egypt including surface, sprinkler, and drip systems, understanding their basic components and operations.
LO3. Observe Water Distribution: Document water distribution processes from main canals through mesqas to field channels, understanding the organizational hierarchy of water delivery.
LO4. Practice Field Measurements: Assist in basic field measurements including water flow, field dimensions, and simple surveying tasks under supervision.
LO5. Develop Professional Skills: Demonstrate punctuality, appropriate workplace behavior, effective communication, and teamwork in professional irrigation sector settings.
LO6. Document Field Operations: Maintain accurate daily logs, prepare weekly reports, and compile photographic documentation of field activities and observations.
LO7. Understand Sector Organization: Describe the organizational structure of Egypt's irrigation sector including MWRI, irrigation districts, and water user associations.
LO8. Apply Safety Protocols: Follow safety procedures for working near water infrastructure, operating equipment, and conducting field activities.
LO9. Identify Career Paths: Explore different career opportunities in irrigation and water management through exposure to various professional roles.
LO10. Present Field Experience: Effectively communicate internship experiences and learning outcomes through a comprehensive final presentation.

WET203: Fundamental Surveying Techniques

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Course Description

This comprehensive course introduces fundamental principles and practices of land surveying essential for irrigation and water resources engineering, providing a thorough foundation in surveying theory, instrumentation, and field techniques from basic measurement concepts and error theory through distance and angular measurements, leveling operations, and traverse computations. Students gain hands-on experience with traditional and modern surveying instruments including tapes, levels, theodolites, total stations, GPS, and GIS applications while developing proficiency in field procedures, data collection, calculations, and mapping techniques through integrated laboratory exercises. The curriculum emphasizes practical applications specific to irrigation projects including topographic mapping, boundary surveys, area calculations, canal alignment, field grading, and drainage system layout, preparing students to apply surveying data in the planning, design, and construction of irrigation systems and water infrastructure projects.

References

Brinker, R.C., Minnick, R., 2012. The Surveying Handbook. Springer Science & Business Media.
Ziwa, I.M., 2016. Applied engineering surveying - Lecture Notes.

Learning Outcomes

LO1: Apply Surveying Fundamentals : Understand surveying history, terminology, units of measurement, and professional standards for irrigation and water resources applications.

LO2: Perform Accurate Measurements : Execute precise distance measurements using tapes and electronic distance measurement (EDM) equipment, applying appropriate corrections and error analysis.
LO3: Conduct Leveling Operations : Perform differential and profile leveling surveys, establish benchmarks, and determine elevations for irrigation system design and construction.
LO4: Measure Angles and Directions : Use theodolites and total stations to measure horizontal and vertical angles, determine bearings and azimuths, and establish project control.
LO5: Execute Traverse Surveys : Plan, conduct, and adjust closed and open traverses for boundary determination and construction layout of irrigation infrastructure.
LO6: Create Topographic Maps : Collect field data and produce contour maps essential for irrigation system design, drainage planning, and earthwork calculations.
LO7: Calculate Areas and Volumes : Compute land areas using various methods and determine earthwork volumes for reservoirs, canals, and land grading projects.
LO8: Maintain Professional Documentation : Prepare clear, accurate field notes and survey records following industry standards and legal requirements.
LO9: Apply Modern Technology : Understand the principles and applications of GPS and GIS technology in modern surveying practice for water resources projects.
LO10: Ensure Quality Control : Identify sources of error, apply appropriate corrections, and implement quality control procedures to ensure survey accuracy.

Lectures

Week 1: Introduction to Surveying, Course overview and objectives, History of surveying, Applications in irrigation engineering, Professional ethics and standards
Week 2: Units and Measurements, "Linear, angular, and area units", Unit conversions, Significant figures, International vs. US systems
Week 3: Mathematical Foundations, Rules of calculations, Trigonometry review, Coordinate geometry, Error propagation
Week 4: Theory of Errors, Types of errors, Error propagation, Precision vs. accuracy, Statistical analysis
Week 5: Maps and Mapping Systems, Map projections, Coordinate systems, Public land survey system, Legal descriptions
Week 6: Distance Measurement, Taping techniques, Systematic errors, Corrections and reductions, Field procedures
Week 7: Electronic Distance Measurement, EDM principles, Atmospheric corrections, Total station introduction, Reflectorless measurement
Week 8: MIDTERM EXAM
Week 9: Angles and Directions, Bearings and azimuths, Magnetic declination, Compass surveying, Direction conversions
Week 10: Leveling Theory, Principles of leveling, Types of levels, Benchmark establishment, Curvature and refraction
Week 11: Advanced Leveling, Profile leveling, Cross-section leveling, Reciprocal leveling, Construction applications
Week 12: Angular Measurements, Theodolite principles, Horizontal angles, Vertical angles, Angle measurement errors
Week 13: Traverse Surveying, Traverse types, Field procedures, Angle and distance balance, Coordinate calculations
Week 14: Traverse Adjustments, Error distribution, Compass rule, Least squares adjustment, Area calculations
Week 15: Topographic Surveying, Contour characteristics, Field methods, Stadia surveying, Digital terrain models
Week 16: Modern Surveying Technology, GPS fundamentals, GIS integration, Data processing, Future trends
Week 17: FINAL EXAM WEEK

Laboratories

Week 1: Lab 1: Field Notes Setup, Proper documentation, Standard formats, Weather data recording
Week 2: Lab 2: Basic Calculations, Unit conversions, Calculator techniques, Precision and accuracy
Week 3: Lab 3: Topographic Map Reading, Map scales and symbols, Contour interpretation, Grid systems
Week 4: Lab 4: Taping Operations, Horizontal taping, Temperature corrections, Sag corrections
Week 5: Lab 5: Public Land Survey, Section subdivision, Legal descriptions, Boundary interpretation
Week 6: Lab 6: Precision Taping, Slope measurements, Breaking tape, Accuracy standards
Week 7: Lab 7: EDM Operations, Instrument setup, Prism constants, Data collection
Week 8: Midterm Review Session
Week 9: Lab 8: Compass Survey, Magnetic bearings, Declination adjustment, Traverse with compass
Week 10: Lab 9: Differential Leveling, Level setup and adjustment, Benchmark circuits, Closure calculations
Week 11: Lab 10: Profile Leveling, Route surveying, Drawing profiles, Grade calculations
Week 12: Lab 11: Theodolite Operations, Instrument setup, Angle measurement, Repetition method
Week 13: Lab 12: Closed Traverse, Field reconnaissance, Data collection, Office calculations
Week 14: Lab 13: Area Determination, Coordinate method, DMD method, Planimeter use
Week 15: Lab 14: Stadia Survey, Stadia principles, Field procedures, Contour plotting
Week 16: Lab 15: GPS/GIS Applications, GPS data collection, Coordinate transformation, GIS mapping
Week 17: Final Review Session

WET204: Wells and Pumps

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WET102

Course Description

This course covers wells and pumps used in irrigation, including both tube wells and open wells. The curriculum addresses groundwater hydrology and the types of formations where exploitable water resources are likely to be found. Students learn the principles of water well construction, the proper selection and sizing of well screens, and procedures for well development. The course also covers the reasons for well failure and presents rehabilitation procedures. A variety of pumps are discussed, from human and animal-powered pumps to the conventional pumps used in modern irrigation systems. Centrifugal pump design, installation, and operation are covered in detail, along with the use, installation, and operation of vertical turbine, submersible, propeller, mixed flow, and jet pumps.

References

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Harding, J.C., 1940. Specifications for Construction of Deep Wells. Journal (American Water Works Association) 32, 65–71.
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Task Committee on Hydraulics of Wells, 2014. Hydraulics of Wells: Design, Construction, Testing, and Maintenance of Water Well Systems, 127th ed. American Society of Civil Engineers, Reston, VA. https://doi.org/10.1061/9780784412732

Learning Outcomes

LO1: Develop water well drilling specifications.
LO2: Select the correct screen and screen size for wells based upon particle size analysis.
LO3: Understand the importance of proper development and well development procedures.
LO4: Identify common problems in wells and rehabilitation options.
LO5: Select pumps for use with manual and animal power situations.
LO6: Understand the advantages and disadvantages of the pumps used in tube wells.
LO7: Select which pump to use and how to size the pump based on flow and head requirements.

Lectures

Week 1: Ground Water Resources Development, Types of Water Bearing Formations, Confined vs Unconfined Aquifer, Pearch Water Table, Hydro-geological Formations, Types of Water Wells.
Week 2: Hydraulics of Wells, Definitions, Well Yield, Aquifer Characteristics, Steady State Flow to Wells, Pump Tests.
Week 3: Open Wells, Types, Lining Status, Construction, Design Of Open Wells, Diameter, Depth.
Week 4: Tube Wells, Types, Well Screens, Classification by Construction Methods, Selection of the Type of Tube, Well Head Safety, Design of Tube Wells, Particle Size Analysis, Housing Pipe and Well Casing, Bore Size, Gravel Pack and Screen.
Week 5: Tube Well Construction, Bore Wells, Driven Wells, Drilling Equipment and Methods, Drill Rigs, Drilling Procedures, Installation of Well Screens.
Week 7: Development and Testing of Tube Wells, Objectives and Methods, Choice of Well Development Method, Tube Wells Testing.
Week 8: Exam 1.
Week 9: Rehabilitation of Tube Wells, Diagnosing Well Performance and Failure, Influence of Faulty Design, Construction and installation.
Week 10: Rehabilitation of Tube Wells, Operation on Well Failures, Mechanical Failures, Corrosion and Incrustation.
Week 11: Man and Animal Powered Lift Pumps, Principles of Lifting Water, Manually Operated Water Lifts, Animal Powered Water Pumps, Reciprocating Pumps, Rotary Pumps.
Week 12: Variable Displacement Pumps, Types, Centrifugal, Friction and Total Head, Power Requirements, Cavitation.
Week 13: Variable Displacement Pumps, Pump Characteristic Curves, Selection of Centrifugal Pumps, Accessories, Economic Pipe Size Selection, Selection of Pump Drive.
Week 14: Centrifugal Pump Design, Installation and Operation, Design Parameters, Design of the Impeller, Installation, Installation in Tube Wells, Maintenance and Troubleshooting.
Week 15: Deep Well Turbine and Submersible Pumps, Vertical Turbine Pumps, Pump Drives, Installation, Operation and maintenance, Troubleshooting, Submersible Pumps, Pump Elements, Installation, Operation and Troubleshooting.
Week 16: Propeller, Mixed Flow and Jet Pumps, Propeller Pumps, Principles of Operation, Construction, Installation, Selection, Mixed Flow Pumps, Principles of Operation, Selection, Jet Pumps, Principles of Operation, Types, Selection and Installation.
Week 17: Final Exam.

WET205: WET Project I - Seminar I

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	3	90	90	120	60	15	25

Course Description

This foundational seminar introduces second-year students to current issues, emerging technologies, and professional practices in irrigation science and water resources management in Egypt and globally, building upon first-year fundamentals and summer field experience to explore contemporary challenges including water scarcity, climate change impacts, irrigation modernization, and sustainable management strategies. Through weekly presentations by faculty, industry professionals, government officials, and senior students covering traditional methods to cutting-edge technologies, students develop critical professional skills in literature review, technical presentation, scientific writing, and academic discussion while examining real-world irrigation challenges and innovative solutions across Egypt's diverse agricultural regions. The seminar emphasizes critical analysis of technical information, effective communication with diverse audiences, and understanding irrigation engineering's broader societal context, serving as a bridge between theoretical learning and practical field applications to prepare students for advanced coursework and professional careers in irrigation and water management.

Learning Outcomes

LO 1. Analyze Current Issues: Identify and critically evaluate contemporary challenges in irrigation and water management facing Egyptian agriculture and propose evidence-based solutions.
LO 2. Present Technical Information: Deliver clear, well-organized oral presentations on irrigation topics using appropriate visual aids and demonstrating professional presentation skills.
LO 3. Conduct Literature Reviews: Search, evaluate, and synthesize scientific literature and technical reports related to irrigation science and water management topics.
LO 4. Engage in Academic Discussion: Participate effectively in technical discussions, ask insightful questions, and provide constructive feedback during seminar presentations.
LO 5. Write Technical Summaries: Prepare concise written summaries of seminar presentations and technical topics following academic writing standards.
LO 6. Understand Professional Context: Describe the roles and responsibilities of irrigation professionals in various sectors including government, private industry, and research.
LO 7. Apply Critical Thinking: Evaluate the feasibility, sustainability, and appropriateness of proposed irrigation solutions for Egyptian conditions.
LO 8. Develop Networking Skills: Interact professionally with guest speakers, faculty, and peers to build professional relationships within the irrigation community.
LO 9. Explore Career Pathways: Identify potential career opportunities in irrigation and water management based on personal interests and strengths.
LO 10. Integrate Interdisciplinary Knowledge: Connect irrigation science with related fields including agronomy, economics, environmental science, and social considerations.

WET206: Groundwater and Surface Water Hydrology

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WET102

Course Description

Course Description
This comprehensive course provides a fundamental understanding of the hydrologic cycle and its components, with an emphasis on the quantitative analysis of both surface water and groundwater systems. Students explore the physical processes governing water movement through the atmosphere, land surface, and subsurface environments, developing skills essential for water resource assessment and management in agricultural and environmental contexts. The course integrates theoretical principles with practical applications, preparing students to address contemporary water challenges like climate variability, water scarcity, and sustainable resource management. Through a combination of lectures, laboratory experiments, and field investigations, students master hydrologic measurement techniques, data analysis methods, and modeling approaches used by water professionals. The curriculum emphasizes the interconnected nature of hydrologic systems, examining how precipitation becomes streamflow and groundwater recharge, and how human activities influence these processes. Special attention is given to water resources relevant to irrigation science, such as soil moisture dynamics and water availability for agricultural use. The course utilizes modern computational tools and industry-standard software, providing students with hands-on experience with stream gauging equipment, soil moisture sensors, and groundwater monitoring techniques. By the end of the course, students will have the theoretical knowledge and practical skills for careers in water resources engineering, environmental consulting, and agricultural water management.

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Melsen, L. A., Teuling, A. J., Van Berkum, S. W., Torfs, P. J. J. F., & Uijlenhoet, R., 2014. Catchments as simple dynamical systems: A case study on methods and data requirements for parameter identification. Water Resources Research, 50(7), 5577-5596.

Learning Outcomes

LO1: Quantify and analyze the major components of the hydrologic cycle including precipitation, evapotranspiration, infiltration, runoff, and groundwater flow using fundamental equations and principles.
LO2: Construct and solve water balance equations at various spatial and temporal scales, from field plots to watersheds, incorporating climate variability and human influences.
LO3: Measure and predict streamflow using hydrologic and hydraulic principles, develop stage-discharge relationships, and analyze flood frequency for design applications.
LO4: Apply Darcy's law and groundwater flow equations to assess aquifer properties, predict well yields, and analyze groundwater-surface water interactions.
LO5: Demonstrate proficiency in field and laboratory techniques for measuring precipitation, soil moisture, streamflow, and groundwater levels using modern instrumentation.
LO6: Apply computational tools including HEC-HMS, Python, and GIS software to analyze hydrologic data, simulate watershed processes, and support water management decisions.
LO7: Measure and interpret basic water quality indicators relevant to agricultural and environmental applications, understanding their hydrologic controls and transport mechanisms.
LO8: Develop and evaluate solutions for water resource problems including stormwater management, irrigation system design, and groundwater sustainability.
LO9: Present hydrologic data, analyses, and recommendations effectively through technical reports, graphical displays, and oral presentations.
LO10: Evaluate impacts of climate variability and change on water resources, incorporating uncertainty into hydrologic assessments and adaptation strategies.

Lectures

Week 1: Introduction to Hydrology, Global water distribution and availability, The hydrologic cycle components, Water balance concepts, Course overview and expectations, Career paths in hydrology.
Week 2: Atmospheric Water and Precipitation, Precipitation formation mechanisms, Precipitation measurement and errors, Spatial and temporal variability, Rainfall statistics and IDF curves, Climate teleconnections.
Week 3: Evaporation and Evapotranspiration, Energy balance principles, Evaporation physics, Reference and actual ET, Penman-Monteith equation, Crop coefficients.
Week 4: Infiltration and Soil Water, Soil physical properties, Infiltration processes, Green-Ampt model, Soil moisture dynamics, Field capacity concepts.
Week 5: Surface Runoff Generation, Runoff mechanisms, Rational method, SCS curve number, Hydrograph components, Urban hydrology impacts.
Week 6: Streamflow and Channel Processes, Open channel hydraulics, Stream gauging principles, Rating curves, Flood routing basics, Channel morphology.
Week 7: Watershed Hydrology, Watershed delineation, Unit hydrograph theory, Time of concentration, Hydrologic modeling concepts, HEC-HMS introduction.
Week 8: Midterm Week.
Week 9: Groundwater Fundamentals, Aquifer types and properties, Darcy's law applications, Hydraulic head concepts, Flow nets, Recharge processes.
Week 10: Groundwater Flow Systems, Steady-state flow equations, Transient flow, Pumping test analysis, Cone of depression, Boundary conditions.
Week 11: Groundwater-Surface Water Interactions, Stream-aquifer connections, Bank storage, Baseflow separation, Springs and seepage, Hyporheic zone.
Week 12: Water Quality Fundamentals, Physical parameters, Chemical constituents, Biological indicators, Agricultural impacts, Transport processes.
Week 13: Hydrologic Modeling Applications, Model types and selection, Calibration and validation, Uncertainty analysis, Scenario development, Decision support.
Week 14: Climate Change and Water Resources, Climate-hydrology linkages, Impact assessment methods, Adaptation strategies, Drought and flood trends, Future projections.
Week 15: Water Resources Management, Integrated approaches, Sustainability concepts, Policy frameworks, Stakeholder engagement, Case study synthesis.
Week 16: FINAL EXAM WEEK.

Laboratories

Week 1: Lab 1: Hydrologic Data Sources, USGS water data navigation, NOAA climate data access, Local watershed exploration, GIS basics for hydrology, Data download and organization.
Week 2: Lab 2: Precipitation Analysis, Rain gauge operation, Tipping bucket calibration, Rainfall data analysis, IDF curve development, Radar precipitation comparison.

Week 3: Lab 3: ET Measurements, Pan evaporation setup, Weather station operation, ET calculation methods, Lysimeter principles, Remote sensing ET.
Week 4: Lab 4: Infiltration Testing, Double ring infiltrometer, Soil texture analysis, Moisture sensor calibration, TDR measurements, Infiltration modeling.
Week 5: Lab 5: Runoff Simulation, Rainfall simulator operation, Runoff collection methods, Curve number determination, Impervious surface effects, Green infrastructure demos.
Week 6: Lab 6: Stream Gauging, Current meter operation, Velocity-area method, Stage measurement, Rating curve development, ADCP demonstration.
Week 7: Lab 7: Watershed Analysis, DEM processing in GIS, Watershed delineation, Flow accumulation, HEC-HMS setup, Model calibration basics.
Week 8: Midterm Exam, Comprehensive exam, Practical problems, Concept integration, Formula applications.
Week 9: Lab 9: Groundwater Basics, Sand tank demonstrations, Permeameter experiments, Flow net construction, Head measurements, Dye tracer studies.
Week 10: Lab 10: Well Hydraulics, Slug test procedures, Pumping test simulation, Data logger setup, Theis curve matching, AQTESOLV software.
Week 11: Lab 11: Field Methods, Seepage meter use, Mini-piezometer installation, Temperature profiling, Baseflow measurements, Tracer techniques.
Week 12: Lab 12: Water Quality, Multi-parameter probes, Sampling protocols, Field chemistry, Lab analysis basics, Data interpretation.
Week 13: Lab 13: Integrated Modeling, HEC-HMS applications, Python scripting, Model coupling, Visualization techniques, Report generation.
Week 14: Lab 14: Climate Analysis, Trend analysis methods, Statistical downscaling, Scenario exploration, Vulnerability mapping, Adaptation planning.
Week 15: Lab 15: Project Presentations, Student presentations, Peer review, Group discussions, Course synthesis, Career planning.
Week 16: Final Exam.

WET207: Irrigation Instrumentation

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180		180	360	4	120	90	120	60	15	25

Requisites

- Prerequisites: EPT202

Course Description

Course Description
This comprehensive course provides fundamental knowledge and practical skills in agricultural instrumentation, diagnostic procedures, and repair principles essential for modern irrigation and water management systems, integrating electronic instrumentation theory with hands-on troubleshooting of irrigation equipment, small engines, electrical systems, weather monitoring stations, and communication networks. Students develop competencies in diagnosing and repairing system components including pumps, motors, controllers, sensors, and automated systems through electrical troubleshooting from basic DC circuits to programmable logic controllers, small engine maintenance, and weather station installation/calibration for ET-based irrigation scheduling. Through extensive laboratory work with multimeters, oscilloscopes, diagnostic software, and specialized testing equipment, students gain practical experience with systematic troubleshooting approaches, communication protocols, and instrumentation maintenance under harsh Egyptian field conditions, working with actual equipment failures, weather station networks, SCADA systems, and precision agriculture technologies to support modernization of Egypt's irrigation infrastructure.

References

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Gensler, W.G., 2012. Advanced agricultural instrumentation: design and use. Springer Science & Business Media.
Henry, Z.A., Zoerb, G.C., Birth, G.S., 1991. Instrumentation and measurement for environmental sciences. American Society of Agricultural Engineers St. Joseph, MI, USA.
Meyer, G.E., 2009. An improved instrumentation and controls course for agricultural and biological engineering, in: 2009 ASEE Midwest Section Conference.
Northrop, R.B., 2018. Introduction to instrumentation and measurements. CRC press.

Learning Outcomes

LO1: Use multimeters, oscilloscopes, and diagnostic tools to troubleshoot electrical problems in irrigation pumps, motors, controllers, and automated systems following systematic procedures.
LO2: Perform maintenance and repair on small engines used in portable pumps, generators, and agricultural equipment including fuel systems, ignition, cooling, and mechanical components.
LO3: Set up, calibrate, and network automatic weather stations for ET monitoring including sensors for temperature, humidity, solar radiation, wind, and precipitation.
LO4: Diagnose and repair irrigation controllers, timers, solenoid valves, flow meters, pressure sensors, and automated control systems using

technical manuals and schematics.
LO5: Configure data acquisition systems, program data loggers, establish communication protocols, and manage telemetry systems for remote monitoring of irrigation networks.
LO6: Calibrate, troubleshoot, and repair soil moisture sensors, pressure transducers, flow meters, water quality probes, and other field instrumentation.
LO7: Implement and troubleshoot serial communications, MODBUS, SDI-12, wireless networks, and cellular telemetry systems used in irrigation monitoring.
LO8: Develop and execute preventive maintenance schedules for irrigation equipment, instrumentation, and monitoring systems to minimize downtime.
LO9: Create accurate service reports, maintain equipment logs, order replacement parts, and communicate technical information to operators and managers.
LO10: Follow electrical safety procedures, lockout/tagout protocols, and environmental regulations while performing instrumentation maintenance and repairs.

Lectures

Week 1: Introduction to Agricultural Instrumentation, Course overview and safety protocols, Egyptian irrigation equipment overview, Instrumentation in modern agriculture, Diagnostic methodology principles, Workshop organization and tools.
Week 2: Basic Electricity & Electrical Safety, AC/DC fundamentals, Ohm's law applications, Electrical safety procedures, Lockout/tagout protocols, Egyptian electrical standards (220V/380V).
Week 3: Electrical Components & Circuits, Switches, relays, and contactors, Motor starters and protection, Control circuits design, Wiring diagrams reading, Troubleshooting procedures.
Week 4: Three-Phase Motors & Controls, Motor types and applications, Starting methods (DOL, Star-Delta), Variable frequency drives (VFDs), Motor protection devices, Efficiency considerations.
Week 5: Pump Systems Diagnostics, Centrifugal pump principles, Performance curves analysis, Mechanical seal inspection, Bearing maintenance, Alignment procedures.
Week 6: Small Engine Fundamentals, Two and four-stroke cycles, Fuel systems (carburetors/injection), Ignition systems, Cooling systems, Egyptian fuel considerations.
Week 7: Engine Repair & Maintenance, Preventive maintenance schedules, Common failures diagnosis, Parts identification, Service procedures, Generator maintenance.
Week 8: Midterm Week, Practical Exam, Electrical troubleshooting, Pump diagnostics, Engine repair, Safety demonstration.
Week 9: Sensors & Transducers, Pressure sensor types, Flow measurement principles, Temperature sensors, Level detection methods, Sensor calibration.
Week 10: Weather Station Systems, ET calculation principles, Meteorological sensors, Data logger configuration, Power supply systems, Egyptian weather networks.
Week 11: Data Communication Systems, Serial communications (RS232/485), MODBUS protocol, SDI-12 standard, Wireless technologies, Cellular telemetry.
Week 12: Irrigation Controllers & Automation, Controller types and features, Solenoid valve operation, Programming procedures, Smart irrigation systems, Integration with sensors.
Week 13: SCADA & Remote Monitoring, SCADA principles, HMI design basics, Alarm management, Data historians, Egyptian irrigation districts.
Week 14: Preventive Maintenance Programs, Maintenance scheduling, Spare parts management, Documentation systems, Cost-benefit analysis, Reliability improvement.
Week 15: System Integration & Troubleshooting, Complex system diagnosis, Integration challenges, Case study analysis, Future technologies, Career opportunities.
Week 16: FINAL EXAM WEEK.

Laboratories

Week 1: Lab 1: Shop Safety & Tools, Safety equipment usage, Hand tools identification, Power tools operation, Measuring instruments, Workshop procedures.
Week 2: Lab 2: Multimeter Usage, Voltage measurements, Current testing, Resistance checks, Continuity testing, Safety demonstrations.
Week 3: Lab 3: Circuit Building, Wiring basic circuits, Relay logic exercises, Motor control circuits, Troubleshooting practice, Schematic interpretation.
Week 4: Lab 4: Motor Testing, Motor insulation testing, Phase rotation checks, VFD programming, Overload adjustment, Troubleshooting motors.
Week 5: Lab 5: Pump Maintenance, Pump disassembly, Impeller inspection, Seal replacement, Bearing service, Performance testing.
Week 6: Lab 6: Engine Diagnostics, Compression testing, Spark testing, Carburetor cleaning, Valve adjustment, Starting problems.
Week 7: Lab 7: Engine Overhaul, Engine disassembly, Parts measurement, Gasket replacement, Reassembly procedures, Testing and tuning.
Week 8: Practical Exam, Electrical troubleshooting, Pump diagnostics, Engine repair, Safety demonstration.
Week 9: Lab 9: Sensor Workshop, Pressure calibration, Flow meter testing, RTD/thermocouple use, 4-20mA signals, Sensor installation.
Week 10: Lab 10: Weather Station Setup, Station assembly, Sensor mounting, Logger programming, Solar panel sizing, Data download.
Week 11: Lab 11: Communications, Cable termination, Protocol analyzers, Network setup, Troubleshooting comms, Remote access.
Week 12: Lab 12: Controller Repair, Controller diagnostics, Solenoid testing, Program backup, Firmware updates, Field wiring.
Week 13: Lab 13: SCADA Systems, HMI navigation, Alarm configuration, Trend analysis, Report generation, System integration.
Week 14: Lab 14: Maintenance Planning, PM schedule creation, Inventory systems, Work order process, Record keeping, Software tools.
Week 15: Lab 15: Final Projects, Project presentations, Peer evaluations, Industry feedback, Best practices, Q&A session.
Week 16: FINAL EXAM WEEK.

WET208: Principles of Irrigation Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180	180		360	4	90	90	120	60	15	25

Course Description

This course provides an overview of agricultural irrigation technology, management practices, and methods for evaluating performance, serving as a basis for more advanced classes on these topics and providing the basic information needed for working in the irrigation industry. Students are introduced to major irrigation system types, including surface, drip, sprinkler, and center pivot, and the considerations for their design and management. The course discusses water supply systems from surface and groundwater sources, as well as alternate sources like reclaimed water. It also introduces considerations for constructing water wells and selecting pumps. Students will learn how to evaluate irrigation systems, understand performance measures for each, and be able to complete system evaluations and calculate efficiencies.

References

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Learning Outcomes

LO1: Understand the importance of irrigation and its potential environmental impact.
LO2: Understand the soil properties important in the design and management of irrigation systems.
LO3: Understand how water is measured in pipelines and canals.
LO4: Identify the proper flow meter for different applicators.
LO5: Understand how plant water requirements are determined and used in irrigation water management.
LO6: Understand how the performance of irrigation systems is evaluated.
LO7: Complete a simple irrigation schedule.
LO8: Select a pump based on flow and head requirements.
LO9: Understand and recognize the different types of irrigation technologies and methods.
LO10: Understand the basic design process for each type of system.

Lectures

Week 1: Introduction to Irrigation, Role of Irrigation Systems, Irrigation Development, Impact of Irrigation on Water Resources and the Environment, Irrigation Management Concepts.
Week 2: Introduction to Soil Water Concepts, Soil Composition, Sil Water Content and Potential, Available Water, Measurement of Soil Water Content.
Week 3: Introduction to Flow Measurement, Dept Volume Relationships, Basic Principles of Flow Measurement, Flow Measurement in Pipes, P\open channel Flow Measurement.
Week 4: Introduction to Plant Water Use, Crop Water Use Processes, Calculating ET, Potential ET, Crop Coefficients.
Week 5: Introduction to Irrigation Performance Concepts, Efficiency, Application Uniformity, Adequacy Of Irrigation, Application Efficiency.
Week 6: Introduction to System Performance Analysis, Irrigation System Capacity, Determining System Capacity Requirements, Operational Factors, Irrigation Efficiency and Water Resources Sustainability.
Week 7: Introduction to Irrigation Scheduling, Plant Response to ET and Soil Water, Water Holding Capacity and Plant Zone Depth, Irrigation Scheduling for Soil Water Management, Tracking Irrigation Water Balance.
Week 8: Exame1.
Week 9: Introduction to Pump Head and Pipeline Hydraulics, Basic Hydraulics, Pressure Loss, Pipelines.
Week 10: Introduction to Pump Head and Pipeline Hydraulics, Pumps and Total Head Concepts, Power Requirements, Energy Consumption, Performance Rating.
Week 11: Water Supply Systems, Surface Water, Groundwater, Aquifers, Groundwater Supplies, Shallow Wells, Cased Wells, Well Hydraulics, Well Construction.
Week 12: Introduction to Surface Irrigation, Advance, Recession and Infiltration, Water Balance, Efficiency, Slope Management, Basin and Border Irrigation, Surge Flow Irrigation.
Week 13: Introduction to Sprinkler Irrigation, System Components, Sprinkler Performance, Principles of Lateral Design, Sprinkler Design Considerations.
Week 14: Traveling Sprinkler Systems, Types of Systems, Operational Characteristics, Management Plans, Uniformity Issues, Design Considerations, Portable Solid Set, Guns, Travelers, Filed Layout, Other Issues.
Week 15: Introduction to Center Pivots and Linear- Move Machines, Center Pivot Characteristics, Pressure Distribution, Application Rate, Water Applicator and Nozzle Selection, Variable Rate Irrigation.

Week 16: Introduction to Micro (Drip) Irrigation, History, System Types, System Components, Water Applicators, Preventing Clogging, Emission Uniformity Concepts.
Week 17: Final Exam.

WET209: WET Project II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	3	90	90	120	60	15	25

Requisites

- Prerequisites: WET205

Course Description

This capstone course integrates engineering design principles, project management, and professional development to prepare students for engineering practice. Students work in teams on real-world projects sponsored by external clients, applying engineering design methodology from concept development through final design recommendations. The course emphasizes professional skills including technical communication, project planning, and client interaction.
Key components include engineering economics and decision-making, preparation for professional licensure (FE/PE exams), ethics and legal considerations, and understanding global engineering challenges. Students develop professional portfolios including resumes and LinkedIn profiles while gaining experience in business writing, presentations, and documentation. Teams conduct literature reviews, patent searches, and competitive analyses to inform their design solutions.
Through regular meetings with faculty advisors and client interactions, students experience the iterative nature of engineering design, develop alternative solutions, and create comprehensive design reports and presentations. The course culminates in a final team project presentation and concept report delivered to the client sponsor.

Learning Outcomes

LO1. Apply Engineering Design Process: Execute a complete engineering design cycle from problem definition through conceptual design, including generating and evaluating design alternatives using systematic engineering methodology.
LO2. Manage Engineering Projects: Develop and implement project plans using tools such as Gantt charts, manage project timelines, and coordinate team activities to meet deliverables and milestones.
LO3. Perform Economic Analysis: Apply engineering economics principles including cost estimation, depreciation, profitability analysis, present worth, and cash flow analysis to evaluate engineering alternatives and make data-driven decisions.
LO4. Communicate Professionally: Create professional engineering documents including technical memos, design reports, and presentations; effectively interact with clients through Q&A sessions, conference calls, and formal presentations.
LO5. Conduct Research and Analysis: Perform comprehensive literature reviews, patent searches, and competitive analyses to inform design decisions and ensure innovation while respecting intellectual property.
LO6. Work Effectively in Teams: Collaborate in multidisciplinary teams, coordinate with faculty advisors, and engage with external clients to deliver engineering solutions that meet stakeholder requirements.
LO7. Demonstrate Professional Readiness: Develop professional credentials including polished resumes and LinkedIn profiles; understand engineering licensure requirements, ethics, legal liability, and the importance of continuing education.
LO8. Analyze Global Engineering Challenges: Evaluate engineering solutions in the context of global challenges related to water, energy, food, and health security, demonstrating awareness of engineering's societal impact.

WET301: Soil and Water Conservation Engineering

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC201

Course Description

This comprehensive course provides fundamental knowledge and practical skills in soil and water conservation engineering essential for sustainable agricultural water management, integrating principles of hydrology, soil science, hydraulics, and environmental engineering to address critical challenges in water resource conservation. Students explore soil-water-agriculture relationships while learning to design and implement conservation practices including water harvesting techniques, erosion control methods, drainage systems, and water quality management that optimize efficiency and protect environmental resources. Through theoretical instruction, laboratory exercises, field experiences, and hands-on design projects using modern tools like GIS applications, hydrologic modeling software, and surveying equipment, students develop competencies in surveying, hydrologic analysis, hydraulic design, and conservation structure implementation, emphasizing sustainable solutions that balance agricultural productivity with environmental stewardship in addressing global water scarcity and soil degradation challenges.

References

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Learning Outcomes

LO1: Evaluate soil properties, water holding capacity, infiltration characteristics, and soil-water dynamics to inform conservation engineering decisions.
LO2: Conduct frequency analysis, predict precipitation patterns, calculate runoff, estimate evapotranspiration, and design hydrologic systems for agricultural applications.
LO3: Calculate soil loss using established models, design conservation structures including terraces, grassed waterways, and sediment basins to minimize erosion and protect water quality.
LO4: Use surveying equipment and techniques to conduct topographic surveys, create contour maps, and establish grades for conservation structures and drainage systems.
LO5: Plan and design both surface and subsurface drainage systems, including open channels, tile drains, and drainage outlets to manage excess water in agricultural lands.
LO6: Assess the environmental impacts of agricultural practices on water quality and design mitigation measures including constructed wetlands and buffer strips.
LO7: Understand fundamental irrigation design concepts and water application methods for efficient water use in agricultural systems.
LO8: Apply GIS tools, computer modeling software, and data analysis techniques to solve complex soil and water conservation problems.
LO9: Develop conservation solutions that balance economic viability, environmental protection, and social responsibility in agricultural water management.
LO10: Present engineering designs, prepare technical reports, and effectively communicate conservation strategies to diverse stakeholders.

Lectures

Week 1: Course Introduction & Global Conservation Issues, Welcome and course outline, Water harvesting and groundwater recharge, Global issues in soil and water conservation, Ecosystems and hydrologic/geologic cycles, Soil Properties & Classification, Soil structure and pedostructure, Cation Exchange Capacity (CEC), Soil survey interpretation, Soil mapping applications.
Week 2: Soil-Water Relationships, Soil water content and potential, Water retention characteristics, Available water capacity, Surveying Fundamentals, Differential leveling principles, Profile leveling and cross sections, Drainage area delineation.
Week 3: Hydrologic Frequency Analysis, Statistical analysis of hydrologic data, Return periods and risk assessment, Log-normal probability distributions.
Week 4: Topographic Surveying, Contour mapping techniques, Digital terrain modeling, Surfer software applications, Precipitation Analysis, Measurement and prediction methods, Intensity-duration-frequency curves, NOAA precipitation data analysis.
Week 5: Infiltration & Runoff, Infiltration processes and measurement, Runoff prediction methods, Rational method and curve numbers.
Week 6: Review Session, EXAM 1, Hydrograph Analysis, Unit hydrograph theory, Flow routing methods.
Week 7: Evapotranspiration, ET measurement and calculation, Pan evaporation methods, Crop water requirements, Open Channel Hydraulics, Flow principles and equations, Channel design criteria, Hydraulic analysis software.
Week 8: GIS Applications, Internet-based GIS tools, Spatial analysis for conservation, Aerial photography interpretation, Soil Erosion Prediction, USLE/RUSLE equations, Erosion factors and control, Wind erosion assessment.
Week 9: Erosion Control Design, Conservation practice selection, Cost-benefit analysis, BMP implementation, Groundwater Hydrology, Aquifer characteristics, Groundwater flow principles, Well hydraulics.
Week 10: Drainage Principles, Surface drainage design, Grassed waterway specifications, Channel stabilization, Subsurface Drainage, Tile drainage systems, Drain spacing and depth, Installation methods.
Week 11: Review Session, EXAM 2.
Week 12: Conservation Structures, Terrace design principles, Flow-through structures, Grade stabilization, Water Quality Modeling, Pollutant transport, TMDL concepts, Model applications.
Week 13: Wetland Engineering, Constructed wetland design, Treatment mechanisms, Performance evaluation, Advanced Water Quality Topics, Nutrient management, Sediment control, Monitoring strategies.
Week 14: Irrigation Design Principles, System components, Application efficiency, Scheduling methods.
Week 15: Sprinkler Irrigation Design, Hydraulic calculations, System layout, Performance evaluation, Erosion Prediction Technology, WEPP model introduction, Advanced modeling techniques.

Week 16: Student Presentations, Design project presentations, Peer evaluations, Course Review, Comprehensive review, Practice problems, FINAL EXAM.

Laboratories

Week 1: Surveying Lab, Introduction to surveying equipment and techniques.
Week 2: Surveying Lab, Differential leveling techniques.
Week 3: Surveying Lab, Profile and cross-sectional leveling.
Week 4: Surveying Lab, Topographic mapping with total station.
Week 5: Erosion Lab, Soil erosion demonstration and analysis.
Week 6: Sediment Analysis Lab, Sedimentation basin design, Griffith tube analysis.
Week 7: Field Trip, Conservation structures, wetlands, water quality monitoring, irrigation systems.
Week 8: GIS Lab, Hands-on GIS applications for conservation planning.
Week 9: Water Quality Lab, Environmental Quality Laboratory procedures.
Week 10: Design Project 1, Grassed waterway design.
Week 11: Design Project 2, Subsurface drainage system design.
Week 12: Design Project 3, Terrace system design.
Week 13: Water Quality Modeling Lab, LTHIA model application.
Week 14: No laboratory or field activities specified.
Week 15: Design Project 4, Sprinkler irrigation system design.
Week 16: No laboratory or field activities specified.

WET302: Water Treatment Reuse

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: GEN131

Course Description

This comprehensive course covers the principles, selection, design, implementation, and management of various treatment methods for agricultural water sources, emphasizing practical applications to address quality concerns like salinity, sediment, pathogens, and chemical contaminants throughout the irrigation cycle. It is an advanced undergraduate course focusing on the theoretical principles of water treatment processes applicable to agricultural and irrigation systems. Students learn to assess water quality parameters, select appropriate treatment technologies, and design integrated treatment systems for agricultural applications. The course emphasizes the relationships between water quality parameters, treatment methods, and the requirements of different irrigation systems and crops. Students will develop skills in water quality assessment, treatment system design, and technology selection to optimize agricultural water use while minimizing environmental impacts and ensuring crop productivity. Throughout the course, students develop a technical understanding of water quality characteristics, treatment processes, economic analysis, and environmental sustainability considerations.

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Water Research Australia - Agricultural Water Treatment Technologies (2024): https://www.waterra.com.au/research/agricultural-water
International Water Association - Agricultural Water Reuse (2023): https://iwa-network.org/agricultural-reuse

Learning Outcomes

LO1: Evaluate agricultural water quality and identify treatment needs for irrigation applications
LO2: Apply fundamental principles of physical, chemical, and biological treatment processes to agricultural contexts
LO3: Select appropriate treatment technologies based on specific water quality parameters and irrigation system requirements
LO4: Design basic treatment systems for addressing common agricultural water contaminants
LO5: Analyze the economics and energy requirements of various treatment options
LO6: Develop implementation and management plans for water treatment systems in agricultural settings
LO7: Understand troubleshooting and optimization methods for treatment systems
LO8: Evaluate the environmental impacts and sustainability of water treatment technologies

Lectures

Week 1: Introduction to Agricultural Water Quality
Week 2: Water Quality Assessment Methods and Standards
Week 3: Sediment and Particulate Removal: Principles and Technologies
Week 4: Mechanical Filtration Systems: Design and Selection
Week 5: Chemical Treatment Methods: Coagulation and Flocculation
Week 6: Chemical Treatment Methods: Oxidation and Disinfection
Week 7: Midterm Examination
Week 8: Salinity Management: Principles and Water Quality Impact
Week 9: Desalination Technologies for Agricultural Applications
Week 10: Biological Treatment Methods and Constructed Wetlands
Week 11: Pathogen Removal Strategies for Agricultural Water
Week 12: Emerging Contaminants and Advanced Treatment Technologies
Week 13: Treatment System Integration and Management
Week 14: Economics and Implementation of Treatment Systems
Week 15: Environmental Impacts, Sustainability, and System Optimization
Week 16: Final Examination

Laboratories

Week 1: Lab 1, Field sampling of agricultural water sources and measurement of basic quality parameters (pH, EC, turbidity, temperature).
Week 2: Lab 2, Laboratory analysis of sediment load and suspended solids in irrigation water.
Week 3: Lab 3, Hands-on testing of mechanical filtration systems (screen, disc, and media filters).
Week 4: Lab 4, Design and setup of a small-scale sand or gravel filtration system for particulate removal.
Week 5: Lab 5, Conduct jar tests to determine optimal coagulant dose and observe floc formation.
Week 6: Lab 6, Disinfection experiments using chlorine and hydrogen peroxide on contaminated water samples.
Week 7: No lab topic specified.
Week 8: Lab 7, Laboratory analysis of salinity and sodium adsorption ratio (SAR) for irrigation water suitability.
Week 9: Lab 8, Operate a bench-scale reverse osmosis (RO) or nanofiltration (NF) unit for desalination.
Week 10: Lab 9, Construction and testing of a small-scale constructed wetland for biological treatment.
Week 11: Lab 10, Microbial testing of irrigation water for coliforms and E. coli using field and lab methods.
Week 12: Lab 11, Evaluation of activated carbon and UV systems for removal of emerging contaminants.
Week 13: Lab 12, Group design workshop for an integrated agricultural water treatment system (Part 1).
Week 14: Lab 13, Group design workshop for an integrated agricultural water treatment system (Part 2): finalization and presentation.
Week 15: Lab 14, Perform environmental and sustainability assessment of selected treatment technologies.
Week 16: Lab 15, Conduct economic analysis of treatment system options using cost modeling tools.

WET303: Agricultural Water Management

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180		180	360	4	120	90	120	60	15	25

Course Description

This course covers the management of water in agricultural irrigation. Students learn to compute crop water requirements using standard methods and use evapotranspiration (ET) concepts to schedule irrigations. The course covers the operation, installation, and programming of ET weather stations. It also addresses irrigation scheduling concepts, including methods based on ET and soil moisture sensing. Students will learn to install soil moisture sensors and use the data to evaluate scheduling practices. The curriculum includes the definition of irrigation system efficiency and its use in evaluating irrigation technologies. Additionally, students learn about the types of meters for measuring flow in pipelines, how to install propeller meters, and how to measure flows in open channels. The course also covers losses in irrigation schemes, their causes, and potential solutions.

References

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Learning Outcomes

LO1: Determine the water capacity of irrigation systems based on crop water requirements.
LO2: Develop an irrigation schedule for crops.
LO3: Calculate ET from weather data.
LO4: Program, install and operate an ET weather station.
LO5: Identify the correct meter for monitoring flows in pipeline.
LO6: Identify flow measurement structures for canal systems.
LO7: Understand the concept of efficient irrigation.
LO8: Conduct a basic economic analysis of the benefits of an irrigation system.

Lectures

Week 1: Introduction to Water Management Concepts, On-farm, Irrigation Schemes, Regionally, Determining water demand, tracking water use and evaluating efficiency.
Week 2: Introduction of evapotranspiration concepts, Atmospheric water demand, Plant regulation of water use, Reference ET, Crop coefficients, UNFAO crop coefficient method, Other Sources of Crop coefficients.
Week 3: Temperature-based Estimation Methods, Pan Evaporation, Combination Method, Forms of the Penman Method, History, Standardization Process, Calculations guides, Data Requirements.
Week 4: Weather parameters in the Determination of ET, Solar Radiation, Temperature, Relative Humidity, Wind Speed, Public Weather Sets, Historical weather data, Estimation of weather data.
Week 5: ET Weather Stations, Types, Sensors, Site Requirements, Communications, Installation, Programming.
Week 6: Soil physics concepts in Irrigation Scheduling, Field Capacity, Plant Available Water, Readily Available Water, Volumetric water content, bulk density, Management allowed depletion.
Week 7: Irrigation Schedules, Irrigation system efficiency, Effective rainfall, Precipitation Rate of Sprinklers, Effective Precipitation Rate of other types of irrigation, Soil-water based scheduling, ET based scheduling, Other scheduling strategies.
Week 8: Exam 1, Exam Review.
Week 9: Soil Moisture Monitoring Sensors and Systems, Types of and Operating Principals of Soil Moisture Sensors, Installation Procedures, Collecting and Recording Data, Interpretation of Results.
Week 10: Performance Measures, Efficiency, Application Uniformity, Adequacy of Irrigation, Convey Efficiency, Overall System Efficiency, Irrigation System Evaluation, Irrigation System Capacity.
Week 11: Flow Measurement – Pipelines, Why Measure Flow, Unites of Measurement, Flow Rate Measurement Considerations, Types of Flow Meters and Operation Considerations, Propeller, Electromagnetic, Ultrasonic and Doppler, Installation.
Week 12: Flow Measurement – Pipelines, Accuracy, Full Scale vs Reading, Trajectory Method, Open Channel Fow Measurement, Introduction, Fundamental Concepts.
Week 13: Open Channel Fow Measurement, Simple Open Channel Measurement Methods, Weirs, Flumes, Broad-Created Weirs, Calibration of gates.
Week 14: Open Channel Fow Measurement, Current Metering, Selecting a Cross Section, Techniques, Velocity Measurement Methodology, Total Flow Calculation, Commercial Flow Meters.
Week 15: Conveyance Efficiencies and Losses in Irrigation Schemes, Definition, Sources of Losses, Seepage and Leakage from Lined and Unlined Canals, Capacity Analysis, Spills, Control Structure, Water Storage, Management Concepts In Irrigation Scheme, Benchmarking, Demand Management, Flow Measurement Structures, Water Accounting, Flow Management, Farm Turnout Considerations, Canal Lining.
Week 16: Principles of Economic Analysis, Economic Optimization at the Farm Scale, Mathematics of Economic Analysis, Predicting Yield Response, Computer Programs for Economic analysis.
Week 17: Final Exam, Exam Review.

Laboratories

Week 1: Lab 1, Field visit to projects that are using meters and other methods to track irrigation water use.
Week 2: Lab 2, Calculating of crop evapotranspiration using the Reference ET method.
Week 3: Lab 3, Calculating ET using the Hardgraves Method, Compare calculations of ET using the combination method and the Hardgraves method.
Week 4: Lab 4, Estimation of solar radiation using temperature methods.
Week 5: Lab 5, Install an ET Weather Station.
Week 6: Lab 6, Measure the water holding capacity of different soil types, Use this data to determine the frequency of irrigation for a crop irrigation system.
Week 7: Lab 7, Calculation of irrigation schedule for different irrigation systems.
Week 8: No lab topic specified.
Week 9: Lab 9, Hands-on installation of soils moisture sensors in the teaching field.
Week 10: Lab 10, Calculation of seasonal water requirements for an on-farm irrigation system as compared to records of actual usage.
Week 11: Lab 11, Demonstration of the installation of a propeller meter in plastic and metal pipe.

Week 12: Lab 12, Determine which meters are more accurate for certain applications using manufacturers reported full scale and reading data.
Week 13: Lab 13, Demonstration of measurement devices in miniature laboratory canal system.
Week 14: Lab 14, Hand-on use of a current meter for measuring open channel flows.
Week 15: Lab 15, Use of the ponding test method to measure seepage and total losses from irrigation canals, Benchmarking of irrigation schemes.
Week 16: Lab 16, Use an economic analysis model to determine the return of investment expected by a new irrigation system.
Week 17: No lab topic specified.

WET304: Modeling Soil and Water Processes

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	120	90	120	60	15	25

Requisites

- Prerequisites: WET301

Course Description

This advanced course integrates mathematical modeling, field observations, and laboratory analysis to understand and predict soil and water processes critical to irrigation and environmental management. It focuses on the quantitative analysis of hydrologic systems, contaminant transport, and water quality dynamics using state-of-the-art modeling tools. Students develop expertise in process-based models like L-THIA and GLEAMS/GRASIM, as well as GIS-based tools, to construct water budgets, predict nutrient and sediment transport, and evaluate best management practices. The curriculum combines the physical, chemical, and biological aspects of soil-water systems with spatial analysis and statistical methods. It emphasizes real-world applications in agricultural water management and watershed planning through case studies, field investigations, and scenario-based learning with environmental professionals to solve contemporary water resource challenges.

References

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Learning Outcomes

LO1: Develop water mass balances, predict runoff, and simulate hydrologic processes for watersheds under different climatic and land use conditions.
LO2: Apply mathematical models to predict nitrogen leaching, phosphorus adsorption, and sediment transport in agricultural and urban systems.
LO3: Conduct chemical and microbiological analyses, interpret results against regulatory standards, and assess impacts on human and ecosystem health.
LO4: Use industry-standard models (L-THIA, GLEAMS, GRASIM) to evaluate management scenarios and predict environmental outcomes.
LO5: Apply GIS tools and spatial statistics to analyze watershed characteristics, land use patterns, and their relationships to water quality.
LO6: Assess the effectiveness of BMPs for water quality protection using modeling tools and field data.
LO7: Develop appropriate sampling strategies, field measurement protocols, and quality assurance procedures for soil and water investigations.
LO8: Integrate multiple models and data sources to address real-world challenges in water resources management.
LO9: Present modeling results, uncertainty assessments, and management recommendations to diverse stakeholders.
LO10: Work effectively in teams, engage with environmental professionals, and develop research proposals for addressing emerging water quality issues.

Lectures

Week 1: Hydrologic Processes I, Water cycle components, Energy balance, Precipitation patterns, Global water resources.

Week 2: Environmental Problem Identification, Local vs. global water issues, Climate change impacts, Agricultural pressures, Urbanization effects.
Week 3: Contaminant Transport Processes, Nitrogen cycle and leaching, Phosphorus dynamics, Sediment transport, USLE application.
Week 4: Advanced Transport Modeling, Advection-dispersion, Adsorption isotherms, Transformation processes, Integrated transport models.
Week 5: Water Quality Policy & Management, Regulatory framework, TMDL development, Stakeholder roles, Case studies.
Week 6: Introduction to Hydrologic Models, Model types and selection, L-THIA principles, Input data requirements, Calibration concepts.
Week 7: Agricultural System Models, GLEAMS overview, GRASIM applications, Parameter estimation, Sensitivity analysis.
Week 8: Water Chemistry Fundamentals, Major ions, Nutrients (N, P), pH and alkalinity, Dissolved oxygen dynamics.
Week 9: Water Microbiology, Indicator organisms, Pathogen transport, Die-off kinetics, Public health implications.
Week 10: Biological Indicators, Ecosystem health metrics, Bioassessment protocols, Index development, Interpretation guidelines.
Week 11: Spatial Statistics & Analysis, Geostatistics basics, Interpolation methods, Uncertainty quantification, Scale considerations.
Week 12: Soil & Groundwater Remediation, Contamination sources, Remediation technologies, Modeling approaches, Case studies.
Week 13: Scenario Analysis & Decision Support, Multi-criteria analysis, Uncertainty assessment, Risk communication, Adaptive management.
Week 14: Research Methods & Proposal Development, Problem formulation, Literature review, Methodology design, Proposal writing.
Week 15: Student Research Presentations, Project presentations, Peer evaluation, Synthesis discussion, Course wrap-up.
Week 16: FINAL EXAM WEEK.

Laboratories

Week 1: Lab 1: Laboratory Safety & Protocols, Chemical handling procedures, Biological safety, Environmental Quality Lab orientation, Equipment training.
Week 2: Lab 2: Ross Hill Watershed Field Trip, Watershed delineation, Field observations, Land use assessment, Stream monitoring.
Week 3: Lab 3: Field Measurements, Soil moisture (gravimetric & TDR), Web-based GIS introduction, Spatial data collection, GPS applications.
Week 4: Lab 4: Wetland Field Trip, Wetland functions, Flow measurement techniques, Water quality sampling, Ecosystem services.
Week 5: Lab 5: Guest Speakers, IDNR representative, City water manager, Consulting engineer, Q&A session.
Week 6: Lab 6: L-THIA Workshop, Software installation, Data preparation, Model runs, Output interpretation.
Week 7: Lab 7: GLEAMS/GRASIM Workshop, Model setup, Crop simulations, Nutrient cycling, Management scenarios.
Week 8: Lab 8: Water Chemistry Analysis, Sample preparation, Ion chromatography, Spectrophotometry, Quality control.
Week 9: Lab 9: Microbiological Analysis, Coliform testing, Plate counts, Microscopy, Data interpretation.
Week 10: Lab 10: Statistical Analysis, Spatial variability, Soil column experiments, Data analysis, Hypothesis testing.
Week 11: Lab 11: Advanced GIS Applications, Spatial analysis tools, Watershed modeling, Land use classification, Change detection.
Week 12: Lab 12: Environmental Case Studies, Video analysis, Group discussions, Problem identification, Solution development.
Week 13: Lab 13: BMP Design & Evaluation, BMP selection, Performance modeling, Cost analysis, Implementation planning.
Week 14: Lab 14: Debate & Discussion, Current water issues, Policy debates, Solution proposals, Peer review.
Week 15: Lab 15: Final Presentations, Research presentations, Q&A sessions, Peer feedback, Course evaluation.
Week 16: Final Exam.

WET305: WET Internship II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	4	90	90	120	60	15	25

Requisites

- Prerequisites: WET103

Course Description

Course Description
This advanced 8-week summer field study offers third-year students specialized practical experience in irrigated crop production systems within Egypt's varied farming environments. Students engage directly with agricultural research stations, commercial farms, agribusinesses, and irrigation technology providers, applying their knowledge of soil-water-plant relationships, irrigation scheduling, and precision agriculture. Through immersive placements in traditional Nile Valley agriculture and modern reclaimed lands, students take part in complete crop production cycles, execute irrigation scheduling, perform field evaluations, and operate advanced irrigation systems. The experience emphasizes integrating modern irrigation technologies, water conservation, and economic considerations to prepare students for leadership roles in Egypt's evolving agricultural sector.

Learning Outcomes

LO1: Develop and implement science-based irrigation scheduling programs for different crops using soil moisture monitoring, weather data, and crop coefficients.
LO2: Conduct comprehensive irrigation system evaluations including uniformity tests, efficiency calculations, and performance optimization recommendations.
LO3: Utilize modern technologies including soil moisture sensors, remote sensing, and variable rate irrigation for optimized water management.
LO4: Integrate irrigation management with overall crop production practices including fertilization, pest management, and harvest planning.
LO5: Calculate and improve crop water productivity metrics, economic water productivity, and implement water-saving strategies.

LO6: Monitor and manage irrigation water quality issues including salinity, sodicity, and implement appropriate leaching requirements.
LO7: Independently operate and troubleshoot modern irrigation systems including center pivots, drip systems with fertigation, and automated control systems.
LO8: Perform cost-benefit analyses of irrigation investments, water pricing impacts, and profitability assessments of different irrigation strategies.
LO9: Demonstrate leadership in coordinating field teams, training operators, and communicating with diverse stakeholders.
LO10: Identify field problems and develop practical, innovative solutions integrating technical knowledge with local conditions and constraints.

Lectures

Pre-Field Study: Campus, Advanced Preparation Program.
Week 1: Agricultural Research Station, Crop Water Requirements Research.
Week 2: Commercial Farm - Field Crops, Large-Scale Irrigation Management.
Week 3: Precision Agriculture Site, Advanced Technologies Integration.
Week 4: Horticultural Production, High-Value Crop Systems.
Week 5: Water-Scarce Region Farm, Water Conservation Practices.
Week 6: Irrigation Equipment Company, Technology Development & Support.
Week 7: Integrated Farm Management, Holistic Production Systems.
Week 8: Synthesis & Innovation, Project Development & Presentation.

Laboratories

Pre-Field Study: Review of soil-water-plant relationships, Advanced instrumentation training, Research methodology for field studies, Placement-specific technical briefing, Development of individual learning plans.
Week 1: Lysimeter operations and ET measurements, Weather station data collection and analysis, Crop coefficient determination, Research plot management, Data quality control procedures.
Week 2: Center pivot operation and programming, Variable rate irrigation implementation, Irrigation scheduling software utilization, Yield mapping and analysis, Economic optimization strategies.
Week 3: Soil moisture sensor network management, Remote sensing for irrigation decisions, GIS applications in water management, Drone technology for crop monitoring, Data integration platforms.
Week 4: Greenhouse irrigation automation, Fertigation system design and operation, Microclimate management, Deficit irrigation strategies, Quality vs. quantity trade-offs.
Week 5: Deficit irrigation implementation, Mulching and conservation techniques, Saline water management, Drought-resistant crop selection, Alternative water source utilization.
Week 6: System design using software, Technical troubleshooting, Customer training programs, New technology testing, Market analysis and trends.
Week 7: Crop rotation impacts on water use, Integrated pest management and irrigation, Soil health and water relations, Sustainable intensification practices, Climate adaptation strategies.
Week 8: Complete applied research project, Develop innovation proposal, Professional networking events, Career development workshops, Final presentations to industry.

WET311: WET Track Elective II

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

WET401: Design of On-Farm Irrigation Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180		180	360	4	120	90	120	60	15	25

Requisites

- Prerequisites: WET206

Course Description

This course covers the engineering principles of irrigation, teaching students how to design drip, surface, and sprinkler irrigation systems. Students also learn to develop ordering specifications for center pivots and linear-move machines. The curriculum includes applying crop consumptive use information to size systems and create irrigation schedules. Key topics include the basic concepts of water flow in pipes, correct pipeline sizing, and determining pressure requirements. The course also covers the types of pumps and flow meters used in irrigation and their proper selection. Students gain hands-on experience installing propeller meters and working with water applicators on center pivots. Additionally, the course addresses the design of efficient furrow and level basin irrigation systems, the principles and benefits of land leveling, and the management of surface systems to maximize water use efficiency.

References

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Learning Outcomes

LO1: Based on crop water system, determine the total amount of water needed when planning an irrigation System.
LO2: Using surveys, determine if land forming is practical and perform basic calculations to develop a land forming (leveling) plan.
LO3: Determine the capacity of on-farm water delivery systems like pipelines and channels.
LO4: Based upon water demand, select nozzles and size piping systems for solid set and potable solid set sprinkler systems.
LO5: Based upon site conditions and water supply, develop the specifications for the ordering of a center pivot.
LO6: Select drip tubing products, determine the layout and total length of product needed, determine the size of the water supply manifold, and select appropriate filtration equipment.
LO7: Design level basin and furrow irrigation systems based upon site conditions.
LO8: Determine weekly irrigation water requirements and irrigation schedules for individual irrigation systems.
LO9: Install propeller flow meters in metal and plastic pipe.
LO10: Select meters for irrigation system monitoring.

Lectures

Week 1: Review of Irrigation Scheduling and Efficiency Concepts, Terminology, Crop consumptive use and ET, Soil-Water Relationships, Infiltration, Scheduling Principles, Irrigation Efficiency Concepts.
Week 2: Land Forming, Land leveling for irrigation, Cut and Fill volumes, Laser land leveling equipment.
Week 3: Surface Irrigation System Design Concepts, Types of surface Irrigation Systems, Efficiency concepts, Relationship between Advance Time, Infiltration Rate and Deep Percolations.
Week 4: Design of Surface Irrigation Systems, Furrow irrigation Design, Empirical Methods, Hydraulic Analysis, Level Basin Irrigation Design, Hydraulic Relationships, Empirical Methods.
Week 5: Management of Surface Irrigation Systems, Cut-back Irrigation, Surge Values and Surge Flow Irrigation water management, Gated Pipe and Poly Pipe.
Week 6: Design of Sprinkler Irrigation Systems, Types of Sprinkler Systems, System Components, Design Objectives, Wind drift, Evaporation, Application Rates.
Week 7: Design of Sprinkler Irrigation Systems, Application rate and infiltration rate, Nozzle Selection and Operating Pressure, System Capacity.
Week 8: Midterm Exam, Review for Exam.
Week 9: Design of Sprinkler Irrigation Systems, Water Flow through Pipes, Determining Friction Loss, Design of Laterals and manifolds.
Week 10: Design of Sprinkler Irrigation Systems, Mainline Pipe Design, Determining Pumping Head Requirements, Slope and Other Considerations.
Week 11: Center Pivot Systems, Types and options, Field measurements, System Capacity, Water Applicators, The Pivot Computer Printout, Water Applicators and accessories.
Week 12: Design of Drip Irrigation Systems, Definitions, Types of Drip, Tape, Tubing, Micro sprays, Pressure Compensating vs Non compensating, Emitter Spacing and Flow Rate, Determining Water Application Rates, Layout of Drip Irrigation Systems.
Week 13: Design of Drip Irrigation Systems, Manifold and Lateral Design, Filter Sizing and Selection, Installation of Drip Irrigation Systems, Fittings and Other Components.
Week 14: Flow Measurement, Types of Meters and Measurement Methods, Meter Accuracy Analysis, Installation of flow meters in pipelines.
Week 15: Pump Systems, Types of Pumps, Hydraulic Principles, Pump Selection, Pump System configuration.
Week 16: Irrigation System Management, Irrigation Scheduling based on ET and Soil Moisture Management, Meeting Peak Consumptive Use Requirements, Tracking Water Use in Irrigation Systems, Use of Flow Meters and Pressure Gauges for Troubleshooting.
Week 17: Final Exam, Review for Exam.

Laboratories

Week 1: Lab 1, Calculation of a weekly irrigation schedule for the peak crop growth stage of an irrigation system, Adjusting the irrigation schedule for efficiency of the system.
Week 2: Lab 2, Use of surveys in land forming, Calculating cut/fill volumes.
Week 3: Lab 3, Calculation of furrow irrigation system efficiency.
Week 4: Lab 4, Determine furrow row length and flow for a site, Design a level basin irrigation system for a site.
Week 5: Lab 5, Programming a surge valve, Sizing holes for poly pipe.
Week 6: Lab 6, Determine the application rate of sprinklers using manufacturer’s specification chart.
Week 7: Lab 7, Size nozzles for a sprinkler irrigation system able to meet capacity needs.
Week 8: Review for Exam.
Week 9: Lab 9, Design a sprinkler irrigation system for a site including laterals, manifold and size all pipes based on flow.
Week 10: Lab 10, Determine pumping head requirements for systems designed in Lab 9.

Week 11: Lab 11, Determine the ordering specifications of a pivot for a site.
Week 12: Lab 12, Determine the water application rates for different combinations of drip product and spacings.
Week 13: Lab 13, Hands-on Installation of a surface drip irrigations system.
Week 14: Lab 14, Demonstration of proper procedures for installation of flow meters in metal and plastic pipe.
Week 15: Lab 15, Reading Pump Curves and Performance Charts, Selection of correct pumping capability f.
Week 16: Lab 16, Determine a water management plan for a sprinkler, drip and center pivot system.
Week 17: Review for Exam.

WET402: Irrigation Water Quality and Salinity Management

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120		240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WET302

Course Description

This course provides students with a comprehensive understanding of irrigation water quality standards and methods to manage water that is high in substances that may affect crop growth and production. The curriculum covers the types of laboratories and portable equipment used to measure water quality and identifies substances of primary interest in irrigated agriculture, with a focus on salinity. Students will learn practices to manage water and soil salinity, including how to determine leaching rates and remediation strategies for sodic soils. The course also addresses the treatment of irrigation water with acids and chlorine, covering types of injection equipment and how to calculate injection rates. Finally, the use of wastewater and reclaimed water for irrigation will be covered, including the special water quality concerns associated with their use.

References

Chhabra, R., 2017. Soil salinity and water quality. Routledge.
Fipps, G., 2003. Irrigation water quality standards and salinity management strategies.
Zaman, M., Shahid, S.A., Heng, L., 2018. Irrigation Water Quality, in: Guideline for Salinity Assessment, Mitigation and Adaptation Using Nuclear and Related Techniques. Springer International Publishing, Cham, pp. 113–131. https://doi.org/10.1007/978-3-319-96190-3_5

Learning Outcomes

LO1: Understand and convert between units used for different substances in water quality analysis reports.
LO2: Determine if water provides a salinity or sodic hazard.
LO3: Understand the common types of portable meters that can be used in the field for assessing water salinity.
LO4: Based on water quality and type of crop, predict the likely reduction in yield.
LO5: Understand how to perform a water balance and calculate leaching rates to maintain crop production and soil productivity.
LO6: Know what kind of filter is needed based upon water quality and understand the use of sediment basins and calculation of settling times.
LO7: Determine which type of injector should be used, calculate acid and choline injection rates to achieve desired water quality, and calibrate injection equipment.
LO8: Understand the water quality measurements of most concern with wastewater to determine if it can be used, and perform water balance calculations to determine how much wastewater can be used and nutrient loading.

Laboratories

Week 1: Overview of Water Quality Concerns, Plant Growth, Soil Productivity, Environmental, Water Testing and Analysis, Laboratory equipment used for water and soil analysis, Portable equipment for in-field testing.
Week 2: Water Testing and Analysis, Units, Terminology, Sampling, Ions and Elements.
Week 3: Water and Soil Salinity Concepts, Origin of Salts, Units, Measuring Salinity, Classification of Water based on Quality, Salinity Hazard, Sodium Hazard, Saline and Sodic Soils.
Week 4: Water Quality Effects on Plants and Crop Yield, Expected Crop Yield Reduction due to Soil Salinity, Effects of Boron on Plant Growth, Foliar Damage due to Sodium and Chlorides under Sprinkler Irrigation.
Week 5: Leaching for Salinity Management, Crop Water Balance Calculations for Determination of Leaching volumes.
Week 6: Leaching for Salinity Management, Calculation of Leaching Volume based on Water and Soil Salinity.
Week 7: Soil Amendments for Managing Sodic Soils, Chemicals Commonly Used, Calculation of Loading Rates.
Week 8: Exam 1.
Week 9: Designing a Complete Salinity Management Program, Case 1: Only Saline Water is the Problem, Case 2: Only Sodic Soils is the Problem, Case 3: Both Saline Water and Sodic Soils are problems.
Week 10: Other Practices for Managing Irrigation Water Quality, Residue Management, More Frequent Irrigations, Changing Irrigation Method, Seed Placement, Pre-Plant Irrigation.

Week 11: Principles of Filtration, Suspended Solids and Sedimentation, Precipitation of Dissolved Solids, Filtration for Organic Materials in Water.
Week 12: Filtration Methods, Settling Basins, Screen, Disc and Sand Media, Filter Flushing and Maintenance Practices.
Week 13: Introduction to Chemigation, Rules and Regulation, Label Guidelines for Pesticides, Injecting Acid for PH control, Injecting Choline for Biological Control, Chemigation Equipment and Operation, Types of Injection Meters, Venturi, Diagram, Piston Drive, Operator and Environmental Safety Equipment.
Week 14: Calculating Injection Rates, Acid, Chlorine, Calibration of Injection Equipment.
Week 15: Wastewater and Reclaimed Water for Irrigation, Classification of Wastewater based on Source, Water Quality Concerns, Crop Suitability, Nutrient Loading, Human Health Considerations.
Week 16: Wastewater and Reclaimed Water for Irrigation, Water Balance Calculations.
Week 17: Final Exam.

WET403: WET Project III + Seminar

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	3	90	90	120	60	15	25

Requisites

- Prerequisites: WET209

Course Description

This capstone seminar synthesizes knowledge from the Irrigation Science and Technology program through student-led presentations, guest lectures, and professional workshops focused on new research, technologies, and challenges in irrigation and water management. It builds on Seminar I by exploring connections between irrigation technology, environmental sustainability, policy, and socioeconomic factors. This is achieved through individual research presentations, panel discussions, and collaborative projects that show mastery of program learning outcomes. The seminar format emphasizes critical analysis of current literature, effective scientific communication, leadership development, and networking with industry professionals and researchers. It aims to foster intellectual discourse and lifelong learning skills needed for careers in the evolving field of irrigation science and water resources management.

Learning Outcomes

LO1: Integrate concepts from across the irrigation science curriculum to address complex, real-world water management challenges.
LO2: Present technical research findings and project outcomes to diverse audiences using appropriate visual aids and communication strategies.
LO3: Analyze and critique current research publications, technical reports, and policy documents related to irrigation and water resources.
LO4: Facilitate and contribute to professional discussions on emerging technologies, best practices, and controversial issues in irrigation science.
LO5: Demonstrate professional skills including resume writing, interview techniques, networking, and workplace communication.
LO6: Analyze ethical dimensions of water resource decisions and articulate positions on controversial irrigation-related issues.
LO7: Develop fundable research or project proposals addressing current challenges in irrigation science and technology.
LO8: Establish connections with industry professionals, researchers, and peers for career development and collaboration.
LO9: Assess emerging technologies and innovative practices for their potential impact on irrigation efficiency and sustainability.
LO10: Exhibit leadership skills through seminar organization, peer mentoring, and professional conduct.

Lectures

Week 1: Course Introduction & Professional Development Planning, Course overview and expectations, Professional portfolio development, Presentation schedule coordination, Career goal setting, LinkedIn profile optimization.
Week 2: Advanced Presentation Skills Workshop, Technical presentation techniques, Visual design principles, Handling Q&A sessions, Virtual presentation skills, Peer evaluation methods.
Week 3: Current Issues in Water Resources, Global water security, Climate change impacts, Policy developments, Technology trends, Regional challenges.
Week 4: Precision Agriculture & Smart Irrigation, IoT applications, AI and machine learning, Drone technology, Variable rate irrigation, Data management.
Week 5: Sustainable Irrigation Practices, Water-energy nexus, Carbon footprint reduction, Regenerative agriculture, Ecosystem services, Certification programs.
Week 6: Research Methods & Proposal Writing, Research design, Funding opportunities, Proposal structure, Budget development, Ethics in research.
Week 7: Water Economics & Policy Forum, Water pricing mechanisms, Subsidy programs, Water rights and allocation, International agreements, Stakeholder engagement.
Week 8: Innovation Showcase, Student innovation projects, Startup opportunities, Patent basics, Commercialization, Pitch techniques.
Week 9: International Perspectives, Global irrigation challenges, Technology transfer, Development projects, Cultural considerations, International careers.
Week 10: Professional Ethics & Leadership, Ethical decision-making, Professional codes, Leadership styles, Conflict resolution, Team

management.
Week 11: Career Development Workshop, Job search strategies, Interview preparation, Salary negotiation, Graduate school options, Professional certifications.
Week 12: Interdisciplinary Connections, Soil science integration, Crop science applications, Environmental engineering, Data science tools, Systems thinking.
Week 13: Future of Irrigation Technology, Emerging technologies, Research frontiers, Industry predictions, Career evolution, Lifelong learning.
Week 14: Capstone Presentations, Final research presentations, Project demonstrations, Peer recognition, Awards ceremony.
Week 15: Professional Networking Event, Industry mixer, Alumni connections, Employer meetings, Research opportunities, Celebration.
Week 16: FINAL PORTFOLIO REVIEW.

WET404: Water Delivery System

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180		180	360	4	90	90	180	60	15	25

Requisites

- Prerequisites: WET401

Course Description

This course provides comprehensive coverage of water delivery systems used in agricultural and landscape irrigation. As a core course in the program, it bridges theoretical hydraulics with practical system design and management. Students learn the fundamental principles of hydraulic design, system components, and operational management for various water delivery methods. The course integrates engineering principles with practical applications to prepare students for designing, installing, and managing efficient water delivery systems. Through lectures, laboratory exercises, and field experiences, students develop competencies in hydraulic calculations, component selection, design methodologies, and performance evaluation for both surface and pressurized systems. Emphasis is placed on water conservation, energy efficiency, and sustainable management practices, with hands-on experience using industry-standard equipment and software.

References

Abdulameer, L.S., Dzhumagulova, N., Algretawee, H., Zhuravleva, L., Alshammari, M.H., 2022. COMPARISON BETWEEN HAZEN-WILLIAMS AND DARCY-WEISBACH EQUATIONS TO CALCULATE HEAD LOSS THROUGH CONVEYANCING TREATED WASTEWATER IN KERBALA CITY, IRAQ. Eastern-European Journal of Enterprise Technologies 115.
Chanson, H., 2004. Hydraulics of open channel flow. Elsevier.
Isman, K.E., 2016. Hydraulics, in: Hurley, M.J., Gottuk, D., Hall, J.R., Harada, K., Kuligowski, E., Puchovsky, M., Torero, J., Watts, J.M., Wieczorek, C. (Eds.), SFPE Handbook of Fire Protection Engineering. Springer New York, New York, NY, pp. 1378–1422. https://doi.org/10.1007/978-1-4939-2565-0_41
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Polanco, G., Zambrano M, L.A., 2024. Practical Approach to Pressure Losses Due to Friction in Design, in: Auer, M.E., Cukierman, U.R., Vendrell Vidal, E., Tovar Caro, E. (Eds.), Towards a Hybrid, Flexible and Socially Engaged Higher Education, Lecture Notes in Networks and Systems. Springer Nature Switzerland, Cham, pp. 235–245. https://doi.org/10.1007/978-3-031-53022-7_24
Tollner, E.W., 2021. Open channel design: fundamentals and applications. John Wiley & Sons.
Valiantzas, J.D., 2005. Modified Hazen–Williams and Darcy–Weisbach Equations for Friction and Local Head Losses along Irrigation Laterals. J. Irrig. Drain Eng. 131, 342–350. https://doi.org/10.1061/(ASCE)0733-9437(2005)131:4(342)

Learning Outcomes

LO1: Apply fundamental hydraulic principles to analyze water flow in pipes, channels, and irrigation systems.
LO2: Design efficient water delivery systems for various irrigation methods including surface, sprinkler, and micro-irrigation.
LO3: Select appropriate pumps, pipes, valves, and control devices based on system requirements and constraints.
LO4: Calculate pressure distributions, flow rates, and uniformity coefficients for irrigation systems.
LO5: Evaluate water distribution uniformity and system efficiency using field measurement techniques.
LO6: Implement basic automation and control strategies for irrigation water delivery.
LO7: Diagnose and troubleshoot common problems in water delivery systems.
LO8: Develop operation and maintenance schedules to optimize system performance and longevity.

Lectures

Week 1: Introduction to Water Delivery Systems, Course overview and objectives, Types of water delivery systems, System components overview, Water sources and quality, Professional applications, Safety protocols.
Week 2: Hydraulic Fundamentals, Fluid properties, Pressure and head concepts, Flow measurement, Continuity equation, Bernoulli's equation, Energy principles.
Week 3: Pipe Hydraulics, Friction losses, Hazen-Williams equation, Darcy-Weisbach equation, Minor losses, Pipe sizing, Velocity constraints.

Week 4: Open Channel Flow, Channel geometry, Manning's equation, Uniform flow, Flow measurement structures, Channel design, Erosion control.
Week 5: Pumping Systems, Pump types and selection, Performance curves, System curves, Operating points, Efficiency considerations, Variable speed drives.
Week 6: Surface Irrigation Delivery, Furrow systems, Border irrigation, Basin irrigation, Water control structures, Distribution uniformity, Automation options.
Week 7: Midterm Review Week.
Week 8: Sprinkler System Components, Sprinkler types, Nozzle selection, Pressure regulators, Valves and controllers, Pipe materials, System layouts.
Week 9: Field Trip Week.
Week 10: Sprinkler System Design, Design procedures, Lateral design, Mainline sizing, Pressure variations, Set/moved systems, Center pivots.
Week 11: Micro-irrigation Systems, Drip irrigation principles, Emitter types, Micro-sprinklers, Filtration requirements, Pressure compensation, Clogging prevention.
Week 12: Micro-irrigation Design, Design methodology, Lateral hydraulics, Manifold design, Filtration sizing, Fertigation systems, Automation integration.
Week 13: Control and Automation, Control system basics, Sensors and actuators, Controllers and timers, Remote monitoring, SCADA systems, Smart irrigation.
Week 14: System Evaluation and Maintenance, Performance testing, Efficiency metrics, Maintenance schedules, Troubleshooting guides, Rehabilitation options, Record keeping.
Week 15: Economic Analysis and Optimization, Life cycle costs, Energy analysis, Water conservation, System comparisons, Funding sources, Decision tools.
Week 16: FINAL PRESENTATIONS.

Laboratories

Week 1: Lab 1: System Component Identification, Equipment familiarization, Component functions, Material properties, Industry standards, Safety training, Tool usage.
Week 2: Lab 2: Flow Measurement, Flow meter types, Calibration procedures, Data collection, Accuracy assessment, Unit conversions, Error analysis.
Week 3: Lab 3: Friction Loss Experiments, Pressure measurements, Loss calculations, Pipe roughness effects, Fitting losses, Data plotting, Software tools.
Week 4: Lab 4: Channel Flow Testing, Flume experiments, Weir calibration, Flow profiles, Velocity measurements, Design calculations, Field observations.
Week 5: Lab 5: Pump Performance Testing, Pump curve generation, Efficiency testing, NPSH calculations, Parallel/series operations, Troubleshooting, Energy audits.
Week 6: Lab 6: Surface System Evaluation, Advance/recession tests, Infiltration measurements, Distribution analysis, Gate operations, Flow monitoring, Efficiency calculations.
Week 7: Midterm Exam, Comprehensive coverage, Problem-solving emphasis, Design calculations, Concept applications.
Week 8: Lab 8: Sprinkler Testing, Discharge measurements, Pattern testing, Pressure effects, Uniformity testing, Catch-can tests, Data analysis.
Week 9: Full-Day Field Trip, Commercial farm visit, Municipal systems tour, Equipment demonstrations, Professional interviews, System evaluations, Photo documentation.
Week 10: Lab 10: Design Software Workshop, CAD basics, Hydraulic software, System modeling, Optimization tools, Cost estimation, Documentation.
Week 11: Lab 11: Emitter Performance, Flow testing, Uniformity evaluation, Clogging assessment, Maintenance procedures, Chemical injection, System flushing.
Week 12: Lab 12: Micro Design Project, Field measurements, Design calculations, Component selection, Cost analysis, Installation planning, Quality control.
Week 13: Lab 13: Automation Workshop, Controller programming, Sensor calibration, Data logging, Remote access, Troubleshooting, Integration examples.
Week 14: Lab 14: Field Evaluations, System audits, Performance testing, Problem diagnosis, Repair procedures, Documentation, Recommendations.
Week 15: Lab 15: Economic Analysis, Cost calculations, Payback analysis, Sensitivity analysis, Optimization tools, Grant writing basics, Case studies.
Week 16: Design Presentations, Student presentations, Peer evaluation, Industry panel feedback, Discussion and synthesis, Course wrap-up, Career planning.

WET405: Remote Sensing for Water Management

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
180		180	360	4	90	90	120	60	15	25

Course Description

This advanced course provides comprehensive training in remote sensing applications for soil moisture monitoring, evapotranspiration estimation, and irrigation water management across Egyptian agricultural systems from the Nile Delta to desert lands. Students develop expertise in satellite imagery analysis using Google Earth Engine, QGIS, and Python to process Landsat, Sentinel, and MODIS data for deriving vegetation indices, land surface temperature, actual evapotranspiration, and soil moisture indicators. Through hands-on exercises and field validation, participants master the complete workflow from data acquisition to actionable irrigation recommendations, emphasizing practical applications including salinity monitoring, water stress detection, and sustainable water resource management under scarcity conditions.

References

Bastiaanssen, W.G., 1998. Remote sensing in water resources management: the state of the art.
Schultz, G.A., Engman, E.T., 2012. Remote sensing in hydrology and water management. Springer Science & Business Media.
Wang, X., Xie, H., 2018. A review on applications of remote sensing and geographic information systems (GIS) in water resources and flood risk management. Water 10, 608.

Learning Outcomes

LO1: Explain electromagnetic radiation principles, spectral signatures of soil and vegetation, and sensor characteristics relevant to agricultural water management applications.
LO2: Acquire, pre-process, and analyze multispectral and thermal satellite data using cloud-based platforms (Google Earth Engine) and desktop software (QGIS) for Egyptian agricultural regions.
LO3: Implement surface energy balance models (SEBAL, METRIC, SEBS) to calculate actual evapotranspiration at field to regional scales for irrigation scheduling and water accounting.
LO4: Derive soil moisture indicators from optical and microwave remote sensing data, integrating thermal-optical approaches for operational irrigation management.
LO5: Calculate vegetation indices and water stress indicators to identify irrigation requirements, detect water deficit conditions, and optimize irrigation timing.
LO6: Conduct scheme-level performance assessments using remote sensing indicators for water productivity, adequacy, equity, and beneficial water use fractions.
LO7: Classify crop types, map irrigated areas, delineate management zones, and monitor cropping patterns using time-series analysis and machine learning algorithms.
LO8: Design ground-truthing protocols, calibrate remote sensing products with field measurements, and assess accuracy of derived irrigation parameters.
LO9: Create operational workflows combining remote sensing data with weather stations, soil sensors, and crop models for integrated irrigation management.
LO10: Prepare professional reports, visualization products, and web-based dashboards to deliver remote sensing insights to farmers, water managers, and policy makers.

Lectures

Week 1: Introduction to Remote Sensing for Agriculture, Course overview and objectives, Electromagnetic spectrum fundamentals, Spectral signatures of soil, water, vegetation, Egyptian agricultural systems overview, Available satellite platforms and sensors.
Week 2: Satellite Systems and Sensors, Optical sensors (Landsat, Sentinel-2, MODIS), Thermal infrared sensors, Microwave sensors (Sentinel-1, SMAP), Spatial, temporal, spectral resolution, Egyptian satellite receiving stations.
Week 3: Image Pre-processing Fundamentals, Radiometric corrections, Atmospheric corrections (DOS, FLAASH), Geometric corrections and registration, Image mosaicking and subsetting, Quality assessment procedures.
Week 4: Vegetation Indices for Water Management, NDVI, EVI, SAVI principles, Water-sensitive indices (NDWI, NDMI), Crop coefficient relationships, Temporal profiles and phenology, Index selection for Egyptian crops.
Week 5: Thermal Remote Sensing Applications, Land surface temperature retrieval, Split-window algorithms, Emissivity estimation, Diurnal temperature variations, Water stress detection.
Week 6: Evapotranspiration Estimation Theory, Surface energy balance principles, SEBAL model framework, METRIC model applications, FAO-56 integration, Egyptian ET validation studies.
Week 7: Soil Moisture Remote Sensing, Optical-based approaches, Thermal inertia methods, Microwave soil moisture (SMAP, SMOS), Downscaling techniques, Integration with field sensors.
Week 8: Midterm Week.
Week 9: Google Earth Engine Applications, JavaScript API basics, Cloud computing advantages, Large-scale processing, Time series analysis, Egyptian agricultural monitoring.
Week 10: Machine Learning for Crop Classification, Supervised classification algorithms, Random Forest, SVM applications, Training data collection, Accuracy assessment, Egyptian crop mapping.
Week 11: Irrigation Performance Assessment, Performance indicators framework, Water productivity mapping, Adequacy and equity analysis, Beneficial fraction estimation, Egyptian scheme evaluation.
Week 12: Water Accounting with Remote Sensing, WaPOR database utilization, Water balance components, Consumed vs beneficial use, Basin-scale accounting, Nile system applications.
Week 13: Integration with Field Systems, Sensor network design, Data fusion techniques, Validation protocols, Uncertainty assessment, Operational systems.
Week 14: Decision Support Systems, DSS architecture, Web-based platforms, Mobile applications, Farmer advisory services, Egyptian case studies.
Week 15: Future Trends & Applications, New satellite missions, AI/ML advances, Precision agriculture integration, Policy applications, Career opportunities.
Week 16: FINAL EXAM WEEK.

Laboratories

Week 1: Lab 1: Software Setup & Data Access, QGIS installation and configuration, Google Earth Engine registration, Python environment setup, Data portal navigation (USGS, Copernicus), Study area selection.
Week 2: Lab 2: Image Acquisition & Visualization, Downloading Landsat/Sentinel data, Basic image display and enhancement, Band combinations for agriculture, Time series data organization, Cloud masking techniques.
Week 3: Lab 3: Pre-processing Workshop, Radiometric calibration, Atmospheric correction application, Image-to-image registration, Creating analysis-ready data, Metadata management.
Week 4: Lab 4: Vegetation Index Calculation, VI computation in QGIS, Time series extraction, Crop coefficient derivation, Statistical analysis, Threshold determination.
Week 5: Lab 5: Thermal Data Processing, LST calculation from Landsat, MODIS LST products, Temperature-VI relationships, Stress index computation, Validation with weather data.
Week 6: Lab 6: ET Model Implementation, SEBAL step-by-step processing, Hot/cold pixel selection, Sensible heat flux calculation, ET fraction determination, Daily ET extrapolation.
Week 7: Lab 7: Soil Moisture Mapping, Optical trapezoid model, SMAP data processing, Downscaling implementation, Accuracy assessment, Operational products.
Week 8: Practical Exam, Image processing tasks, Index calculation, ET estimation exercise, Interpretation questions.
Week 9: Lab 9: GEE Development, Script development basics, Image collection filtering, Batch processing, Visualization tools, App development.
Week 10: Lab 10: Classification Workshop, Training sample design, Classifier implementation, Confusion matrix analysis, Area estimation, Change detection.
Week 11: Lab 11: Performance Analysis, Indicator calculation, Spatial variability assessment, Temporal trend analysis, Benchmarking methods, Report generation.
Week 12: Lab 12: Water Accounting, WaPOR data access, Water balance calculation, Productivity assessment, Scenario analysis, Dashboard creation.
Week 13: Lab 13: System Integration, Field data collection, Calibration procedures, Error propagation, Quality control, Real-time systems.
Week 14: Lab 14: DSS Development, Interface design, Database integration, Visualization tools, User testing, Deployment strategies.
Week 15: Lab 15: Final Presentations, Student presentations, Peer review, Industry feedback, Best practices, Implementation planning.
Week 16: Final Exam.

WET406: WET Project IV

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
60			60	3	90	90	120	60	15	25

Requisites

- Prerequisites: WET403

Course Description

This two-semester capstone sequence integrates knowledge from the Pivot Irrigation Technology track through team-based client projects, with IRT209 Project 1 focusing on initial evaluation and solution development, followed by IRT403 Project 2 emphasizing advanced design, testing, iteration, and final implementation of comprehensive pivot irrigation systems. Students engage in continuous client communication, weekly meetings with instructional project managers, and collaboration with technical writing assistants to develop professional engineering solutions that satisfy economic, environmental, social, and technical constraints while emphasizing sustainability in decision-making processes. The courses culminate in comprehensive engineering reports and professional presentations, with required participation in the El Sewedy University Engineering Project Showcase and Irrigation Technology Capstone Showcase, preparing students to deliver sound engineering solutions that meet or exceed client expectations through effective technical communication and methodical design processes. This is a Writing Intensive (W) course.

Learning Outcomes

LO1: Evaluate pivot irrigation design problems based on engineering principles including hydraulics, soil-water relationships, and crop water requirements, engineering economic analysis principles for irrigation investments, ethical engineering practices in water resource management, and codes, standards, laws and safety constraints specific to irrigation systems.
LO2: Identify, understand and perform an appropriate literature review for pivot irrigation engineering problems, including current technologies, water conservation methods, and precision agriculture applications.
LO3: Identify and formulate multiple potential ideas and solutions to address irrigation system challenges, including water efficiency, energy optimization, and automation technologies.
LO4: Develop detailed irrigation engineering design products including system layout drawings and hydraulic designs, control system software and automation protocols, prototype components and fabrication plans, economic assessments including water and energy costs, risk assessments for system reliability, and sustainability assessments for water resource management.
LO5: Develop and implement sound engineering testing and evaluation methodologies to evaluate pivot irrigation designs, including uniformity testing, pressure measurements, and efficiency calculations.
LO6: Use testing and evaluation data to improve designs through an iterative engineering design process, optimizing for water application uniformity, energy efficiency, and crop yield potential.
LO7: Effectively document the engineering process including design notebooks, interim reports, verbal updates, meeting minutes, and technical specifications for irrigation components.

LO8: Function effectively on a team, working collaboratively and inclusively to establish goals, plan tasks, and meet objectives in multidisciplinary irrigation projects.
LO9: Effectively communicate irrigation design ideas and solutions through technical reports and professional presentations to diverse stakeholders including farmers, water managers, and regulatory agencies.
LO10: Integrate sustainability principles in irrigation design, balancing water conservation, energy efficiency, economic viability, and environmental protection in agricultural water management.

Lectures

Week 1: Capstone Overview and Project Launch
Capstone structure and expectations, team formation, client introductions, project scoping, review of IRT403 outcomes.
Week 2: Engineering Design Process
Design thinking, problem definition, constraint identification, system boundaries, client requirements.
Week 3: Pivot Irrigation Design Review
Hydraulic principles, system layout fundamentals, component selection, water and energy efficiency considerations.
Week 4: Literature Review Methods
Research databases, scholarly vs. industry sources, summarizing and citing, relevance to pivot irrigation technologies.
Week 5: Concept Development and Innovation
Idea generation, technology scouting, sketching system concepts, evaluating alternatives, feasibility assessment.
Week 6: Technical Communication and Interim Reporting
Design notebooks, report structure, professional writing practices, tracking changes, preparing for midterm review.
Week 7: Midterm Design Review
Team presentations, feedback from faculty and clients, evaluation of design progress, refinement guidance.
Week 8: Pivot Control Systems and Automation
Controllers, sensor integration, communication protocols, programming logic, remote operation features.
Week 9: Prototyping and Fabrication Planning
Material selection, component sourcing, 3D modeling, safety considerations, prototype build planning.
Week 10: Testing Protocols and Field Evaluation
Uniformity tests, pressure and flow measurements, automation performance, calibration and troubleshooting.
Week 11: Iteration and Design Optimization
Analyzing test results, refining designs, energy and water optimization strategies, system resilience.
Week 12: Economic and Sustainability Analysis
Cost modeling, ROI analysis, environmental trade-offs, life-cycle assessments, social and regulatory impacts.
Week 13: Engineering Documentation
Final report structure, technical specs, drawing standards, bill of materials, risk and mitigation sections.
Week 14: Presentation Skills and Stakeholder Communication
Visual communication, tailoring messages to different audiences, Q&A preparation, professionalism in delivery.
Week 15: Final Project Review and Showcase Preparation
Presentation dry runs, peer feedback, final edits to reports, setup for Capstone Showcase.
Week 16: FINAL PRESENTATIONS
Participation in El Sewedy University Engineering Project Showcase and Irrigation Technology Capstone Showcase.

WET407: Smart Irrigation Technologies

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3		90	120	60	15	25

Course Description

This upper-level technical course provides comprehensive coverage of advanced technologies transforming modern irrigation systems through automation, data analytics, and intelligent control. It bridges the gap between traditional irrigation practices and cutting-edge digital solutions, with students exploring the integration of the Internet of Things (IoT) sensors, wireless networks, cloud computing, and artificial intelligence in irrigation management. The course emphasizes practical applications to optimize water use efficiency, reduce operational costs, and enhance crop productivity through real-time monitoring and automated decision-making systems. Through hands-on laboratory work and field demonstrations, students learn to design, install, and manage smart irrigation systems, including soil moisture sensors, weather stations, remote controllers, and variable rate irrigation technologies. Key aspects addressed include system architecture, data collection and analysis, automation protocols,

References

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Msibi, S.T., 2021. Hydraulic performance characterisation of variable rate irrigation technology (PhD Thesis). University of Southern Queensland.
Nguyen, A.T., Thompson, A.L., Sudduth, K., Vories, E., 2015. Automating variable rate irrigation management prescription for center pivots from field data maps, in: 2015 ASABE/IA Irrigation Symposium: Emerging Technologies for Sustainable Irrigation-A Tribute to the Career of Terry

Howell, Sr. Conference Proceedings. American Society of Agricultural and Biological Engineers, pp. 1–14.
Obaideen, K., Yousef, B.A., AlMallahi, M.N., Tan, Y.C., Mahmoud, M., Jaber, H., Ramadan, M., 2022. An overview of smart irrigation systems using IoT. Energy Nexus 7, 100124.
Yari, A., 2017. Application of variable-rate irrigation technology to conserve water and improve crop productivity. McGill University (Canada).

Learning Outcomes

LO1: Design and configure smart irrigation systems incorporating IoT sensors, controllers, and communication networks for specific applications.
LO2: Select, install, and calibrate various sensor types including soil moisture, weather, and plant-based sensors for irrigation monitoring.
LO3: Collect, process, and analyze real-time irrigation data using cloud platforms and decision support systems.
LO4: Program and configure irrigation controllers for automated scheduling based on sensor feedback and environmental conditions.
LO5: Integrate smart irrigation systems with other precision agriculture technologies including GPS, GIS, and variable rate application.
LO6: Assess the performance, efficiency, and economic benefits of smart irrigation implementations.
LO7: Diagnose and resolve technical issues in smart irrigation hardware, software, and communication systems.
LO8: Apply industry best practices for cybersecurity, data management, and system maintenance in smart irrigation operations.

Lectures

Week 1: Introduction to Smart Irrigation, Evolution of irrigation technology, Smart vs. conventional systems, IoT fundamentals, Course objectives, Industry overview.
Week 2: Sensor Technologies, Soil moisture sensors, Capacitance vs. TDR, Weather stations, Plant sensors, Flow meters.
Week 3: Wireless Communication, Radio frequencies, LoRaWAN networks, Cellular connectivity, Mesh networks, Range and reliability.
Week 4: Data Collection Systems, Data loggers, Cloud platforms, APIs and protocols, Data formats, Storage solutions.
Week 5: Smart Controllers, Controller types, Programming logic, ET-based scheduling, Sensor integration, Remote access.
Week 6: Weather-Based Systems, ET calculations, Weather data sources, Microclimate factors, Forecast integration, Adjustment algorithms.
Week 7: Midterm Review Week.
Week 8: Variable Rate Irrigation, VRI principles, Prescription maps, Pivot modifications, Drip zone control, Economic analysis.
Week 9: Field Trip Week.
Week 10: Data Analytics, Statistical analysis, Machine learning basics, Predictive models, Decision trees, Optimization algorithms.
Week 11: System Integration, SCADA systems, Farm management software, API development, Database design, Interoperability.
Week 12: Remote Monitoring, Monitoring platforms, Alert systems, Diagnostic tools, Performance metrics, Reporting systems.
Week 13: Automation Strategies, Control algorithms, Feedback loops, Safety systems, Fail-safe design, Optimization methods.
Week 14: Maintenance & Troubleshooting, Preventive maintenance, Diagnostic procedures, Common failures, Repair techniques, System upgrades.
Week 15: Future Technologies, AI applications, Drone integration, Blockchain potential, 5G networks, Research trends.
Week 16: FINAL PRESENTATIONS

Laboratories

Week 1: Lab 1: Technology Overview, Smart controller demo, Sensor types display, Communication devices, Mobile app exploration, System architecture.
Week 2: Lab 2: Sensor Workshop, Sensor calibration, Installation techniques, Data logging setup, Accuracy testing, Maintenance procedures.
Week 3: Lab 3: Network Setup, Gateway configuration, Node deployment, Signal testing, Troubleshooting, Network mapping.
Week 4: Lab 4: Data Systems, Logger programming, Cloud account setup, Data upload testing, Dashboard creation, API connections.
Week 5: Lab 5: Controller Programming, Basic programming, Sensor input setup, Schedule creation, Remote management, Mobile app control.
Week 6: Lab 6: ET Controllers, Weather station setup, ET programming, Historical analysis, Adjustment factors, Validation methods.
Week 7: Midterm Exam, Theory concepts, Practical applications, System design, Troubleshooting.
Week 8: Lab 8: VRI Systems, Map creation, Controller setup, Field verification, Performance testing, Data analysis.
Week 9: Full-Day Field Trip, Commercial farm visit, Smart system demos, Vendor presentations, Case studies, Q&A sessions.
Week 10: Lab 10: Analytics Tools, Data preprocessing, Visualization tools, Model development, Report generation, Dashboard design.
Week 11: Lab 11: Integration Workshop, API testing, Data exchange, System linking, Error handling, Documentation.
Week 12: Lab 12: Remote Systems, Platform setup, Alert configuration, Mobile monitoring, Report scheduling, User management.
Week 13: Lab 13: Advanced Automation, Algorithm testing, Scenario programming, Safety protocols, Performance tuning, Documentation.
Week 14: Lab 14: Troubleshooting, Fault diagnosis, Repair procedures, Firmware updates, Calibration checks, Documentation.
Week 15: Lab 15: Innovation Lab, Emerging tech demos, Research presentations, Industry speakers, Career discussion, Future planning.
Week 16: Project Presentations, Student demonstrations, Peer evaluation, Industry feedback, Best practices, Course synthesis.

WETC201: Introduction to Soil

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Course Description

This interdisciplinary course explores soil as both a scientific subject and a cultural touchstone in literature and environmental writing. Students will examine fundamental soil science concepts while analyzing how soil has been represented in literature, poetry, and environmental texts throughout history. The course bridges scientific understanding with humanistic perspectives, emphasizing how soil functions as both physical matter and metaphor in our understanding of place, agriculture, and human relationships with the earth. It is a unique course that combines soil science with literary and cultural studies. Students engage with both scientific analysis of soil properties and critical examination of soil representation in literary works. The course includes laboratory soil testing, field trips for soil sampling, and analysis of diverse texts that feature soil as a subject or metaphor. This integrated approach helps students develop a holistic understanding of soil's significance in both natural systems and human culture.

References

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Eswaran, H., Ahrens, R., Rice, T.J., Stewart, B.A., 2002. Soil classification: a global desk reference. CRC press.
Landa, E.R., Feller, C. (Eds.), 2009. Soil and Culture. Springer Netherlands, Dordrecht. https://doi.org/10.1007/978-90-481-2960-7
Nikiforova, A.A., 2019. Soil classification. KO KNOWLEDGE ORGANIZATION 46, 467–488.
Osman, K.T., 2013. Physical Properties of Soil, in: Soils. Springer Netherlands, Dordrecht, pp. 49–65. https://doi.org/10.1007/978-94-007-5663-2_5

Learning Outcomes

LO1: Identify and describe the basic physical, chemical, and biological properties of soil using scientific methods and terminology.
LO2: Analyze the representation of soil and earth in selected literary works and environmental writing through critical reading and interpretation.
LO3: Explain the ecological significance of soil and its role in supporting biodiversity and ecosystem functions.
LO4: Interpret how cultural and historical perspectives on soil have shaped human interactions with land and agricultural practices.
LO5: Apply scientific concepts to understand references to soil in literature and vice versa, demonstrating interdisciplinary thinking.
LO6: Conduct basic soil analyses and relate findings to broader ecological and cultural frameworks.
LO7: Articulate the connections between soil health, food systems, and environmental sustainability.
LO8: Develop critical writing skills that integrate scientific and humanistic approaches to soil.

Lectures

Week 1: Introduction: Soil as Matter and Metaphor, Course overview and objectives, Soil in human consciousness, Scientific vs. cultural perspectives, The language of soil, Introduction to interdisciplinary thinking.
Week 2: Soil Formation and the Soil Profile, Pedogenesis processes, Soil horizons and profiles, Parent materials, Time as a soil-forming factor, Soil as palimpsest in literature.
Week 3: Physical Properties of Soil, Soil texture and structure, Porosity and density, Water holding capacity, Early agricultural literature (Virgil's Georgics), Soil as foundation metaphor.
Week 4: Soil Chemistry and Fertility, Essential nutrients, pH and cation exchange, Soil fertility concepts, Soil as symbol of wealth in literature, Pearl S. Buck's "The Good Earth".
Week 5: Soil Biology and Ecology, Soil organisms and food webs, Decomposition processes, Mycorrhizal relationships, The "Living Soil" movement, Soil as living entity in literature.
Week 6: Soil Classification Systems, USDA soil taxonomy, World Reference Base, Indigenous soil knowledge systems, Traditional ecological knowledge, Naming and knowing soil.
Week 7: Soil and Food Systems, Soil-food connections, Agricultural sustainability, Food security issues, Agricultural literature analysis, Wendell Berry's agrarian essays.
Week 8: Midterm Review Week.
Week 9: Soil Conservation, Erosion processes and control, Conservation practices, Historical soil loss, Dust Bowl literature (Steinbeck), Lessons from history.
Week 10: Urban Soils, Urban soil characteristics, Contamination issues, Green infrastructure, Gardens in literature, Urban nature writing.
Week 11: Soil Pollution and Remediation, Types of soil pollutants, Remediation techniques, Environmental justice, Toxic narratives in literature, Silent Spring connections.
Week 12: Global Soil Challenges, Climate change impacts, Carbon sequestration, Desertification, Climate fiction analysis, Future scenarios.
Week 13: Field Methods Intensive, Advanced sampling techniques, GPS and mapping, Data management, Field safety, Research design.
Week 14: Soil Ethics and Land Stewardship, Environmental ethics, Land ethic concepts, Indigenous stewardship, Aldo Leopold's philosophy, Braiding Sweetgrass themes.
Week 15: Future of Soils, Emerging technologies, Precision agriculture, Soil in space, Speculative fiction, Imagining soil futures.
Week 16: FINAL PRESENTATIONS.

Laboratories

Week 1: Lab 1: Introduction to Soil Science, Laboratory safety protocols, Basic soil sampling techniques, Introduction to lab equipment, Soil observation exercises, Field notebook setup.
Week 2: Lab 2: Soil Profile Examination, Soil pit observation, Horizon identification, Profile description techniques, Soil color determination, Profile sketching.
Week 3: Lab 3: Soil Physical Analysis, Texture by feel method, Particle size analysis, Aggregate stability tests, Infiltration measurements, Data recording.
Week 4: Lab 4: Chemical Testing, pH measurement, Nutrient testing kits, Electrical conductivity, Organic matter estimation, Results

interpretation.
Week 5: Lab 5: Soil Biology, Microscopic observation, Soil respiration tests, Earthworm counts, Root observation, Biological activity indicators.
Week 6: Lab 6: Soil Classification, Using soil keys, Diagnostic features, Local soil mapping, Indigenous classifications, Comparative systems.
Week 7: Lab 7: Agricultural Soils, Crop suitability assessment, Fertility recommendations, Sustainable practice evaluation, Local farm visit preparation, Interview techniques.
Week 8: Field Trip: Local Farm Visit, On-farm soil assessment, Farmer interviews, Management practice observation, Soil-crop relationships, Data collection.
Week 9: Lab 9: Erosion Studies, Erosion simulation, Conservation structure models, Cover crop demonstrations, Historical photo analysis, Prevention strategies.
Week 10: Lab 10: Urban Soil Sampling, Campus soil survey, Compaction testing, Heavy metal screening, Garden soil assessment, Remediation options.
Week 11: Lab 11: Contamination Analysis, Pollution indicators, Bioassay techniques, Phytoremediation demos, Risk assessment basics, Case study analysis.
Week 12: Lab 12: Carbon and Climate, Soil carbon measurement, Climate impact modeling, Adaptation strategies, Scenario planning, Data visualization.
Week 13: Lab 13: Field Sampling Trip, Multi-site sampling, Transect methods, Field data recording, Sample preservation, Team coordination.
Week 14: Lab 14: Restoration Planning, Site assessment, Restoration design, Native plant selection, Monitoring protocols, Community engagement.
Week 15: Lab 15: Innovation Showcase, New technology demos, Student project work, Peer feedback sessions, Presentation preparation, Course synthesis.
Week 16: Student Presentations, Project presentations, Peer evaluation, Group discussion, Course reflection, Celebration.

WETC301IFC: Drainage Engineering

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120	120		240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC201

Course Description

This course covers the principles of subsurface drainage for controlling the water table and managing salinity. Students learn about soil water properties relevant to drainage design and how to manually calculate flow to relief and interceptor drains. A key component of the course is learning how to use software such as DRAINMOD, which is widely used internationally for designing and evaluating drainage systems. The curriculum also addresses materials used in drainage systems, methods for installation, and considerations for their operation and management. Additionally, the potential environmental impacts of drainage are covered.

References

Gupta, S.K., 2019. Drainage Engineering: Principles and Practices. Scientific Publishers.
Ritzema, H., 2014. Main Drainage Systems.

Learning Outcomes

LO1: Describe the effects of inadequate drainage on crop growth and yields.
LO2: Use simplified physical-mathematical models for analyzing drainage performance and to design alternatives in routine situations.
LO3: Determine soil water properties for drainage design and select conduit material for subsurface drains.
LO4: Use DRAINMOD software to design subsurface drainage systems.
LO5: Use DRAINMOD software to evaluate the effectiveness of proposed drainage system Design

Lectures

Week 1: Introduction and Definition of Drainage Systems, Relationship to Crop production, Types of Drainage Systems, Water Table Control, Leaching and Salinity Control, Reclamation of salinized Soils.
Week 2: Environmental Considerations, Irrigation water Quality, Soil Water Quality, Drainage System Effluent Quality, Drainage and Wetlands.
Week 3: Soil Water Movement in Drained Land, Conductivity, Percolation, Hydraulic Gradients, Capillary Rise, Soil Water Properties Affecting Movement.
Week 4: Measurement of Important Soil Water Parameters, Horizontal Conductivity, Soil Water Characteristics, In-field and laboratory Measurement.
Week 5: Infiltration Rate, Concepts, Data Requirements, Equations.
Week 6: Design of Relief Drains, Definitions, Steady Flow Approach, The Hooghoudt Equation, Transient Flow.
Week 7: Relief Drain Design Example 1: Steady-state Example, Sources of Data, Problem Definition, Equations and Calculation Procedures,

Results.
Week 8: Exam 1.
Week 9: Relief Drain Design Example II: Transient Example, Sources of Data, Problem Definition, Results, Comparison to the Steady State Example.
Week 10: Flow to Interceptor Drains, Concept, Equations, Sample Problem.
Week 11: Determining Design Variables, Water Table Depth, Drain Depth, Depth to Barrier, Hydraulic Conductivity, Drainage Requirements, Drainage Porosity.
Week 12: Drain Tubing Materials and Considerations, Tubing and Pipe, Envelop, Outlet, Receiving Bodies of Water, Construction Methods and Equipment, Operation.
Week 13: Use of DRAINMOD Software for Drainage Design Part 1, Instruction on Use of the Model, Run a Sample Project, Discuss Results.
Week 14: Use of DRAINMOD Software for Drainage Design- Part 2, Overview of the Model Capabilities, Creating input files, Set Modeling Parameters – Length, Time Step, Output.
Week 15: Use DRAINMOD for Drainage Design – Part 3, Drainage Problem 1 – Use DRAINMOD to Design a Drainage System for Water Table Control.
Week 16: Use of DRAINMOD Software for Drainage Design – Part 4, Drainage Problem 2 – Use DRAINMOD to Design a Drainage System for Salinity Management.
Week 17: Final.

WETC301PIT: Advanced Irrigation System Design

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC201

Course Description

This course builds upon IRT310, providing more experience in completing irrigation designs of greater complexity. Students learn how to use crop consumptive use information when designing irrigation systems with multi-cropping rotations and how to utilize irrigation blocks when the water supply is insufficient. The course focuses on complex design problems for sprinkler, drip, and surface irrigation systems. It also covers the design and selection of big gun systems and the design of drip and micro-spray irrigation systems for orchards and vineyards.

References

Dean E. Eisenhauer, Derrel L. Martin, Derek M. Heeren, Glenn J. Hoffman, 2021. Irrigation Systems Management, in: Irrigation Systems Management. Presented at the Irrigation Systems Management, American Society of Agricultural and Biological Engineers.
Gu, Z., Qi, Z., Burghate, R., Yuan, S., Jiao, X., Xu, J., 2020. Irrigation Scheduling Approaches and Applications: A Review. J. Irrig. Drain Eng. 146, 04020007. https://doi.org/10.1061/(ASCE)IR.1943-4774.0001464
Liang Z., Liu X., Xiao J., Liu C., 2021. Review of conceptual and systematic progress of precision irrigation. ijabe 14, 20–31. https://doi.org/10.25165/j.ijabe.20211404.5463
Pereira, L.S., 1996. Surface Irrigation Systems, in: Pereira, L. S., Feddes, R.A., Gilley, J.R., Lesaffre, B. (Eds.), Sustainability of Irrigated Agriculture. Springer Netherlands, Dordrecht, pp. 269–289. https://doi.org/10.1007/978-94-015-8700-6_16

Learning Outcomes

LO1: Based on crop water system, determine the total amount of water needed when planning an irrigation system with multi-cropping.
LO2: Determine the capacity of mainline water supply pipelines serving multiple fields.
LO3: Determine the size of irrigation machine needed based on site conditions and crops to design Big Gun Irrigation Systems.
LO4: Based upon water demand, select nozzles and size piping systems for solid set and potable solid set sprinkler systems.
LO5: Select drip tubing products, determine the layout and total length of product needed, select appropriate filtration equipment, and determine the size of the water supply manifold.
LO6: Design Micro-spray irrigations systems for Orchards.
LO7: Design drip irrigation systems for Vinyards.
LO8: Design level basin and furrow irrigation systems based upon site conditions.
LO9: Determine weekly irrigation water requirements and irrigation schedules for multiple fields on the same water delivery pipeline.
LO10: Divide irrigation systems into blocks and develop schedules for muti-cropping farming.

Lectures

Week 1: Review of Irrigation Scheduling and Efficiency Concepts, Terminology, Crop consumptive use and ET, Soil-Water Relationships, Infiltration, Scheduling Principles, Irrigation Efficiency Concepts.
Week 2: Planning Irrigation Systems with Multiple Crop, On-farm irrigation capacity requirements, Multiple cropping in irrigation schemes.

Week 3: Design of Surface Irrigation Systems, Furrow irrigation Design, Empirical Methods, Hydraulic Analysis, Level Basin Irrigation Design, Hydraulic Relationships, Empirical Methods.
Week 4: Managing Runoff in Surface Irrigation, Options for Managing Runoff, Description of Runoff Recovery Systems, Design of Runoff Recovery Systems.
Week 5: Management of Surface Irrigation Systems, Cut-back Irrigation, Surge Values and Surge Flow Irrigation water management, Gated Pipe and Poly Pipe.
Week 6: Design of Sprinkler Irrigation Systems, Design Objectives, Wind drift, Evaporation, Application Rates, System Capacity, Use of Irrigation Blocks.
Week 7: Design Problem 1, Design of a complete sprinkler irrigation system to include all components with multiple fields, irrigation blocks and varying ET demand, Size main supply pipeline, Determining pumping head requirements, Develop an irrigation schedule for this system.
Week 8: Midterm Exam.
Week 9: Design Problem 2, Design of a complete sprinkler irrigation system to include all components with multiple fields, irrigation blocks and varying ET demand, Size main supply pipeline, Determining pumping head requirements, Develop an irrigation schedule for this system.
Week 10: Big Guns, Types, Performance characteristics, Application Rates and Soils, Energy and Pressure Requirements, Big Guy Selection based on Site Conditions.
Week 11: Design of Drip Irrigation Systems, Determining Water Application Rates with crop rotations, Layout of Drip Irrigation Systems for multiple cropping operations.
Week 12: Design Problem 3, Design of a complete drip irrigation system to include all components with multiple fields, irrigation blocks and varying ET demand, Size main supply pipeline, Determining pumping head requirements, Develop an irrigation schedule for this system.
Week 13: Orchard and Vineyards, Options for micro-sprays for orchards, Options for drip emitters and products for vineyards, Benefits and disadvantages of various products, Typical layouts, Design Procedures.
Week 14: Design Problem 4, Design of a complete micro-spray irrigation system for an orchard to include all components with multiple irrigation blocks, Size main supply pipeline, Determining pumping head requirements, Develop an irrigation schedule for this system.
Week 15: Design Problem 5, Design of a complete drip irrigation system for a vineyard to include all components with multiple irrigation blocks, Size main supply pipeline, Determining pumping head requirements, Develop an irrigation schedule for this system.
Week 16: Irrigation System Management, Irrigation Scheduling based on ET and Soil Moisture Management, Meeting Peak Consumptive Use Requirements, Tracking Water Use in Irrigation Systems, Use of Flow Meters and Pressure Gauges for Troubleshooting.
Week 17: Final Exam.

WETC301WMT: Irrigation Hydraulics and Conveyance Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC201

Course Description

This course focuses on the design of water delivery systems for irrigation, consisting of pipelines and open channels. For pipe flow, the course covers hydraulic principles determining friction loss in pipelines of different materials. Topics include static and dynamic characteristics of liquids, uniform and non-uniform flow in open and closed channels, flow measurement, and the design of manifolds used in sprinkler and drip irrigation. For open channels, the course covers design principles, including considerations for both erodible and non-erodible channels. Students learn the principles of operation for water flow control and measurement structures, and are introduced to the design of branching channel systems. The course also introduces available software packages for designing both pipelines and open channels.

References

Chaudhry, M.H. (Ed.), 2008. Channel Design, in: Open-Channel Flow. Springer US, Boston, MA, pp. 279–299. https://doi.org/10.1007/978-0-387-68648-6_9
Lewin, J., 2001. Hydraulic Gates and Valves: In Free Surface Flow and Submerged Outlets. Thomas Telford.
Tollner, E.W., 2021. Open Channel Design: Fundamentals and Applications. John Wiley & Sons.
Tullis, J.P., 1989. Hydraulics of Pipelines: Pumps, Valves, Cavitation, Transients. John Wiley & Sons.

Learning Outcomes

LO1: Design a water supply pipeline with minimum friction losses and maximum flow.
LO2: Determine pressure loses in pipelines.
LO3: Determine pumping head requirements for an irrigation system and water supply pipeline.
LO4: Design a canal for delivering water to an irrigation system.
LO5: Design water control structures for open channels.
LO6: Select computer software to aid in the design of pipelines and channels.

Lectures

Week 1: Introduction to Hydraulic Principles and Concepts, Definitions, Units, Basic Relationships, Flow and Pressure, Maximum Flow.
Week 2: Friction Loss in Pipes, Characteristics of Pipe Sizes and Materials, Empirical Equations, Hazen Williams, Manning Roughness, Use of Friction Loss Tables, Maximum Working Pressure of Pipes, Friction Loss in Fittings, Pipe Sizing.
Week 3: Manifolds, Analysis of Manifold Flow, Manifold Design and Pipe Sizing.
Week 4: Friction Loss in Irrigation Systems, Friction Loss in Components, Sectional Analysis, Maximum Allowable Pressure Variation, Worst Case Analysis.
Week 5: Pumping Head Determination, Definitions, Determining Total Pressure Loss in System, Calculation of Total Dynamic Head.
Week 6: Minimizing Friction Loss, Telescoping of pipelines, Telescoping of Center Pivot Mainlines.
Week 7: Flow In Pipeline Networks, Considerations in the Design of Networks, Pipeline Components, Introduction to Computer Software for Pipeline Design.
Week 8: Exam 1.
Week 9: Flow In Pipeline Networks, Introduction to Computer Software for Pipeline Design (continued).
Week 10: Open Channels, Definitions, Types and Purposes, Hydraulic Principles, Stages and Equations of Flow.
Week 11: Channel Design 1, Dimensions, slide slopes, freeboard, Common Dimension Charts for Channels, Soil Considerations.
Week 12: Channel Design 2, Channel Roughness, Channel Velocity, Non-erodible Channels, Erodible Channels.
Week 13: Channel Design 3, Uniform Flow Equations, Gradually Varied Flow, Design Problems, Lining.
Week 14: Channel Flow Control, Types, Gates, Weirs, Flumes, Drop Structures, Selection, Design Procedures.
Week 15: Designing Branching Canal Networks, Concepts, Control Systems, Water Losses.
Week 16: Channel Design, Introduction to Open Channel Design Software.
Week 17: Final Exam.

WETC302IFC: Field Crop Irrigation System Design Fundamentals

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC301IFC

Course Description

This foundational design course introduces the comprehensive design process for agricultural irrigation systems including field crop irrigation, center pivot systems, and integrated water management approaches, developing essential skills in design methodology, economic analysis, and project management. Through lectures, workshops, and hands-on exercises, students master fundamental principles of site assessment, water source evaluation, system selection, and hydraulic calculations while emphasizing systematic thinking and sustainable solutions for Egyptian agriculture. The curriculum culminates in a comprehensive real-world design project integrating technical, economic, environmental, and social factors, providing practical experience in the iterative design process essential for professional irrigation engineering practice.

References

Ali, H., 2010. Fundamentals of Irrigation and On-farm Water Management: Volume 1. Springer Science & Business Media.
Hargreaves, G.H., Merkley, G.P., 1998. Irrigation Fundamentals: An Applied Technology Text for Teaching Irrigation at the Intermediate Level. Water Resources Publication.
Preface and Contents, n.d.
Singh, V.P., Su, Q., 2022. Irrigation Engineering: Principles, Processes, Procedures, Design, and Management. Cambridge University Press.
Waller, P., Yitayew, M., 2015. Irrigation and Drainage Engineering. Springer.

Learning Outcomes

LO1: Implement systematic design processes including problem definition, data collection, analysis, synthesis, and evaluation for irrigation system development.
LO2: Research, evaluate, and synthesize technical literature on irrigation practices, technologies, and design standards relevant to their specialization track.
LO3: Assess soil-water-plant relationships, topography, water sources, and environmental factors to inform irrigation system design decisions.
LO4: Calculate capital costs, operating expenses, benefit-cost ratios, and payback periods for irrigation projects using engineering economics principles.
LO5: Establish appropriate design parameters including capacity, efficiency targets, reliability standards, and performance indicators for irrigation systems.
LO6: Produce conceptual layouts, system schematics, and basic hydraulic calculations for irrigation systems appropriate to specific site conditions.
LO7: Utilize project management tools including work breakdown structures, Gantt charts, and resource planning for irrigation project implementation.

LO8: Prepare professional design reports, technical drawings, and oral presentations to effectively communicate design solutions to diverse stakeholders.
LO9: Incorporate water conservation, energy efficiency, and environmental protection principles into irrigation system design decisions.
LO10: Work in multidisciplinary teams to develop integrated design solutions that address technical, economic, and social requirements.

Lectures

Week 1: Introduction to Design Process, Course overview and track options, Design thinking principles, Systems approach to irrigation, Egyptian design standards, Professional ethics in design.
Week 2: Literature Review Methodology, Research strategies, Database navigation, Citation management, Technical writing standards, Review paper structure.
Week 3: Site Assessment & Data Collection, Site investigation procedures, Soil-water-plant relationships, Climate data analysis, Water source evaluation, Constraint identification.
Week 4: Design Criteria Development, Performance specifications, Regulatory requirements, Stakeholder needs assessment, Sustainability indicators, Risk assessment.
Week 5: System Selection & Alternatives, Technology assessment, Selection matrices, Comparative analysis, Innovation opportunities, Appropriate technology.
Week 6: Hydraulic Design Fundamentals, Flow principles, Pressure requirements, System capacity, Hydraulic calculations, Software applications.
Week 7: Economic Analysis Basics, Cost estimation methods, Life cycle costing, Benefit identification, Financial indicators, Sensitivity analysis.
Week 8: Midterm Week, Design Review, Progress presentations, Peer feedback, Instructor consultation, Design refinement.
Week 9: Project Management Fundamentals, Project lifecycle, Planning techniques, Resource allocation, Risk management, Quality control.
Week 10: Environmental Considerations, Environmental impact assessment, Water conservation strategies, Energy efficiency, Ecosystem services, Climate adaptation.
Week 11: Layout & System Configuration, Design principles, Optimization techniques, Flexibility considerations, Expansion planning, Integration aspects.
Week 12: Control & Automation Basics, Control system principles, Automation levels, Sensor integration, SCADA basics, Smart irrigation.
Week 13: Design Documentation, Technical drawing standards, Report writing, Specification development, Design justification, Professional presentation.
Week 14: Design Integration, System integration, Interface management, Commissioning planning, Operation considerations, Maintenance planning.
Week 15: Design Presentations.
Week 16: Course Synthesis, Design process review, Lessons learned, Industry perspectives, Career pathways, Transition to Design.

Laboratories

Week 1: Studio 1: Design Orientation, Team formation, Track selection confirmation, Design software introduction, Portfolio setup, Case study introduction.
Week 2: Studio 2: Literature Workshop, Database search practice, Reference management tools, Annotated bibliography, Track-specific sources, Peer review process.
Week 3: Studio 3: Site Analysis, Map interpretation, Data collection planning, Site visit simulation, Constraint mapping, SWOT analysis.
Week 4: Studio 4: Criteria Workshop, Stakeholder analysis, Requirements matrix, Performance metrics, Track-specific criteria, Design brief development.
Week 5: Studio 5: Alternative Generation, Brainstorming techniques, Concept sketching, Feasibility screening, Decision matrices, Concept development.
Week 6: Studio 6: Hydraulic Workshop, Calculation exercises, Software tutorials, Network analysis, Track-specific applications, Design verification.
Week 7: Studio 7: Economic Modeling, Cost database use, Spreadsheet development, NPV/IRR calculations, Track-specific economics, Uncertainty analysis.
Week 8: Design Review, Progress presentations, Peer feedback, Instructor consultation, Design refinement.
Week 9: Studio 9: PM Workshop, WBS development, Gantt chart creation, Resource planning, Risk registers, MS Project basics.
Week 10: Studio 10: Sustainability, Impact assessment, Mitigation strategies, Green design elements, Carbon footprint, Adaptation planning.
Week 11: Studio 11: Layout Development, CAD drawing basics, Layout optimization, Track-specific layouts, 3D visualization, Design iterations.
Week 12: Studio 12: Control Systems, Control logic development, Sensor selection, Interface design, Track applications, Cost-benefit analysis.
Week 13: Studio 13: Documentation, Drawing preparation, Report structuring, Specification writing, Presentation design, Portfolio development.
Week 14: Studio 14: Integration Workshop, System integration, Interface definition, Testing protocols, O&M planning, Training requirements.
Week 15: Studio 15: Final Presentations, Student presentations, Industry panel feedback, Peer evaluation, Design defense, Reflection session.
Week 16: Portfolio Review, Portfolio completion, Individual feedback, Improvement planning, Design 2 preview.

WETC302PIT: Center Pivot Irrigation System Design

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC301PIT

Course Description

This capstone course integrates engineering design principles, project management, and professional development to prepare students for engineering practice. Students work in teams on real-world projects sponsored by external clients, applying engineering design methodology from concept development through final design recommendations. The course emphasizes professional skills including technical communication, project planning, and client interaction. Key components include engineering economics and decision-making, preparation for professional licensure (FE/PE exams), ethics and legal considerations, and understanding global engineering challenges. Students develop professional portfolios, including resumes and LinkedIn profiles, while gaining experience in business writing, presentations, and documentation. Teams conduct literature reviews, patent searches, and competitive analyses to inform their design solutions. Through regular meetings with faculty advisors and client interactions, students experience the iterative nature of engineering design, develop alternative solutions, and create comprehensive design reports and presentations. The course culminates in a final team project presentation and concept report delivered to the client sponsor.

References

CENTER PIVOT IRRIGATION SYSTEM MODIFICATION TO PROVIDE VARIABLE WATER APPLICATION DEPTHS, n.d.
Evans, R.G., 2001. CENTER PIVOT IRRIGATION.
Splinter, W.E., 1976. Center-Pivot Irrigation. Scientific American 234, 90–99.
Valín, M.I., Cameira, M.R., Teodoro, P.R., Pereira, L.S., 2012. DEPIVOT: A model for center-pivot design and evaluation. Computers and Electronics in Agriculture 87, 159–170. https://doi.org/10.1016/j.compag.2012.06.004

Learning Outcomes

LO1: Execute a complete engineering design cycle from problem definition through conceptual design, including generating and evaluating design alternatives using systematic engineering methodology.
LO2: Develop and implement project plans using tools such as Gantt charts, manage project timelines, and coordinate team activities to meet deliverables and milestones.
LO3: Apply engineering economics principles including cost estimation, depreciation, profitability analysis, present worth, and cash flow analysis to evaluate engineering alternatives and make data-driven decisions.
LO4: Create professional engineering documents including technical memos, design reports, and presentations, and effectively interact with clients through Q&A sessions, conference calls, and formal presentations.
LO5: Perform comprehensive literature reviews, patent searches, and competitive analyses to inform design decisions and ensure innovation while respecting intellectual property.
LO6: Collaborate in multidisciplinary teams, coordinate with faculty advisors, and engage with external clients to deliver engineering solutions that meet stakeholder requirements.
LO7: Develop professional credentials including polished resumes and LinkedIn profiles, and understand engineering licensure requirements, ethics, legal liability, and the importance of continuing education.
LO8: Evaluate engineering solutions in the context of global challenges related to water, energy, food, and health security, demonstrating awareness of engineering's societal impact.

WETC302WMT: Water Resource Management System Design

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC301WMT

Course Description

This foundational design course introduces the comprehensive design process for integrated water management systems, including water distribution networks, treatment facilities, monitoring systems, and policy frameworks. It aims to develop essential skills in water resource optimization, conservation technology, and sustainable management practices. Through a combination of lectures, workshops, and hands-on exercises, students master fundamental principles of water balance assessment, distribution system design, quality management, and regulatory compliance, with an emphasis on efficient scheduling integration and resource conservation for Egyptian water systems. The course culminates in a comprehensive, real-world water management project that integrates technical infrastructure, monitoring technologies, economic optimization, and policy requirements, providing practical experience in designing modern systems for sustainable agricultural and municipal water use.

Learning Outcomes

LO1: Implement systematic design processes for water management systems including resource assessment, distribution network planning, and monitoring system integration.
LO2: Research, evaluate, and synthesize technical literature on water management technologies, conservation practices, and international water policy frameworks.
LO3: Assess water resources, distribution infrastructure, quality parameters, and demand patterns to optimize water management system design.
LO4: Calculate water system costs, conservation benefits, infrastructure investments, and water pricing strategies using resource economics principles.
LO5: Establish design parameters including water quality standards, distribution efficiency targets, monitoring requirements, and sustainability indicators.
LO6: Produce water distribution layouts, treatment schematics, SCADA architectures, and water accounting frameworks for integrated systems.
LO7: Utilize project management tools for water infrastructure implementation, stakeholder coordination, and regulatory compliance scheduling.
LO8: Prepare professional water management reports, policy briefs, and presentations for government agencies, water user associations, and communities.
LO9: Incorporate water conservation, energy efficiency, ecosystem protection, and climate resilience into water management designs.
LO10: Work with hydrologists, policy makers, farmers, and communities to develop integrated water management solutions.

Lectures

Week 1: Introduction to Design Process, Course overview and track options, Design thinking principles, Systems approach to irrigation, Egyptian design standards, Professional ethics in design.
Week 2: Literature Review Methodology, Research strategies, Database navigation, Citation management, Technical writing standards, Review paper structure.
Week 3: Site Assessment & Data Collection, Site investigation procedures, Soil-water-plant relationships, Climate data analysis, Water source evaluation, Constraint identification.
Week 4: Design Criteria Development, Performance specifications, Regulatory requirements, Stakeholder needs assessment, Sustainability indicators, Risk assessment.
Week 5: System Selection & Alternatives, Technology assessment, Selection matrices, Comparative analysis, Innovation opportunities, Appropriate technology.
Week 6: Hydraulic Design Fundamentals, Flow principles, Pressure requirements, System capacity, Hydraulic calculations, Software applications.
Week 7: Economic Analysis Basics, Cost estimation methods, Life cycle costing, Benefit identification, Financial indicators, Sensitivity analysis.
Week 8: Midterm Week.
Week 9: Project Management Fundamentals, Project lifecycle, Planning techniques, Resource allocation, Risk management, Quality control.
Week 10: Environmental Considerations, Environmental impact assessment, Water conservation strategies, Energy efficiency, Ecosystem services, Climate adaptation.
Week 11: Layout & System Configuration, Design principles, Optimization techniques, Flexibility considerations, Expansion planning, Integration aspects.
Week 12: Control & Automation Basics, Control system principles, Automation levels, Sensor integration, SCADA basics, Smart irrigation.
Week 13: Design Documentation, Technical drawing standards, Report writing, Specification development, Design justification, Professional presentation.
Week 14: Design Integration, System integration, Interface management, Commissioning planning, Operation considerations, Maintenance planning.
Week 15: Design Presentations.
Week 16: Course Synthesis, Design process review, Lessons learned, Industry perspectives, Career pathways, Transition to Design 2.

Laboratories

Week 1: Studio 1: Design Orientation, Team formation, Water management track confirmation, Design software introduction, Portfolio setup, Case study introduction.
Week 2: Studio 2: Literature Workshop, Database search practice, Reference management tools, Annotated bibliography, Water management sources, Peer review process.
Week 3: Studio 3: Site Analysis, Map interpretation, Data collection planning, Site visit simulation, Constraint mapping, SWOT analysis.
Week 4: Studio 4: Criteria Workshop, Stakeholder analysis, Requirements matrix, Performance metrics, Water management criteria, Design brief development.
Week 5: Studio 5: Alternative Generation, Brainstorming techniques, Concept sketching, Feasibility screening, Decision matrices, Concept development.
Week 6: Studio 6: Hydraulic Workshop, Calculation exercises, Software tutorials, Network analysis, Water distribution applications, Design verification.
Week 7: Studio 7: Economic Modeling, Cost database use, Spreadsheet development, NPV/IRR calculations, Water economics, Uncertainty analysis.
Week 8: Design Review, Progress presentations, Peer feedback, Instructor consultation, Design refinement.
Week 9: Studio 9: PM Workshop, WBS development, Gantt chart creation, Resource planning, Risk registers, MS Project basics.
Week 10: Studio 10: Sustainability, Impact assessment, Mitigation strategies, Green design elements, Carbon footprint, Adaptation planning.
Week 11: Studio 11: Layout Development, CAD drawing basics, Layout optimization, Water network layouts, 3D visualization, Design iterations.
Week 12: Studio 12: Control Systems, Control logic development, Sensor selection, Interface design, Water management applications, Cost-benefit analysis.
Week 13: Studio 13: Documentation, Drawing preparation, Report structuring, Specification writing, Presentation design, Portfolio development.
Week 14: Studio 14: Integration Workshop, System integration, Interface definition, Testing protocols, O&M planning, Training requirements.
Week 15: Studio 15: Final Presentations, Student presentations, Industry panel feedback, Peer evaluation, Design defense, Reflection session.
Week 16: Portfolio Review, Portfolio completion, Individual feedback, Improvement planning, Design 2 preview.

WETC401IFC: Advanced Field Crop Irrigation Design

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC302IFC

Course Description

This advanced design course builds upon Design 1 fundamentals to develop expertise in creating comprehensive irrigation system solutions through mastery of optimization algorithms, multi-criteria decision analysis, integrated modeling, and sustainable design practices for professional-grade packages meeting industry standards. Through workshops, design charrettes, client interactions, and collaborative projects accommodating track specializations in field crop irrigation, center pivot systems, and water resource management, students refine their ability to evaluate alternatives and create solutions balancing technical excellence with economic viability and environmental sustainability. The curriculum culminates in a comprehensive capstone project for actual clients requiring professional design packages with detailed drawings, specifications, economic analyses, and implementation plans, providing real-world experience that prepares graduates for immediate professional practice or advanced graduate studies in irrigation engineering.

References

Ali, A., Hussain, T., Zahid, A., 2025. Smart Irrigation Technologies and Prospects for Enhancing Water Use Efficiency for Sustainable Agriculture. 7, 106.
Varman, S., 2025. Advanced Irrigation and Drainage Techniques. Educohack Press.

Learning Outcomes

LO1: Apply advanced optimization techniques including linear programming, genetic algorithms, and multi-objective optimization to irrigation system design.
LO2: Conduct sophisticated comparative analyses of design alternatives using multi-criteria decision analysis, life-cycle assessment, and risk-based approaches.
LO3: Utilize advanced simulation software to predict irrigation system performance under various operational scenarios and environmental conditions.
LO4: Incorporate IoT sensors, automation, artificial intelligence, and precision agriculture technologies into comprehensive design solutions.
LO5: Create construction-ready design packages including detailed drawings, specifications, bills of quantities, and quality assurance protocols.
LO6: Conduct sophisticated financial analyses including real options valuation, Monte Carlo simulations, and investment portfolio optimization.
LO7: Design systems that optimize water-energy-food nexus interactions while enhancing ecosystem services and climate resilience.
LO8: Lead complex design projects from inception through delivery, managing teams, budgets, schedules, and stakeholder expectations.
LO9: Navigate complex regulatory frameworks, environmental permits, and certification requirements for irrigation projects.
LO10: Deliver compelling presentations and proposals to clients, regulatory agencies, and funding organizations.

Lectures

Week 1: Advanced Design Theory, Systems thinking in design, Design innovation principles, Biomimicry applications, Regenerative design, Industry 4.0 integration.
Week 2: Optimization Techniques, Linear/nonlinear programming, Genetic algorithms, Particle swarm optimization, Multi-objective optimization, Software applications.
Week 3: Advanced Hydraulic Modeling, Transient flow analysis, Network optimization, Surge protection, Energy optimization, CFD applications.
Week 4: Smart Irrigation Systems, IoT architecture, Sensor networks, Data analytics, Machine learning applications, Predictive maintenance.
Week 5: Multi-Criteria Decision Analysis, MCDA methodologies, AHP/ANP techniques, Fuzzy logic applications, Stakeholder weighting, Decision support systems.
Week 6: Integrated Water-Energy-Food Nexus, Nexus assessment tools, Trade-off analysis, Co-optimization strategies, Circular economy principles, Resource recovery.
Week 7: Climate Resilient Design, Climate scenario analysis, Adaptation strategies, Resilience metrics, Flexible design approaches, Nature-based solutions.
Week 8: Midterm Design Reviews.
Week 9: Advanced Economic Analysis, Real options theory, Monte Carlo simulation, Portfolio optimization, PPP structuring, Carbon markets.
Week 10: Regulatory & Certification, Environmental compliance, Permitting processes, Certification systems, Standards compliance, Quality management.
Week 11: Construction Planning, Constructability review, Phasing strategies, Safety planning, Quality control, Commissioning protocols.
Week 12: Innovation Workshop, Emerging technologies, Disruptive innovations, Technology transfer, Intellectual property, Commercialization.
Week 13: Project Delivery Methods, Design-build, EPC contracts, Alliance contracting, Performance contracts, Risk allocation.

Week 14: Professional Practice, Ethics case studies, Expert witness roles, Continuing education, Professional registration, Business development.
Week 15: Final Design Presentations.
Week 16: Industry Symposium, Design showcase, Industry networking, Career fair, Alumni panel, Future pathways.

Laboratories

Week 1: Studio 1: Design Challenge, Client brief analysis, Site reconnaissance, Stakeholder mapping, Design team formation, Project charter development.
Week 2: Studio 2: Optimization Lab, Problem formulation, Software tutorials, Constraint definition, Objective functions, Sensitivity analysis.
Week 3: Studio 3: Hydraulic Simulation, Advanced EPANET, Surge analysis, Energy audits, Pump selection optimization, System curves.
Week 4: Studio 4: Smart Systems Lab, Sensor integration, Dashboard design, Algorithm development, Cloud platforms, Cybersecurity basics.
Week 5: Studio 5: Decision Workshop, Criteria development, Weight elicitation, Software applications, Sensitivity testing, Consensus building.
Week 6: Studio 6: Nexus Modeling, System boundaries, Flow diagrams, Integration opportunities, Synergy identification, Impact quantification.
Week 7: Studio 7: Resilience Planning, Vulnerability assessment, Scenario development, Adaptation pathways, Robustness testing, Monitoring frameworks.
Week 8: Client Presentations, Preliminary designs, Client feedback, Peer reviews, Design refinement, Iteration planning.
Week 9: Studio 9: Financial Modeling, Stochastic modeling, Risk quantification, Financing structures, Investment analysis, Scenario comparison.
Week 10: Studio 10: Compliance Workshop, Permit applications, EIA preparation, Certification checklists, Audit preparation, Documentation systems.
Week 11: Studio 11: Construction Docs, Detail development, Specification writing, BOQ preparation, Schedule development, Risk mitigation.
Week 12: Studio 12: Innovation Lab, Technology scouting, Patent searches, Prototype development, Business models, Pitch preparation.
Week 13: Studio 13: Delivery Planning, Contract strategies, Risk workshops, Procurement planning, Partner selection, Performance metrics.
Week 14: Studio 14: Final Production, Document finalization, Quality reviews, Client preparation, Presentation rehearsal, Portfolio updates.
Week 15: Client & Industry Panel, Professional presentations, Q&A sessions, Panel feedback, Peer evaluations, Awards ceremony.
Week 16: Design Exhibition, Poster sessions, Design displays, Digital presentations, Networking reception, Feedback collection.

WETC401PIT: Advanced Pivot Irrigation System Design

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC302PIT

Course Description

This course is the second in a two-part capstone sequence in the Pivot Irrigation Technology track, designed to integrate the knowledge and experience undergraduate students have acquired throughout their degree programs. In the preceding course, IRTC401 Design 1, student teams evaluated a client's proposed irrigation project and developed an initial recommended engineering solution. In IRTC402, students will further develop their recommended solution, critically test the design, and then redesign it through a methodical and documented iterative process to propose a final, sound engineering solution. A key emphasis is placed on sustainability, which is defined as satisfying economic, environmental, and social requirements in addition to the client's technical constraints.
Communication is a critical component of the course. Teams are required to communicate with their client at scheduled intervals, both in writing and verbally, throughout the semester. Students are also expected to meet with their instructional project manager at least weekly for guidance. To ensure high-quality written reports, teams must meet with the course's technical writing assistant. The goal is for teams to produce engineering solutions that meet or exceed client expectations.
The course culminates in a comprehensive final engineering report and a professional presentation. Students must attend and participate in the El Sewedy University of Technology Engineering Project Showcase on April 25, 2025, and the Irrigation Technology Capstone Showcase on April 30, 2025. As a designated Writing Intensive (W) course, IRTC402 has additional requirements regarding passing grades on written assignments.

References

Bacchav, G., Pawar, M., Alone, V., Patil, M., Mulla, R., rane, priyanka, 2025. Innovations in Center-Pivot Irrigation Systems. International Water and Irrigation 44, 240–244.
Elshikha, D.E., Attalah, S., Waller, P., Levinson, R., Bloomfield, M., Koralewski, S., Teeter, M., Moller, P., Orr, E., Elsadek, E., 2025. Smart Irrigation Solutions for Today's Farms az2109, 1–6.

Learning Outcomes

LO1: Evaluate pivot irrigation design problems based on engineering principles including hydraulics, soil-water relationships, and crop water

requirements, engineering economic analysis principles for irrigation investments, ethical engineering practices in water resource management, and codes, standards, laws and safety constraints specific to irrigation systems.
LO2: Identify, understand and perform an appropriate literature review for pivot irrigation engineering problems, including current technologies, water conservation methods, and precision agriculture applications.
LO3: Identify and formulate multiple potential ideas and solutions to address irrigation system challenges, including water efficiency, energy optimization, and automation technologies.
LO4: Develop detailed irrigation engineering design products including system layout drawings and hydraulic designs, control system software and automation protocols, prototype components and fabrication plans, economic assessments including water and energy costs, risk assessments for system reliability, and sustainability assessments for water resource management.
LO5: Develop and implement sound engineering testing and evaluation methodologies to evaluate pivot irrigation designs, including uniformity testing, pressure measurements, and efficiency calculations.
LO6: Use testing and evaluation data to improve designs through an iterative engineering design process, optimizing for water application uniformity, energy efficiency, and crop yield potential.
LO7: Effectively document the engineering process including design notebooks, interim reports, verbal updates, meeting minutes, and technical specifications for irrigation components.
LO8: Function effectively on a team, working collaboratively and inclusively to establish goals, plan tasks, and meet objectives in multidisciplinary irrigation projects.
LO9: Effectively communicate irrigation design ideas and solutions through technical reports and professional presentations to diverse stakeholders including farmers, water managers, and regulatory agencies.
LO10: Integrate sustainability principles in irrigation design, balancing water conservation, energy efficiency, economic viability, and environmental protection in agricultural water management.

WETC401WMT: Integrated Water Management System Design

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC302WMT

Course Description

This advanced design course builds upon Design 1 fundamentals to develop expertise in creating comprehensive water management solutions through mastery of integrated resource optimization, SCADA system design, water policy implementation, and sustainable management practices for professional-grade packages meeting international standards. Through workshops, design charrettes, stakeholder interactions, and collaborative projects focused on water distribution networks, conservation technologies, and regulatory frameworks, students refine their ability to evaluate water management alternatives and create solutions balancing resource efficiency with policy compliance and community needs. The curriculum culminates in a comprehensive capstone project for actual water districts or municipalities requiring professional water management packages with detailed monitoring systems, water accounting frameworks, conservation strategies, and stakeholder engagement programs, providing real-world experience that prepares graduates for immediate professional practice in water resource consulting or advanced graduate studies.

References

Ali, A., Hussain, T., Zahid, A., 2025. Smart Irrigation Technologies and Prospects for Enhancing Water Use Efficiency for Sustainable Agriculture. 7, 106.
Erfani, M., Goharian, E., 2025. Optimizing integrated water supply management for multi-purpose reservoirs: a policy tree approach. Hydrological Sciences Journal 70, 483–494. https://doi.org/10.1080/02626667.2024.2437571
Kumar, R., Saxena, A., 2025. Smart Water Management and Resource Conservation, in: Sustainable Smart Cities and the Future of Urban Development. IGI Global Scientific Publishing, pp. 235–262. https://doi.org/10.4018/979-8-3693-6740-7.ch010
Maglia, N., Raimondi, A., 2025. A new approach on design and verification of integrated sustainable urban drainage systems for stormwater management in urban areas. Journal of Environmental Management 373, 123882. https://doi.org/10.1016/j.jenvman.2024.123882

Learning Outcomes

LO1: Apply advanced optimization techniques to water distribution networks, allocation algorithms, and multi-source water management systems.
LO2: Conduct sophisticated comparative analyses of water management strategies using integrated modeling, water footprint assessment, and policy impact analysis.
LO3: Utilize advanced hydraulic and water quality modeling software to predict system performance under various demand scenarios and climate conditions.
LO4: Incorporate SCADA systems, real-time monitoring networks, AI-based demand forecasting, and blockchain water trading into comprehensive solutions.
LO5: Create implementation-ready water management packages including network designs, monitoring protocols, water accounting systems, and policy frameworks.

LO6: Conduct sophisticated water pricing analyses, conservation incentive modeling, and public-private partnership evaluations.
LO7: Design systems that balance human water needs with ecosystem requirements while building climate resilience and resource security.
LO8: Lead complex water infrastructure projects coordinating with government agencies, water user associations, and community stakeholders.
LO9: Navigate water rights frameworks, environmental regulations, international water agreements, and quality standards.
LO10: Deliver compelling presentations to water boards, government officials, international donors, and community organizations.

Lectures

Week 1: Advanced Design Theory, Systems thinking in water management, Integrated resource management, Digital water concepts, Regenerative water systems, Industry 4.0 integration.
Week 2: Optimization Techniques, Network optimization algorithms, Water allocation optimization, Multi-objective resource planning, Demand management modeling, Software applications.
Week 3: Advanced Hydraulic Modeling, Transient analysis in networks, Water quality modeling, Leak detection systems, Pressure management, Energy recovery.
Week 4: Smart Irrigation Systems, SCADA architecture, Remote monitoring networks, Data integration platforms, Predictive analytics, Cybersecurity protocols.
Week 5: Multi-Criteria Decision Analysis, Water allocation criteria, Stakeholder priorities, Environmental flows, Social equity metrics, Decision support systems.
Week 6: Integrated Water-Energy-Food Nexus, Nexus assessment methodologies, Cross-sector optimization, Resource recovery systems, Circular economy applications, Ecosystem services valuation.
Week 7: Climate Resilient Design, Drought management strategies, Flood integration planning, Adaptive management, Alternative water sources, Nature-based solutions.
Week 8: Midterm Design Reviews.
Week 9: Advanced Economic Analysis, Water pricing mechanisms, Conservation incentives, PPP structuring, Grant funding strategies, Economic instruments.
Week 10: Regulatory & Certification, Water rights administration, Quality standards compliance, Environmental regulations, International agreements, ISO certification.
Week 11: Construction Planning, Network construction phasing, Community disruption minimization, Quality assurance protocols, Safety management, Commissioning procedures.
Week 12: Innovation Workshop, Digital twins, Blockchain water trading, AI demand prediction, Satellite monitoring, Future technologies.
Week 13: Project Delivery Methods, Public sector models, PPP structures, Community management, Performance contracts, Capacity building.
Week 14: Professional Practice, Water consulting practice, International development, Policy advisory roles, Research integration, Business development.
Week 15: Final Design Presentations.
Week 16: Industry Symposium.

Laboratories

Week 1: Studio 1: Design Challenge, Water district client analysis, System reconnaissance, Stakeholder mapping, Design team formation, Project charter development.
Week 2: Studio 2: Optimization Lab, Allocation algorithms, Distribution optimization, Loss minimization, Cost optimization, Sensitivity analysis.
Week 3: Studio 3: Hydraulic Simulation, Network modeling, Quality simulation, Energy audits, Pressure optimization, System calibration.
Week 4: Studio 4: Smart Systems Lab, SCADA design, Sensor deployment, Dashboard development, Alert systems, Mobile platforms.
Week 5: Studio 5: Decision Workshop, Criteria development, Stakeholder weighting, Trade-off analysis, Consensus building, Policy integration.
Week 6: Studio 6: Nexus Modeling, System mapping, Flow analysis, Integration opportunities, Synergy quantification, Impact assessment.
Week 7: Studio 7: Resilience Planning, Risk assessment, Scenario planning, Adaptation pathways, Emergency protocols, Monitoring systems.
Week 8: Client Presentations, Preliminary designs, Stakeholder feedback, Agency input, Design refinement, Iteration planning.
Week 9: Studio 9: Financial Modeling, Tariff design, Subsidy analysis, Investment planning, Risk assessment, Funding proposals.
Week 10: Studio 10: Compliance Workshop, Permit applications, Compliance protocols, Audit preparation, Documentation systems, Certification planning.
Week 11: Studio 11: Construction Docs, Phasing plans, Specification writing, BOQ preparation, Timeline development, QA/QC procedures.
Week 12: Studio 12: Innovation Lab, Technology evaluation, Pilot design, Implementation planning, Cost-benefit analysis, Patent review.
Week 13: Studio 13: Delivery Planning, Institutional design, Contract structures, Training programs, M&E frameworks, Sustainability planning.
Week 14: Studio 14: Final Production, Document finalization, Quality reviews, Policy brief completion, Presentation preparation, Portfolio updates.
Week 15: Client & Industry Panel, Professional presentations, Agency feedback, Q&A sessions, Panel evaluation, Awards ceremony.
Week 16: Design Exhibition, Poster sessions, Technology demonstrations, Digital presentations, Networking reception, Career opportunities.
Sources

WETC402IFC: Cropping Systems

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC401IFC

Course Description

This advanced course examines diverse irrigation methods and their integration with cropping systems in Egyptian agriculture, teaching the selection and implementation of appropriate irrigation technologies based on crop requirements, environmental conditions, and economic considerations. Students analyze systems beyond traditional methods, including pressurized (drip, micro-sprinkler, sprinkler), surface, and precision irrigation technologies suitable for Egypt's agricultural regions. The course integrates agronomic principles with irrigation engineering to optimize water productivity for major Egyptian crops like wheat, cotton, maize, rice, vegetables, and fruit trees, considering various soil, water, climate, and economic factors. Through hands-on labs, field evaluations, and design projects, participants develop skills in system selection, performance evaluation, and integrated crop-water management. Emphasis is placed on sustainable intensification to address challenges of water scarcity, salinity, energy costs, and climate variability, preparing students to modernize Egypt's irrigation systems using decision support tools and economic models.

References

Ashour, M., tony, M., Elgaafary, A., Sayed, T., 2023. Adaptation of Gated Pipe as a Hybrid Modernized Irrigation System for the Egyptian Old Clay Lands.
Hieu-Hien, P., Nghi, N., 2016. Saving irrigation water and energy with laser leveling equipment for environment protection and sustainable agriculture.
Ramadan, A., El-Shafie, A.F., Abdelbaset, M.M., Dewedar, O., 2024. The Latest Techniques for Sustainable Management of Irrigation Water under the Egyptian Environmental Arid Conditions: A Review. Egyptian Journal of Chemistry. https://doi.org/10.21608/ejchem.2023.151273.6550
Rubia, G.A.L., Safaat, M., 2024. Surge Irrigation: Advancements, Challenges, and Prospects in Agricultural Water Management.

Learning Outcomes

LO1: Compare and assess surface, sprinkler, micro-irrigation, and subsurface irrigation systems for different crops, analyzing advantages, limitations, and suitability for Egyptian conditions.
LO2: Determine irrigation water requirements for major Egyptian crops using ET calculations, crop coefficients, and soil moisture monitoring, adjusting for local climate conditions.
LO3: Develop irrigation system designs that optimize water use efficiency while meeting crop production goals, integrating soil properties, water availability, and economic constraints.
LO4: Conduct field evaluations of irrigation uniformity, efficiency, and adequacy using standard protocols, identifying opportunities for improvement in existing systems.
LO5: Perform comprehensive economic analyses comparing irrigation alternatives, including capital costs, operational expenses, water productivity, and return on investment.
LO6: Design leaching requirements and irrigation strategies to prevent salt accumulation in different soil types, particularly in Delta and newly reclaimed areas.
LO7: Integrate modern technologies including soil moisture sensors, variable rate irrigation, remote sensing, and automation for optimized water management.
LO8: Develop irrigation strategies for crop rotations, intercropping, and intensive cultivation systems that maximize water productivity and economic returns.
LO9: Diagnose and remedy common irrigation problems including poor distribution, waterlogging, salinity, and system inefficiencies in practical situations.
LO10: Apply multi-criteria decision frameworks to recommend appropriate irrigation technologies for specific farms considering technical, economic, social, and environmental factors.

Lectures

Week 1: Introduction to Modern Irrigation Systems, Course overview and objectives, Evolution of irrigation in Egypt, Classification of irrigation methods, Current adoption patterns, Water productivity concepts.
Week 2: Crop Water Requirements & Scheduling, ET concepts and calculations, Crop coefficients for Egyptian crops, Soil moisture monitoring methods, Irrigation scheduling approaches, Deficit irrigation strategies.
Week 3: Surface Irrigation Modernization, Traditional vs improved methods, Laser land leveling benefits, Gated pipe and surge flow, Raised bed cultivation, Evaluation procedures.
Week 4: Sprinkler Irrigation Systems, System types and components, Hydraulic design principles, Sprinkler selection criteria, Wind effects and uniformity, Portable vs permanent systems.
Week 5: Micro-Irrigation Fundamentals, Drip system components, Emitter types and selection, Micro-sprinkler applications, Filtration requirements, Maintenance protocols.
Week 6: Advanced Micro-Irrigation, Subsurface drip systems, Fertigation principles, Automation and control, Troubleshooting techniques, System longevity.
Week 7: Water Quality & Treatment, Egyptian water quality issues, Salinity effects on crops, Filtration system design, Chemical treatment options, Drainage water reuse.
Week 8: Midterm Week.
Week 9: Economic Analysis Framework, Capital investment analysis, Operating cost comparisons, Water productivity metrics, Payback calculations, Risk assessment.
Week 10: Precision Irrigation Technologies, Variable rate irrigation, Soil moisture sensors, Remote sensing applications, IoT and automation, Data management.

Week 11: Vegetable Production Systems, Protected cultivation irrigation, High-frequency systems, Crop-specific requirements, Quality considerations, Export standards.
Week 12: Tree Crop Irrigation, Orchard establishment, Micro-sprinkler vs drip, Root zone management, Deficit strategies, Long-term sustainability.
Week 13: Field Crop Integration, Cotton irrigation methods, Wheat water management, Maize production systems, Rotation considerations, Mechanization compatibility.
Week 14: System Selection Framework, Multi-criteria analysis, Decision support tools, Stakeholder considerations, Technology adoption barriers, Extension approaches.
Week 15: Future Directions & Sustainability, Climate adaptation strategies, Energy considerations, Policy implications, Research frontiers, Career opportunities.
Week 16: FINAL EXAM WEEK.

Laboratories

Week 1: Lab 1: Irrigation Equipment Overview, System component identification, Basic hydraulic principles, Flow measurement tools, Pressure testing equipment, Safety protocols.
Week 2: Lab 2: ET Calculations Workshop, Weather data analysis, CROPWAT software training, Crop coefficient selection, Schedule development, Mobile app tools.
Week 3: Lab 3: Surface System Evaluation, Advance rate measurement, Infiltration testing, Distribution uniformity, Efficiency calculations, Improvement recommendations.
Week 4: Lab 4: Sprinkler Testing, Catch can testing, Uniformity coefficient, Pressure measurements, Nozzle selection, System adjustments.
Week 5: Lab 5: Drip System Design, Hydraulic calculations, Lateral design, Emitter spacing, Pressure compensating devices, Installation techniques.
Week 6: Lab 6: Fertigation Workshop, Injection equipment, Fertilizer calculations, EC/pH monitoring, Clogging prevention, Maintenance schedules.
Week 7: Lab 7: Water Quality Analysis, Sample collection, EC/pH/SAR testing, Clogging risk assessment, Treatment recommendations, Monitoring protocols.
Week 8: Practical Exam, System identification, Design calculations, Troubleshooting scenarios, Economic analysis.
Week 9: Lab 9: Economic Modeling, Cost-benefit templates, Sensitivity analysis, Investment comparison, Software tools, Decision matrices.
Week 10: Lab 10: Sensor Workshop, Sensor installation, Calibration procedures, Data interpretation, Integration with controllers, Troubleshooting.
Week 11: Lab 11: Greenhouse Systems, Greenhouse irrigation setup, Climate integration, Monitoring systems, Crop management, Yield optimization.
Week 12: Lab 12: Orchard Evaluation, Root zone assessment, Wetted area calculation, System modifications, Mulching effects, Performance monitoring.
Week 13: Lab 13: Field Demonstrations, Center pivot operation, Lateral move systems, Mobile drip systems, Performance comparison, Adaptation strategies.
Week 14: Lab 14: Decision Workshop, Case study analysis, Stakeholder mapping, Technology selection, Implementation planning, Farmer engagement.
Week 15: Lab 15: Final Presentations, Student presentations, Peer evaluation, Industry feedback, Best practices, Implementation planning.
Week 16: Final Exam.

WETC402PIT: Environmental Impact of Irrigation

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC401PIT

Course Description

This course examines the environmental consequences of agricultural and landscape irrigation practices. Students will study the complex relationships between irrigation systems and environmental processes, including impacts on water resources, soil health, ecosystem function, and climate change. The course integrates principles from hydrology, soil science, ecology, and agricultural engineering to provide a comprehensive understanding of how irrigation affects natural systems and how sustainable irrigation practices can mitigate negative environmental impacts. Environmental Impact of Irrigation is an upper-level course focusing on the ecological and environmental consequences of various irrigation methods. Through both theoretical study and field observation, students analyze the effects of irrigation on water resources, soil quality, and ecosystem health. The course addresses critical issues such as water source depletion, soil salinization, agricultural runoff, energy consumption, and climate implications. Students learn to evaluate existing irrigation systems from an environmental perspective and develop strategies to mitigate negative impacts through sustainable practices and technologies.

References

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Agrotechnical Systems. Resources 13, 93. https://doi.org/10.3390/resources13070093
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Singh, A., 2021. A review of wastewater irrigation: Environmental implications. Resources, Conservation and Recycling 168, 105454. https://doi.org/10.1016/j.resconrec.2021.105454
Verma, R.D., 1986. Environmental Impacts of Irrigation Projects. Journal of Irrigation and Drainage Engineering 112, 322–330. https://doi.org/10.1061/(ASCE)0733-9437(1986)112:4(322)

Learning Outcomes

LO1: Identify and describe major irrigation methods and their specific environmental impacts
LO2: Analyze the relationships between irrigation practices and water resource depletion
LO3: Evaluate the effects of irrigation on soil quality, including salinization and degradation
LO4: Assess the impacts of irrigation runoff on water quality and aquatic ecosystems
LO5: Explain the connections between irrigation, energy use, and greenhouse gas emissions
LO6: Apply principles of sustainable water management to irrigation case studies
LO7: Critically evaluate irrigation policies and regulations from an environmental perspective
LO8: Propose evidence-based solutions to mitigate the negative environmental impacts of irrigation

Lectures

Week 1: Introduction to Irrigation Systems and Environmental Concerns
Week 2: Water Source Impacts: Surface Water Diversion and Depletion
Week 3: Water Source Impacts: Groundwater Extraction and Aquifer Depletion
Week 4: Soil Salinization and Alkalinization Processes
Week 5: Drainage Problems: Waterlogging and Impacts on Soil Structure
Week 6: Water Quality Impacts: Agricultural Runoff and Eutrophication
Week 7: Midterm Examination
Week 8: Ecological Impacts: Wetland and Riparian Habitat Alteration
Week 9: No lecture topic specified
Week 10: Energy Requirements of Irrigation and Carbon Footprint
Week 11: Climate Change: Irrigation Adaptation and Contribution
Week 12: Sustainable Irrigation Technologies and Practices
Week 13: Irrigation Policy, Water Rights, and Environmental Regulations
Week 14: Case Studies: Successful Mitigation of Irrigation Impacts
Week 15: Future Directions: Smart Irrigation and Environmental Monitoring
Week 17: Final Project Presentations

WETC402WMT: Water Policy

Contact Time				CH	SWL	Exams Time		Marks		
LCT	TUT	LAB	Total			MT	FE	CW	ME	FE
120		120	240	3	90	90	120	60	15	25

Requisites

- Prerequisites: WETC401WMT

Course Description

This course examines the legal and regulatory frameworks for agricultural water use in Egypt and the Middle East/North Africa region, focusing on how water rights, allocation methods, and conservation policies affect irrigation and sustainable resource management. It integrates principles of water law, environmental policy, economics, and governance to address challenges facing Egypt's agricultural water systems, especially concerning Nile River management, groundwater sustainability, and water scarcity. Students will analyze Egypt's water governance, from ancient laws to modern agreements, and cover topics such as the Nile Waters Agreement, national water plans, and water user associations. Through case studies, policy simulations, and engagement with professionals from the Ministry of Water Resources and Irrigation, students will develop skills in policy analysis, regulatory interpretation, and conflict resolution. The course emphasizes balancing agricultural productivity with environmental protection, social equity, and economic efficiency, examining real-world policy challenges like the management of the High Aswan Dam, groundwater depletion in the Western Desert, and climate adaptation strategies.

References

El Bedawy, R., 2014. Water Resources Management: Alarming Crisis for Egypt. J. Mgmt. & Sustainability 4, 108.
Eldabbagh, F., Abdelwahab, N., Brouziyne, Y., Sanchez Ramirez, J.C., Nicol, A., 2024. Framing policy coherence toward improving climate-adaptive water productivity in Egypt.
Luo, P., Sun, Y., Wang, Shuangtao, Wang, Simeng, Lyu, J., Zhou, M., Nakagami, K., Takara, K., Nover, D., 2020. Historical assessment and future sustainability challenges of Egyptian water resources management. Journal of Cleaner Production 263, 121154. https://doi.org/10.1016/j.jclepro.2020.121154
Moniem, A.E., A, A., 2009. Overview of water resources and requirements in Egypt; the factors controlling its management and development. Journal of Environmental Studies 2, 82–97. https://doi.org/10.21608/jesj.2009.183681
Omar, E.M., 2024. Development Challenges in Egypt: Constraints, Practices, and Opportunities. J. Pol. & L. 17, 1.

Learning Outcomes

LO1: Evaluate Egypt's water governance framework including Nile water rights, groundwater regulations, and traditional irrigation laws, understanding their implications for agricultural water security.
LO2: Navigate Egyptian water laws and regulations including Law 12/1984 for irrigation and drainage, Law 48/1982 for Nile protection, ministerial decrees, and their impacts on agricultural operations.
LO3: Assess Egypt's water allocation methods including rotation systems (mesqas), water user associations, modern irrigation projects, and priority systems during scarcity in the Nile Valley and Delta.
LO4: Develop and evaluate policy instruments for agricultural water conservation including irrigation modernization programs, crop pattern modifications, water pricing mechanisms, and regulatory approaches suitable for Egyptian conditions.
LO5: Identify and analyze diverse stakeholder interests in Egyptian agricultural water management, facilitating collaborative governance between farmers, water user associations, and government agencies.
LO6: Apply economic analysis to Egyptian water policy including irrigation improvement costs, water productivity enhancement, subsidies reform, and economic incentives for water conservation.
LO7: Understand Nile Basin cooperation, transboundary water governance, Arab Water Council initiatives, and comparative MENA region policy approaches.
LO8: Develop adaptive water policies addressing sea level rise in the Delta, changing Nile flows, extreme events, and long-term sustainability of Egyptian agricultural water supplies.
LO9: Evaluate water policies through equity lenses, addressing impacts on small farmers, landless laborers, women farmers, and ensuring fair access to irrigation water across Egyptian governorates.
LO10: Prepare policy briefs in Arabic and English, present to ministry officials, and effectively advocate for evidence-based water policy solutions in the Egyptian context.

Lectures

Week 1: Introduction to Egyptian Water Policy, Course overview and objectives, Egypt's water resources overview, Nile dependency and challenges, National water policy framework, Ministry structure and governance.
Week 2: Historical Development of Egyptian Water Law, Pharaonic irrigation traditions, Islamic water law principles, Ottoman water administration, Modern Egyptian water legislation, Customary rights in Upper Egypt.
Week 3: Nile Water Rights and Agreements, 1959 Nile Waters Agreement, Cooperative Framework Agreement, Ethiopian Renaissance Dam impacts, Downstream rights doctrine, Negotiation strategies.
Week 4: Egyptian Irrigation Law Framework, Law 12/1984 provisions, Irrigation improvement projects, Water user associations law, Violations and penalties, Implementation challenges.
Week 5: Groundwater Regulation in Egypt, Groundwater law provisions, Well licensing procedures, Aquifer management zones, Western Desert regulations, Enforcement mechanisms.
Week 6: Water Quality Regulation, Law 48/1982 Nile protection, Agricultural drainage laws, Reuse water standards, Industrial discharge control, Monitoring and compliance.
Week 7: Agricultural Water Allocation Systems, Rotation schedules (mesqas), Priority during shortage, Crop water requirements, Modern vs traditional systems, Equity considerations.
Week 8: Midterm Week.
Week 9: Water Pricing and Economic Instruments, Current pricing structure, Cost recovery principles, Subsidy reform proposals, Economic incentives, International comparisons.
Week 10: Irrigation Modernization Policy, National improvement projects, Technology adoption policies, Financing mechanisms, Implementation challenges, Performance indicators.
Week 11: Climate Change and Water Policy, Nile flow projections, Sea level rise impacts, Adaptation strategies, Policy flexibility needs, Regional cooperation.
Week 12: Delta Water Management Policy, Salinity management, Drainage water reuse, Land subsidence issues, Urban encroachment, Integrated management.
Week 13: New Valley & Desert Development, Toshka project policies, New Delta regulations, Groundwater sustainability, Settlement policies, Investment frameworks.
Week 14: Institutional Reform and Governance, MWRI restructuring, Decentralization efforts, Integrated management, Capacity building needs, Corruption prevention.
Week 15: Project Presentations.
Week 16: FINAL EXAM WEEK.

Laboratories

Week 1: Lab 1: Policy Analysis Tools, Policy mapping software, Egyptian water databases, MWRI portal navigation, GIS for policy analysis, Research methods setup.

Week 2: Lab 2: Legal Research Methods, Egyptian legal databases, Law interpretation techniques, Case study methodology, Arabic legal terminology, Documentation standards.
Week 3: Lab 3: Transboundary Analysis, Nile flow data analysis, Water sharing scenarios, Negotiation simulation, Impact assessment tools, Regional cooperation mapping.
Week 4: Lab 4: WUA Formation Workshop, WUA establishment process, Bylaws development, Conflict resolution methods, Financial management, Government liaison.
Week 5: Lab 5: Groundwater Policy Tools, Permit application process, Monitoring requirements, Violation documentation, Economic analysis, Sustainability assessment.
Week 6: Lab 6: Water Quality Standards, Egyptian standards review, Sampling protocols, Violation reporting, Remediation planning, Cost-benefit analysis.
Week 7: Lab 7: Allocation Modeling, Rotation optimization, Shortage scenarios, Equity analysis tools, Stakeholder mapping, Decision support systems.
Week 8: Practical Exam, Policy analysis exercise, Legal interpretation, Stakeholder assessment, Solution development.
Week 9: Lab 9: Economic Analysis, Pricing model development, Impact assessment, Farmer affordability, Revenue projections, Reform scenarios.
Week 10: Lab 10: Project Evaluation, Cost-benefit analysis, Performance monitoring, Farmer adoption rates, Water savings calculation, Policy recommendations.
Week 11: Lab 11: Climate Scenarios, Flow variation modeling, Salinity intrusion maps, Adaptation costing, Policy stress testing, Resilience indicators.
Week 12: Lab 12: Delta Challenges, Salinity monitoring, Reuse potential mapping, Land use analysis, Integration strategies, Stakeholder engagement.
Week 13: Lab 13: Desert Development, Feasibility assessment, Water budget analysis, Settlement planning, Investment evaluation, Sustainability criteria.
Week 14: Lab 14: Governance Tools, Institutional mapping, Reform evaluation, Capacity assessment, Transparency measures, Performance monitoring.
Week 15: Lab 15: Final Presentations, Student presentations, Ministry feedback, Peer evaluation, Best practices, Implementation planning.
Week 16: Final Exam.