

ACADEMIC REGULATIONS

(VR - 24 for B.Tech.)

For

Bachelor of Technology (B.Tech)

(Program Duration: Four Years)

(Applicable for the batches admitted from the A.Y. 2024-25)



VISAKHA INSTITUTE OF ENGINEERING & TECHNOLOGY (A)

88th Division, GVMC, Narava, Visakhapatnam - 530027, Andhra Pradesh.

1. Award of the Degree

- (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:**
 - (i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gapyear facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).
 - (ii) Registers for **160 credits** and secures all **160 credits**.

- (b) Award of B.Tech. degree with Honors**
A student will be declared eligible for the award of the B.Tech. with Honors if he/she fulfils the following:
 - (i) Student secures additional **15 credits** fulfilling all the requisites of B.Tech. program i.e., **160 credits**.
 - (ii) Registering for Honors is optional.
 - (iii) Honors is to be completed simultaneously with B.Tech. program.

- 2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with clause 1 a) i).**

3. Admissions

Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government / University from time to time. Admissions shall be made either based on the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

4. Programs of study and related terms

The following programmes of study are offered at present for the B.Tech.
Programmes Visakha Institute of engineering and technology (Autonomous)

Sl.No.	Name of Program	Code	Short Name
1	Civil Engineering	01	CE
2	Electrical & Electronics Engineering	02	EEE
3	Mechanical Engineering	03	ME
4	Electronics & Communication Engineering	04	ECE
5	Computer Science and Engineering	05	CSE
6	Computer Science and Engineering (Artificial Intelligence and Machine Learning)	42	CSM
7	Computer Science and Engineering (Data Science)	44	CSD
8	Computer Science and Engineering (Cyber Security)	46	CSC

Credit: A unit by which the course work is measured. It determines the number of hours of instruction required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

Credit definition:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hrs. Practical (Lab) per week	1 Credit

- a) **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.
- b) **Choice Based Credit System (CBCS):** The CBCS provides a choice for students to select from the prescribed courses.

5. Semester/Credits:

- i) A semester comprises **90 working days** and an academic year is divided into two semesters.
- ii) The summer term is for **eight weeks** during summer vacation. **Internship/apprenticeship** / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.
- iii) Regular courses may also be offered during the summer on a fast-track mode to enable students to do additional courses or complete backlogs in coursework.
- iv) The institution can decide on the courses to be offered in the summer term depending on the availability of faculty and the number of students. As per guidelines of Universities/HEIs

6. Structure of the Undergraduate Program

All courses offered for the undergraduate program (B. Tech.) are broadly classified as follows:

S.No.	Category	Breakup of Credits (Total 160)	Percentage of total Credits	AICTE Recommendation(%)
1.	Humanities and Social Science including Management (HM)	13	8 %	8 – 9%
2.	Basic Sciences (BS)	20	13 %	12 - 16%
3.	Engineering Sciences (ES)	23.5	14%	10 – 18%
4.	Professional Core (PC)	54.5	34 %	30 – 36%
5.	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21 %	19 - 23%

6.	Internships & Project work (PR)	16	10 %	8 – 11%
7.	Mandatory Courses (MC)	Non-Credit	Non-Credit	-

7. Course Classification:

All subjects/ courses offered for the undergraduate program in Engineering & Technology (B.Tech. degree programs) are broadly classified as follows:

S.No.	Broad Course Classification	Course Category	Description
1.	Foundation Core Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses
2.	Core Courses	Professional Courses (PC)	Includes subjects related to the discipline/department/branch of parent Engineering
3.	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/ branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
		Domain specific skill enhancement courses (SEC)	interdisciplinary/job-oriented/domain courses which are relevant to the industry
4.	Project & Internships	Project	B.Tech. Project or Major Project
		Internships	Summer Internships – Community based and Industry Internships; Industry oriented Full Semester Internship
5.	Audit Courses	Mandatory Credit courses	Covering subjects of developing desired attitude among the learners

8. Programme Pattern

- i. Total duration of the of B. Tech (Regular) Program is **four academic years**.
- ii. Each academic year of study is divided into **two semesters**.
- iii. Minimum number of instruction days in each semester is **90 days**.
- iv. There shall be mandatory student **induction program** for freshers, with **three- week duration** before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency

Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.

- v. Health/wellness/yoga/sports and NSS /NSS /Scouts & Guides / Community service activities are made mandatory as Credit courses for all the undergraduate students
- vi. Courses like Environmental Sciences, Indian Constitution, and Technical Paper Writing & IPR are offered as non-Credit mandatory courses for all the undergraduate students.
- vii. Design Thinking for Innovation & Tinkering Labs are made mandatory as Creditcourses for all the undergraduate students.
- viii. Increased flexibility for students through an increase in the elective componentof the curriculum, with **05 Professional Elective courses and 04 Open Elective courses.**
- ix. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses canlead to students specializing in emerging areas within the chosen field of study.
- x. A total of **04 Open Electives** are offered in the curriculum. A student can complete the requirement for **B.Tech. Degree with a Minor** within the 160 Credits by opting for the courses offered through various verticals/tracks under Open Electives.
- xi. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.
- xii. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be **05 skill-oriented courses** offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.
- xiii. Students shall undergo mandatory summer internships, for a minimum of eightweeks duration at the end of second and third year of the program. The internship at the end of second year shall be community oriented and industry internship at the end of third year.
- xiv. There shall also be mandatory full **internship in the final semester** of the program along with the project work.
- xv. Undergraduate degree with Honors is introduced by the University for the students having good academic record.
- xvi. The Institution will take measures to implement Virtual Labs which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments

- during the regular labs.
- xvii. The Institution will assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.
 - xviii. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

9. Evaluation Process

The performance of a student in each semester shall be evaluated subject wise with a maximum of **100 marks for theory and 100 marks for practical subject**. Summer Internships shall be evaluated for **50 marks**, Full Internship &Project work in final semester shall be evaluated for **200 marks**, mandatory courses with no Credits shall be evaluated for 30 mid semester marks.

A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. Incase of a mandatory course, he/she should secure 40% of the total marks.

9.1 Theory Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

- i) For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.
- ii) For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.
- iii) If any course contains two different branch subjects, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.
- iv) If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given same subject code with an extension of “T” for theory subject and “P” for practical subject.

a) Continuous Internal Evaluation

- i) For theory subjects, during the semester, there shall be two mid-term examinations. Each mid-term examination shall be evaluated for 30 marks of which 10 marks for part A (20 minutes duration) with multiple choice questions or Quiz or Matching type questions, 15 marks for part B (90 minutes duration) and 5 marks for assignment.
- ii) The mid exam of question parts has two parts. Part A shall contain for 05 short answer questions with 2 marks each for 10 marks. The part B shall contain 3 either or type questions (totally six questions from Units of I to VI) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the part B are condensed to 15 marks.

Note:

- The part A paper shall be prepared in line with the quality of competitive examinations questions.
 - The part B subjective paper shall contain 3 either or type questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
 - The answer booklet shall be distributed for writing part A and Part B questions. After 120 minutes the answered booklets are collected back.
 - Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered.
- iii) If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.
 - iv) First mid-term examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second mid-term examination shall be conducted for III, IV and V units with one either or type question from each unit.
 - v) Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

For Example:

Marks obtained in first mid:

25 Marks obtained in second

mid: 20

Final mid semester Marks: $(25 \times 0.8) + (20 \times 0.2) = 24$

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other.

For Example:

- Marks obtained in first mid: 25
- Marks obtained in second mid: 20
- Final mid semester Marks: $(25 \times 0.8) + (0 \times 0.2) = 20$

b) End Examination Evaluation:

End examination of theory subjects shall have the following pattern:

- i) There shall be 6 questions and all questions are compulsory.
- ii) Question 1 shall contain 10 compulsory short answer questions from each unit covering 2 questions for a total of 20 marks
- iii) In each of the questions from 2 to 6, there shall be either/or type questions of 10 Marks each. Student shall answer any one of them.
- iv) The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

End examination of theory subjects consisting of two parts of different subjects, for example: Basic Electrical & Electronics Engineering shall have the following pattern:

- i) Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.
- ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1 mark.
- iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
- iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

9.2 Practical Courses:

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

- a) For practical courses, there shall be a continuous evaluation during the semester for **30 sessional marks** and end examination shall be for **70 marks**.
- b) **Day-to-day work** in the laboratory shall be evaluated for **15 marks** by the concerned laboratory teacher based on the regularity/record/viva and **15 marks for the internal test**
- c) The end examination shall be evaluated for **70 marks**, conducted by the concerned laboratory teacher and an external expert in the subject nominated by the principal.
 - **Procedure: 20 marks**
 - **Experimental work & Results: 30 marks**
 - **Viva voce: 20 marks.**

In a practical subject consisting of two parts (Eg: Basic Electrical & Electronics Engineering Lab), the end examination shall be conducted for 70 marks as a single laboratory in 3 hours. Mid semester examination shall be evaluated 35 marks in each part. Mid semester examination shall be evaluated as above for 30 marks in each part and final mid semester marks shall be arrived by considering the average of marks obtained in two parts.

- d) For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination.

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final sessional

marks for the subject.

The end examination pattern for Engineering Graphics, shall consists of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination. However, the end examination pattern for other subjects related to design/drawing, multiple branches, etc. is mentioned along withthe syllabus.

- e) There shall be no external examination for mandatory courses with zero Credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.
- f) The laboratory records and mid semester test papers shall be preserved for a minimum of **3 years** in the respective institutions as per the institution norms and shall be produced to the Committees of the University as and when the same are asked for.
- g) The course shall carry **100 marks** and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

10. Skill oriented Courses

- i) There shall be five skill-oriented courses offered from III to VII semesters.
- ii) Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.
- iii) The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor theevaluation process. The marks/grades shall be assigned to the students by the abovecommittee based on their performance.

- iv) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the Credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalentmarks/grades.
- v) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the principal.
- vi) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the University.

11. Massive Open Online Courses (MOOCs):

A Student has to pursue and complete one course compulsorily through MOOCs approved by the Institution. A student can pursue courses other than core through MOOCs and it is mandatory to complete one course successfully through MOOCs for awarding the degree. A student is not permitted to register and pursue core courses through MOOCs.

A student shall register for the course (Minimum of either 8 weeks or 12 weeks) offeredthrough MOOCs with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's progression. The studentneeds to earn a certificate by passing the exam. The student shall be awarded the Credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.

Students who have qualified in the proctored examinations conducted through MOOCsplatform can apply for Credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent Credit course only)conducted by the university.

Necessary amendments in rules and regulations regarding adoption of MOOC courseswould be proposed from time to time.

12. Credit Transfer Policy

Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit

Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the University shall allow up to a maximum of 20% of the total courses being offered in a particular Programme i.e., maximum of 32 Credits through MOOCs platform.

- i) The University shall offer Credit mobility for MOOCs and give the equivalent Credit weightage to the students for the Credits earned through online learningcourses.
- ii) Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.
- iii) Credit transfer policy will be applicable to the Professional & Open Elective courses only.
- iv) The concerned department shall identify the courses permitted for Credit transfer.
- v) The University/institution shall notify at the beginning of semester the list of the online learning courses eligible for Credit transfer.
- vi) The institution shall designate a faculty member as a Mentor for each course toguide the students from registration till completion of the Credit course.
- vii) The institution shall ensure no overlap of MOOC exams with that of the university examination schedule. In case of delay in results, the university will re-issue the marks sheet for such students.
- viii)Student pursuing courses under MOOCs shall acquire the required Credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.
- ix) The institution shall submit the following to the examination section
 - a) List of students who have passed MOOC courses in the current semester along with the certificate of completion.
 - b) Undertaking form filled by the students for Credit transfer.
- x) The institution shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its Credit transfer policy in thelight of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

Note: Students shall be permitted to register for MOOCs offered through online platforms approved by the University from time to time.

13. Academic Bank of Credits (ABC)

The Institution will implement Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to

- i. Provide option of mobility for learners across the universities of their choice
- ii. Provide option to gain the Credits through MOOCs from approved digital platforms.
- iii. Facilitate award of certificate/diploma/degree in line with the accumulated Credits in ABC
- iv. Execute Multiple Entry and Exit system with Credit count, Credit transfer and Credit acceptance from students' account.

14. Mandatory Internships Summer Internships

Two summer internships either onsite or virtual each with a minimum of 08 weeks duration, done at the end of second and third years, respectively are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the undergraduate program. One of the two summer internships at the end of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations/NGOs & others. The other internship at the end of third year is Industry Internship and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE

/ University / Institution shall be followed for carrying out and evaluation of Community Service Project and Industry Internship.

Evaluation of the **summer internships** shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. The report and the oral presentation shall carry **50% weightage** each. It shall be evaluated for **50 external marks**. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.

Full Semester Internship and Project work:

In the final semester, the student should mandatorily register and undergo internship (onsite/virtual) and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

The **project report** shall be evaluated with an external examiner. The total marks for project work **200 marks** and distribution shall be **60 marks for internal** and **140 marks** for external evaluation. The supervisor assesses the student for **30 marks** (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior

faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the institution and is evaluated for 140 marks.

The college shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

15. Guidelines for offering a Minor

To promote interdisciplinary knowledge among the students, the students admitted into B.Tech. in a major stream/branch are eligible to obtain degree in Minor in another stream.

- i) The Minor program requires the completion of 12 Credits in Minor stream chosen.
- ii) Two courses for 06 Credits related to a Minor are to be pursued compulsorily for the minor degree, but maybe waived for students who have done similar/equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should complete the compulsory courses (or equivalents) before registering for the electives.
- iii) Electives (minimum of 2 courses) to complete a total of 12 Credits.

Note: A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for Minor within the 160 Credits by opting for the courses offered through various verticals/tracks under Open Electives.

16. Guidelines for offering Honors

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The Programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

- i) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
- ii) A student shall earn additional 15 Credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the Credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 Credits).
- iii) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.
- iv) The Principal shall arrange separate class work and timetable of the courses offered under Honors program.
- v) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.
- vi) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-Credit course and 8 weeks duration for a 2-Credit course satisfying the criteria for Credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B.Tech courses.
- vii) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.
- viii) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.
- ix) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree program.
- x) If a student drops or is terminated from the Honors program, the additional Credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet

- mentioning the additional courses completed by them.
- xii) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

Enrolment into Honors:

- i) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline
- ii) The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.
- iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.
- iv) Transfer of Credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.
- v) Honors is to be completed simultaneously with a Major degree program.

Registration for Honors:

- i) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.
- ii) The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.
- iii) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.
- iv) There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

17. Attendance Requirements:

- i) A student shall be eligible to appear for the University external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.
- ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

- iii) A stipulated fee shall be payable towards condonation of shortage of attendance to the University.
- iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
- v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.
- vi) If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
- vii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.
- viii) For induction program attendance shall be maintained as per AICTE norms.

18. Promotion Rules:

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in section 16.

- i) A student shall be promoted from first year to second year if he/she fulfills the minimum attendance requirement as per university norms.
- ii) A student will be promoted from II to III year if he/she fulfills the academic requirement of securing 40% of the Credits (any **decimal** fraction should be **rounded off** to **lower** digit) up to in the subjects that have been studied up to III semester.
- iii) A student shall be promoted from III year to IV year if he/she fulfills the academic requirements of securing 40% of the Credits (any **decimal** fraction should be **rounded off** to **lower** digit) in the subjects that have been studied up to V semester.
And in case a student is detained for want of Credits for a particular academic year by ii) & iii) above, the student may make up the Credits through supplementary examinations and only after securing the required Credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.
- iv) When a student is detained due to lack of Credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

19. Grading:

As a measure of the student's performance, a 10 - point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be

followed:

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade points Assigned
90 & above	S (Superior)	10
80 - 89	A (Excellent)	9
70 - 79	B (Very Good)	8
60 - 69	C (Good)	7
50 - 59	D (Average)	6
40 - 49	E (Pass)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

- i) A student obtaining Grade “F” or Grade “Ab” in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.
- ii) For non-Credit audit courses, “Satisfactory” or “Unsatisfactory” shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of Credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of Credits of all the courses undergone by a student,i.e.,

$$SGPA = \frac{\sum (C_i \times G_i)}{\sum C_i}$$

where, C_i is the number of Credits of the i^{th} subject and G_i is the grade pointscored by the student in the i^{th} course.

The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses undergone by a student over all the semesters of a program,i.e.,

$$CGPA = \Sigma (Ci \times Si) / \Sigma Ci$$

where "Si" is the SGPA of the i^{th} semester and C_i is the total number of Credits up to that semester.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. **Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5 (Without any supplementary appearance)
First Class	$\geq 6.5 < 7.5$
Second Class	$\geq 5.5 < 6.5$
Pass Class	$\geq 5.0 < 5.5$

Note: * Students who have written supplementary examinations to fulfil the Credit requirement will not be awarded First Class with Distinction. For such students the highest degree that is awarded will be First Class Only.

CGPA to Percentage conversion Formula – (CGPA – 0.5) x 10

20. Withholding of Results

If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld in such cases.

21. Multiple Entry / Exit Option

(a) Exit Policy:

The students can choose to exit the four-year program at the end of first/second/third year.

- i) **UG Certificate in (Field of study/discipline)** - Programme duration: First year (first two semesters) of the undergraduate program, 40 Credits followed by an additional exit 10-Credit bridge course(s) lasting two months, including at least 6- Credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.
- ii) **UG Diploma (in Field of study/discipline)** - Programme duration: First two years(first four semesters) of the undergraduate program, 80 Credits followed by an additional exit 10-Credit bridge course(s) lasting two months, including at least 6- Credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.
- iii) **Bachelor of Science (in Field of study/discipline)** i.e., **B.Sc. Engineering in (Field of study/discipline)**- Programme duration: First three years (first six semesters) of the undergraduate program, 120 Credits.

(b) Entry Policy:

Modalities on multiple entry by the student into the B.Tech. program will be provided in due course of time.

Note: The institution shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

22. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship program/to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The principal of the respective college shall forward such proposals submitted by the students to the University. An evaluation committee constituted by the University shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not

23. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the

unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

24. Minimum Instruction Days for a Semester:

The minimum instruction days including exams for each semester shall be 90 days.

25. Medium of Instruction:

The medium of instruction of the entire B. Tech undergraduate program in Engineering & Technology (including examinations and project reports) will be in English only.

26. Student Transfers:

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the Universities from time to time.

27. General Instructions:

- a. The academic regulations should be read as a whole for purpose of any interpretation.
- b. Malpractices rules-nature and punishments are appended.
- c. Where the words "he", "him", "his", occur in the regulations, they also include "she", "her", "hers", respectively.
- d. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- e. The institution may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the institution.
- f. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Head of the institution is final.

ACADEMIC REGULATIONS (VR24) FOR B.TECH. **(LATERAL ENTRY SCHEME)**

(Effective for the students getting admitted into II year through Lateral Entry Scheme
from the Academic Year **2025-2026** onwards)

1. Award of the Degree

- (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:
 - (i) Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).
 - (ii) Registers for **120 Credits** and secures all **120 Credits**.

- (b) Award of the B.Tech. Degree with Honors
A student will be declared eligible for the award of the B.Tech. with Honors if he/she fulfils the following:
 - (i) Student secures additional **15 Credits** fulfilling all the requisites of a B.Tech. program i.e., **135 Credits**.
 - (ii) Registering for Honors is optional.
 - (iii) Honors is to be completed simultaneously with B.Tech. program.

- 2. Students, who fail to fulfil the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

3. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.2

- i. A student shall be deemed to have satisfied the minimum academic requirements and earned the Credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.
- ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing **40% of the Credits** (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester and in case if student is already detained for want of Credits for particular academic year, the student may make up the Credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. Course Pattern

- i) The entire course of study is three academic years on semester pattern.
- ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.
- iii) When a student is detained due to lack of Credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

5. All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

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**MALPRACTICES RULES
DISCIPLINARY ACTION FOR / IMPROPER
CONDUCT IN EXAMINATIONS**

	Nature of Malpractices / Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.

2.	<p>Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.</p>	<p>Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year.</p>
3.	<p>Impersonates any other candidate in connection with the examination.</p>	<p>The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.</p>

4.	<p>Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.</p>	<p>Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with Forfeiture of seat.</p>
5.	<p>Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.</p>	<p>Cancellation of the performance in that subject.</p>

6.	<p>Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.</p>	<p>In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.</p>
7.	<p>Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.</p>	<p>Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.</p>

8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student is expelled from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.

12.	<p>If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.</p>	
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

**COURSE STRUCTURE & SYLLABUS for B. Tech.
CSE (DS) (VR-24 Regulations)**

(Applicable for batches admitted from 2024-2025)



**VISAKHA INSTITUTE OF ENGINEERING &
TECHNOLOGY (A) NARAVA,
VISAKHAPATNAM -530027**



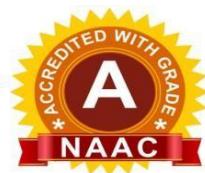
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
 (DATA SCIENCE)**

COURSE STRUCTURE 2024-2025

Academic Regulations VR-24 for B.Tech. (Full time)

I Year I Semester							
S. No.	Course Category	Course Code	Course Name	L	T	P	Credits
1.	BS		Linear Algebra & Calculus	3	0	0	3
2.	BS		Engineering Physics	3	0	0	3
3.	HS		Communicative English	2	0	0	2
4.	ES		Basic Civil & Mechanical Engineering	3	0	0	3
5.	ES		Introduction to Programming	3	0	0	3
6.	HS		Communicative English Lab	0	0	2	1
7.	BS		Engineering Physics Lab	0	0	2	1
8.	ES		Engineering Workshop	0	0	3	1.5
9.	ES		IT Workshop	0	0	2	1
10.	ES		Computer Programming Lab	0	0	3	1.5
11.	MC		Health and Wellness, Yoga, and Sports	0	0	1	0.5
Total				14	0	13	20.5

I Year II Semester							
S. No.	Course Category	Course Code	Course Name	L	T	P	Credits
1.	BS		Differential Equations and Vector calculus	3	0	0	3
2.	BS		Chemistry	3	0	0	3
3.	ES		Engineering Graphics	1	0	4	3
4.	ES		Basic Electrical & Electronics Engineering	3	0	0	3
5.	PC		Data Structures	3	0	0	3
6.	BS		Chemistry Lab	0	0	2	1
7.	ES		Electrical & Electronics Engineering workshop	0	0	3	1.5
8.	PC		Data Structures Lab	0	0	3	1.5
9.	MC		NSS/NCC/Scouts & Guides/ Community Service	0	0	1	0.5
Total				13	0	13	19.5



II Year I Semester							
S. No.	Course Category	Course Code	Title	L	T	P	Credits
1	BS		Discrete Mathematics & Graph Theory	3	0	0	3
2	HSMC		Universal human values – understanding harmony and Ethical human conduct	2	1	0	3
3	ES		Introduction to Data Science	3	0	0	3
4	PC		Advanced Data Structures & Algorithms Analysis	3	0	0	3
5	PC		Object-Oriented Programming Through JAVA	3	0	0	3
6	PC		Data Science Lab	0	0	3	1.5
7	PC		Object-Oriented Programming Through JAVA Lab	0	0	3	1.5
8	SEC		Python programming	0	1	2	2
9	Audit Course		Environmental Science	2	0	0	-
Total				15	2	10	20

II Year II Semester						
S. No.	Category	Course Code	Title	L	T	P
1	MC		Probability and Statistics	2	0	0
2	ES/BS		Statistical methods for Data science	3	0	0
3	PC		Data Engineering	3	0	0
4	PC		DBMS	3	0	0
5	PC		Digital Logic and Computer Organization	3	0	0
6	PC		Data Engineering Lab	0	0	3
7	PC		DBMS Lab	0	0	3
8	SEC		Exploratory Data Analysis with Python	0	1	2
9	ES		Design Thinking &Innovation	1	0	2
Total				15	1	10



I Year I Semester		L	T	P	C
		3	0	0	3
LINEAR ALGEBRA & CALCULUS (Common to All branches of Engineering)					

Course Objectives:

- To equip the students with standard concepts and tools of mathematics to handle various real-world problems and their applications.

Course Outcomes:

At the end of the course, the student will be able to:

- CO1:** Develop matrix algebra techniques that is needed by engineers for practical applications.
- CO2:** To find the eigen values and eigen vectors and solve the problems by using linear transformation
- CO3:** Learn important tools of calculus in higher dimensions.
- CO4:** Familiarize with functions of several variables which is useful in optimization.
- CO5:** Familiarize with double and triple integrals of functions of several variables in two and three dimensions.

UNIT - I:

MATRICES: Rank of a matrix by echelon form, normal form. Cauchy –Binet formulae (without proof). Inverse of Non-singular matrices by Gauss-Jordan method

System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

UNIT- II:

LINEAR TRANSFORMATION AND ORTHOGONAL TRANSFORMATION:

Eigen values, Eigen vectors and their properties (without Proof), Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation

UNIT- III:

MEAN VALUE THEOREMS: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT- IV:

PARTIAL DIFFERENTIATIONS AND APPLICATIONS (Multi variable calculus):

Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT – V :

MUTIPLE INTEGRALS (Multi variable Calculus): Double integrals - change of variables (Cartesian and Polar coordinates), Change of order of integration, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).



Text books:

1. Higher Engineering Mathematics, B.S.Grewal,44/e,Khanna Publishers,2017.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 10/e,John Wiley & Sons, 2018.

Reference Books:

1. Advanced Engineering Mathematics, R.K.Jain and S.R.K.Iyengar, 5/e, Alpha Science International Ltd.,2021 (9th reprint).
2. Thomas Calculus, George B. Thomas, Maurice D.Weir and Joel Hass, 14/e, Pearson Publishers, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, 5/e, Pearson publishers, 2018.
4. Advanced Engineering Mathematics, Michael Greenberg, 9thedition, Pearson Publishers, 2010
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publishers,2021.



I Year – I Semester		L	T	P	C
		1	0	4	3
ENGINEERING PHYSICS (Common to All Branches of Engineering)					

COURSE OBJECTIVES

- Bridging the gap between the Physics in school at 10+2 level and UG level engineering courses.
- To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications
- Enlighten the periodic arrangement of atoms in Crystalline solids by Bragg's law
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
- Enlightenment of the concepts of Quantum Mechanics and to provide fundamentals of de Broglie matter waves, quantum mechanical wave equation and its application, the importance of free electron theory for metals.
- To Understand the Physics of Semiconductors and their working mechanism, Concepts utilization of transport phenomenon of charge carriers in semiconductors.

COURSE OUTCOMES

- CO1:** Analyze the intensity variation of light due to polarization, interference and diffraction.
- CO2:** Familiarize with the basics of crystals and their structures.
- CO3:** Explain fundamentals of quantum mechanics and apply it to one dimensional motion of particles.
- CO4:** Summarize various types of polarization of dielectrics and classify the magnetic materials.
- CO5:** Explain the basic concepts of Quantum Mechanics and the band theory of solids, Identify the type of semiconductor using Hall effect.

UNIT I: Wave Optics

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT II: Crystallography and X-ray diffraction

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods

UNIT III: Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation



polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT IV: Quantum Mechanics and Free electron Theory

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

UNIT V: Semiconductors

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

Textbooks:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun, Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press. 2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Web Resources: <https://www.loc.gov/rr/scitech/selected-internet/physics.html>



I Year – I Semester		L	T	P	C
		2	0	0	2
COMMUNICATIVE ENGLISH (Common to All branches of Engineering)					

Course Objectives:

The main objective of introducing this course,

- Communicative English, is to facilitate using Listening, Reading, Speaking and Writing skills effectively by the students.
- It should result in their better comprehending abilities, oral presentations, reporting useful information and with enhanced knowledge of grammatical structures and vocabulary.
- This course helps the students in using speaking and writing (productive) skills more efficiently and to make them industry- ready.

Course Outcomes:

- CO1:** By the end of the course the students will have Learned how to understand the context, topic, and specific information from social or transactional dialogues.
- CO2:** Remedially learn applying grammatical structures to formulate sentence sand use appropriate words and correct word forms.
- CO3:** Improved communicative competence in formal and informal contexts and for social and academic purposes.
- CO4:** Critically comprehending and appreciating reading /listening texts and to write summaries based on global comprehension of these texts.
- CO5:** Writing coherent paragraphs essays, letters/e-mails and resume.

Instructions:

1. The reading texts can be given as podcasts to the students so that their listening skills can be enhanced.
2. While listening and reading to the text can be given as homework, the classwork for the students can be to discuss and critically evaluate the texts based on the context, purpose or writing the text and understanding it from the author's as well as reader's point of view.
3. Reading as habit for both academic and non-academic (pleasure) purposes have to be inculcated in the students. So, training has to be given in intensive and extensive reading strategies.
4. Writing for both academic (assignments, examinations, reports, e-mails/letters etc.)
5. The writing tasks given in the class are to be self and peer evaluated by the students before they are finally graded by the faculty.

Note: Please note that the texts given here are just contexts for teaching various language skills and sub skills. The students' ability to use language cannot be confined to comprehending or using the language related to the given texts (textbooks). The given texts can be used only for practice.

6. All the activities to develop language skills have to be integrated and interconnected, within each unit and across the units.
7. Use as many supplementary materials as possible in various modes (Audio, visual and printed versions) in the classroom so that the students get multimode input and will how to use language skills in the absence of the teacher.



UNIT I

Lesson: HUMAN VALUES: A Power of a Plate of Rice by Ifeoma Okoye (Short Story)

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.
(That has to be part of the bridge course- 2 weeks before the actual academic Programme starts)

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II

Lesson: NATURE: Night of the Scorpion by Nissim Ezekiel (Indian and contemporary)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics) **Grammar:** Cohesive devices -linkers, use of articles and zero article prepositions. **Vocabulary:** Homonyms, Homophones, Homographs.

UNIT III

Lesson: BIOGRAPHY Steve Jobs

Listening: Listening for global comprehension and summarizing what is listened.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing

Grammar: Verbs – tenses; subject-verb agreement; Compound words, Collocations

Vocabulary: Compound words, Collocations

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters, Resumes

Grammar: Reporting verbs, Direct & Indirect speech, Active& Passive Voice

Vocabulary: Words often confused, Jargons



UNIT V

Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic on texts

Reading: Reading comprehension.

Writing: Writings structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject-verb agreement)

Vocabulary: Technical Jargons

Textbooks:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient BlackSwan, 2023 (Units 1,2 & 3)
2. Empowering English by Cengage Publications, 2023 (Units 4 & 5)

Suggestion: Instead of giving the syllabus in the form of textbooks it would be better to procure the soft copies of individual texts (stories or poems or biographies and non-fiction texts) by the university and make them available on the university website for registered students to access and download

Reference Books:

1. English for Engineers, Dubey, Sham Ji & Co., Vikas Publishers, 2020
2. Academic writing: A Handbook for International Students, Bailey, Stephen.. Routledge, 2014.
3. English Grammar in Use, Fourth Edition, Murphy, Raymond. Cambridge University Press, 2019.
4. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary, Lewis, Norman.. Anchor, 2014.

Web Resources:

GRAMMAR:

1. www.bbc.co.uk/learningenglish
2. <https://dictionary.cambridge.org/grammar/british-grammar/>
3. www.eslpod.com/index.html
4. <https://www.learngrammar.net/>
5. <https://english4today.com/english-grammar-online-with-quizzes/>
6. <https://www.talkenglish.com/grammar/grammar.aspx>

VOCABULARY

1. <https://www.youtube.com/c/DailyVideoVocabulary/videos>
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfA



I Year – I Semester	L	T	P	C
	3	0	0	3

BASIC CIVIL & MECHANICAL ENGINEERING
(Common to All branches of Engineering)

Course Objectives:

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

Course Outcomes: On completion of the course, the student should be able to:

- CO1:** Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.
- CO2:** Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.
- CO3:** Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.
- CO4:** Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.
- CO5:** Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

UNIT I

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

UNIT II

Surveying: Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

UNIT III

Transportation Engineering Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).



Textbooks:

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition, 2005.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers, Fifth Edition, 2019.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, 38th Edition. Delhi 2023.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications, 10th Edition 2019..
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

PART B: BASIC MECHANICAL ENGINEERING

Course Objectives: The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

Course Outcomes: On completion of the course, the student should be able to

CO1: Understand the different manufacturing processes.

CO2: Explain the basics of thermal engineering and its applications.

CO3: Describe the working of different mechanical power transmission systems and power plants.

CO4: Describe the basics of robotics and its applications.

UNIT I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II

Manufacturing Processes: Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.



UNIT III

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants. **Mechanical Power Transmission** - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

Textbooks:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.2005.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd., 2007.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd, 2010.

Reference Books:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I, 2000.
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications, 2011.
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd, 2007.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd, 2011.



I Year – I Semester	L	T	P	C
	3	0	0	3
INTRODUCTION TO PROGRAMMING				

Course Objectives:

The objectives of this course is to acquire knowledge on the

- To impart adequate knowledge on the need of programming languages and problem-solving techniques and develop programming skills.
- To enable effective usage of Control Structures and Implement different operations on arrays.
- To demonstrate the use of Strings and Functions.
- To impart the knowledge of pointers and understand the principles of dynamic memory allocation.
- To understand structures and unions and illustrate the file concepts and its operations.
- To impart Knowledge Searching and Sorting Techniques

Course Outcomes:

At the end of the Course, Students should be able to:

- CO1:** Illustrate the Fundamental concepts of Computers and the basics of computer programming and problem-solving approach
- CO2:** Understand the Control Structures, branching, and looping statements
- CO3:** Use of Arrays and Pointers in solving complex problems.
- CO4:** Develop Modular program aspects and Strings fundamentals.
- CO5:** Demonstrate the ideas of user-defined data types and files. Solve real-world problems using the concept of Structures, Unions, and File operations.

UNIT-I

Introduction to Computer Problem Solving:

Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

UNIT-II

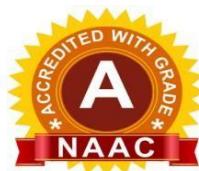
Introduction to C Programming:

Introduction, Structure of a C Program. Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements. Operators, Type Conversion. Control Flow, Relational Expressions: Conditional Branching Statements: if, if-else, if-else—if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, go to statement.

UNIT-III

Arrays:

Introduction, Operations on Arrays, Arrays as Function Arguments, Two-Dimensional Arrays, Multidimensional Arrays. Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers as Function Arguments, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments.



UNIT-IV

Functions:

Introduction Function: Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Variable Storage Classes. Recursion.

Strings: String Fundamentals, String Processing with and without Library Functions, Pointers and Strings.

UNIT-V

Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type —E num variables, Using Type def keyword, Bit Fields. Data Files: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

Note: The syllabus is designed with C Language as the fundamental language of implementation.

Text Books:

1. A Structured Programming Approach Using C, Forouzan, Gilberg, Cengage, 3rd Edition, 2007.
2. How to solve it by Computer, R. G.Dromey, and Pearson Education, 1 Edition, 2001.
3. Programming In C A-Practial Approach. Ajay Mittal, Pearson, 2000.

References:

1. Computing fundamentals and C Programming”, Balagurusamy, E., Mc Graw-Hill Education,2008.
2. Outline of Programming with C”, Byron Gottfried, Schaum, McGraw-Hill, 2nd Edition,2000.
3. Computer Programming”, Reema Thareja, Oxford University Press, 2021.
4. The C Programming Language”, Dennis Richie and Brian Kernighan, Pearson Education, 2nd Edition, 1999.
5. Programming In C”, Ashok Kamthane, Second Edition, Pearson Publication,2001.
6. Letus C”, Yashwanth Kanetkar, 16th Edition,BPB Publication,2010.

Web References:

1. <http://www.c4learn.com/>
2. <http://www.geeksforgeeks.org/c/>
3. <http://nptel.ac.in/courses/122104019/>
4. <http://www.learn-c.org/>
5. <https://www.tutorialspoint.com/cprogramming/>



I Year – I Semester		L	T	P	C
		0	0	2	1
COMMUNICATIVE ENGLISH LAB (Common to All Branches of Engineering)					

Course Objectives:

- The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

Course Outcomes:

- CO1:** Understand the different aspects of the English language proficiency with emphasis on LSRW skills.
- CO2:** Apply communication skills through various language learning activities.
- CO3:** Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
- CO4:** Evaluate and exhibit professionalism in participating in debates and group discussions.
- CO5:** Create effective Course Objectives:

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Suggested Software:

- Walden Infotech
- Young India Films

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.
2. Taylor Grant: English Conversation Practice, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed), Kindle, 2013



Web Resources

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. <https://www.britishcouncil.in/english/online>
5. <http://www.letstalkpodcast.com/>
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. <https://www.youtube.com/c/ArnelsEverydayEnglish/featured>
8. <https://www.youtube.com/c/engvidAdam/featured>
9. <https://www.youtube.com/c/EnglishClass101/featured>
10. <https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists>
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. <https://www.youtube.com/user/letstalkaccent/videos>
2. <https://www.youtube.com/c/EngLanguageClub/featured>
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA



I Year – I Semester		L 0	T 0	P 2	C 1
ENGINEERING PHYSICS LAB (Common to All Branches of Engineering)					

Course Objectives:

- To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

Course Outcomes: The students will be able to

- CO1:** Operate optical instruments like travelling microscope and spectrometer.
CO2: Estimate the wavelengths of different colours using diffraction grating.
CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance.
CO4: Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.
CO5: Calculate the band gap of a given semiconductor.
CO6: Identify the type of semiconductor using Hall effect.

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.



14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

References:

- A Textbook of Practical Physics - S. Bala subramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

Web Resources

- www.vlab.co.inhttps://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype



I Year – I Semester		L 0	T 0	P 3	C 1.5
ENGINEERING WORKSHOP (Common to All branches of Engineering)					

Course Objectives:

- To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

Course Outcomes:

- CO1:** Identify workshop tools and their operational capabilities.
- CO2:** Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.
- CO3:** Apply fitting operations in various applications.
- CO4:** Apply basic electrical engineering knowledge for House Wiring Practice

SYLLABUS

- Demonstration:** Safety practices and precautions to be observed in workshop.
- Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
 - Half – Lap joint
 - Mortise and Tenon joint
 - Corner Dovetail joint or Bridle joint
- Sheet Metal Working:** Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
 - Tapered tray
 - Conical funnel
 - Elbow pipe
 - Brazing
- Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
 - V-fit
 - Dovetail fit
 - Semi-circular fit
 - Bicycle tire puncture and change of two-wheeler tyre
- Electrical Wiring:** Familiarity with different types of basic electrical circuits and make the following connections.
 - Parallel and series
 - Two-way switch
 - Godown lighting
 - Tube light
 - Three phase motor
 - Soldering of wires
- Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
- Welding Shop:** Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
- Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.



2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.



I Year – I Semester		L	T	P	C
		0	0	2	1
IT WORKSHOP (Common to all branches of Engineering)					

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot for both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of the Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

Course Out comes:

- CO1:** Perform Hard ware trouble shooting.
CO2: Understand Hardware components and inter-dependencies.
CO3: Safeguard computer systems from viruses/worms.
CO4: Document/ Presentation preparation.
CO5: Perform calculations using spread sheets

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VM Ware) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VM Ware) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task 1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.



Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

La Te X and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of La Te X and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La Te X and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La Te X and word–Accessing, overview of toolbars, saving files, Using help and resources, format painter in word.

Task 2: Using La Te X and Word to create a project certificate. Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La Te X and Word.

Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task4: Creating a News letter: Features to be covered:- Table of Content, News paper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel– Accessing, overview of toolbars, saving excelfiles, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto-fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered: - Cell Referencing, Formulae in Excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/ VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word



Art, Formatting Text, Bullets and Numbering, AutoShapes, Lines and Arrows in Power Point.

Task 2: Interactive presentations- Hyperlinks, Inserting–Images, ClipArt, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AITOOLS– Chat GPT

Task1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing in complete sentences to see how the model completes them.

- Ex: Prompt: " You area knowledgeable AI.P lease answer the following question: What is the capital of France?"

Task2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEYD reamtech,2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 3rd edition 2013.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson, 2nd edition Education, 2012
4. PC Hardware-A Hand book, KateJ. Chase, PHI (Microsoft), 2001.
5. La Te X Companion, Leslie Lamport, PHI/Pearson. 1999.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfinson and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition,2002.
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition,2005.



I Year – I Semester	L	T	P	C
	0	0	3	1.5

COMPUTER PROGRAMMING LAB
(Common for all Branches for I Year B. Tech)

Course Objectives:

- The course aims to give students hands-on experience and train them on the concepts of the C- programming language.

Course Out comes:

- CO1:** Read, understand, and trace the execution of programs written in C language.
- CO2:** Select the right control structure for solving the problem.
- CO3:** Develop C programs which utilize memory efficiently using programming constructs like pointers.
- CO4:** Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.
- CO5:** Develop, Debug and Execute file operations

UNIT I WEEK1

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/ Activities:

Tutorial1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

- Basic Linux environment and its editors like Vi, Vim & Emacs etc.
- Exposure to Turbo C, gcc
- Writing simple programs using print(), scan()

WEEK 2

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments/ Activities:

Tutorial 2: Problem-solving using Algorithms and Flowcharts.

Lab1: Converting algorithms/ flow charts into CS code.

Developing the algorithms/ flow charts for the following sample programs

- Sum and average of 3 numbers
- Conversion of Fahrenheit to Celsius and vice versa
- Simple interest calculation

WEEK 3

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/ Activities:

Tutorial 3: Variable types and type conversions:



Lab 3: Simple computational problems using arithmetic expressions.

- i) Finding the square root of a given number
- ii) Finding compound interest
- iii) Area of a triangle using heron's formulae
- iv) Distance travelled by an object

UNIT II WEEK4

Objective: Explore the full scope of expressions, type- compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/ Activities:

Tutorial 4: Operators and the precedence and as associatively:

Lab4: Simple computational problems using the operator' precedence and associatively

- i) Evaluate the following expressions.
 - a. $A+B*C+(D*E)+F*G$
 - b. $A/B*C-B+A*D/3$
 - c. $A+++B---A$
 - d. $J=(i++)+ (++i)$
- ii) Find the maximum of three numbers using conditional operator
- iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

Objective: Explore the full scope of different variants of —if construct|| namely if-else, null- else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for —if construct||.

Suggested Experiments/ Activities:

Tutorial 5: Branching and logical expressions:

Lab5: Problems involving if-then-else structures.

- i) Write a C program to find the max and min of four numbers using if-else.
- ii) Write a C program to generate electricity bill.
- iii) Find the roots of the quadratic equation.
- iv) Write a C program to simulate a calculator using switch case.
- v) Write a C program to find the given year is a leap year or not.

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

Lab 6: Iterative problems e.g., the sum of series

- i) Find the factorial of given number using any loop.
- ii) Find the given number is a prime or not.
- iii) Compute sine and cos series
- iv) Checking a number palindrome
- v) Construct a pyramid of numbers.



UNIT

III

WEEK

7:

Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7: 1D Array manipulation, linear search

- i) Find the min and max of a 1-D integer array.
- ii) Perform linear search on 1D array.
- iii) The reverse of a 1D integer array
- iv) Find 2's complement of the given binary number.
- v) Eliminate duplicate elements in an array.

WEEK 8:

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

- i) Addition of two matrices
- ii) Multiplication two matrices
- iii) Sort array elements using bubble sort
- iv) Concatenate two strings without built-in functions
- v) Reverse a string using built-in and without built-in string functions

UNIT

IV

WEEK

9:

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc(), calloc(), realloc() and free() functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

- i) Write a C program to find the sum of a 1D array using malloc()
- ii) Write a C program to find the total, average of n students using structures
- iii) Enter n students data using calloc() and display failed students list
- iv) Read student name and marks from the command line and display the student details along with the total.
- v) Write a C program to implement realloc()

WEEK 10:

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures



Suggested Experiments/Activities:

Tutorial 10: Bitfields, Self-Referential Structures, Linked lists

Lab 10 : Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit-fields

- i) Create and display a singly linked list using self-referential structure.
- ii) Demonstrate the differences between structures and unions using a C program.
- iii) Write a C program to shift/rotate using bitfields.
- iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT V WEEK 11:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:

Tutorial 11: Functions, call by value, scope and extent,

Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

- i) Write a C function to calculate NCR value.
- ii) Write a C function to find the length of a string.
- iii) Write a C function to transpose of a matrix.
- iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

- i) Write a recursive function to generate Fibonacci series.
- ii) Write a recursive function to find the lcm of two numbers.
- iii) Write a recursive function to find the factorial of a number.
- iv) Write a C Program to implement Ackermann function using recursion.
- v) Write a recursive function to find the sum of series.

WEEK 13:

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers.

- i) Write a C program to swap two numbers using call by reference.
- ii) Demonstrate Dangling pointer problem using a C program.
- iii) Write a C program to copy one string into another using pointer.
- iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK 14:

Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.



Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

- i) Write a C program to write and read text into a file.
- ii) Write a C program to write and read text into a binary file using fread() and fwrite()
- iii) Copy the contents of one file to another file.
- iv) Write a C program to merge two files into the third file using command-line arguments.
- v) Find no. of lines, words and characters in a file
- vi) Write a C program to print last n characters of a given file.

Textbooks:

1. Programming in C: A practical approach, Ajay Mittal, Pearson, 1999.
2. Outline of Programming with C, Byron Gottfried, Schaum's McGraw Hill, 2001.

Reference Books:

1. The C Programming Language, Prentice-Hall of India, Brian W. Kernighan and Dennis M. Ritchie, 2005.
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 2012.



I Year – I Semester		L 0	T 0	P 3	C 1.5
HEALTH AND WELLNESS, YOGA AND SPORTS (Common to All branches of Engineering)					

Course Objectives:

- The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Outcomes: After completion of the course the student will be able to

- CO1:** Understand the importance of yoga and sports for Physical fitness and sound health.
- CO2:** Demonstrate an understanding of health-related fitness components.
- CO3:** Compare and contrast various activities that help enhance their health.
- CO4:** Assess current personal fitness levels.
- CO5:** Develop Positive Personality

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

- i) Organizing health awareness programmes in community
- ii) Preparation of health profile
- iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

- i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.

Practicing general and specific warm up, aerobics

- ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

- Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
- T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
- Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993



4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.



I Year – II Semester		L	T	P	C
		3	0	0	3

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
 (Common to All Branches of Engineering)

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them in to advanced level by handling various real-world applications.

Course Outcomes:

At the end of the course, the student will be able to:

- CO1:** solve the differential equations related to various engineering fields.
CO2: model engineering problems as higher order differential equations and solve analytically.
CO3: identify solution methods for partial differential equations that model physical processes.
CO4: interpret the physical meaning of different operators such as gradient, curl and divergence.
CO5: estimate the work done against a field, circulation and flux using vector calculus.

UNIT - I :

DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE:

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits

UNIT – II :

LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER (Constant Coefficients):

Definitions, homogenous and non-homogenous, complimentary function, general particular integral, Wronskian, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT – III :

PARTIAL DIFFERENTIAL EQUATIONS: Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT - IV :

VECTOR DIFFERENTIATION: Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions - Divergence and Curl, vector identities

UNIT – V :

VECTOR INTEGRATION: Line integral- circulation- work done, surface integral-flux, Green's



theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

Reference Books:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Michael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson Edition.
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
5. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017



I Year – II Semester	L	T	P	C
	3	0	0	3

CHEMISTRY
 (Common to EEE, ECE, CSE, IT & allied branches)

Course Objectives:

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches.

Course Outcomes: At the end of the course, the students will be able to:

- CO1:** Compare the materials of construction for battery and electrochemical sensors.
- CO2:** Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.
- CO3:** Explain the principles of spectrometry, slc in separation of solid and liquid mixtures.
- CO4:** Apply the principle of Band diagrams in the application of conductors and semiconductors.
- CO5:** Summarize the concepts of Instrumental methods.

UNIT I: Structure and Bonding Models:

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2 , particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O₂ and CO, etc. π -molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II: Modern Engineering materials

Semiconductors – Introduction, basic concept, application Super conductors-Introduction basic concept, applications.

Super capacitors: Introduction, Basic Concept-Classification – Applications.

Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphines nanoparticles.

UNIT III: Electrochemistry and Applications

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).



UNIT IV Polymer Chemistry

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics – Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Poly Lactic Acid (PLA).

UNIT V: Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

Textbooks:

1. Engineering Chemistry, Jain and Jain, 16/e, DhanpatRai, 2013.
2. Physical Chemistry, Peter Atkins, Julio de Paula and James Keeler, Atkins' 10/e, Oxford University Press, 2010.

Reference Books:

1. Principles of Instrumental Analysis, Skoog and West, 6/e, Thomson, 2007.
2. Concise Inorganic Chemistry, J.D. Lee, 5th Edition, Wiley Publications, Feb.2008
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition, 2010.



I Year – II Semester		L	T	P	C
		1	0	4	3
ENGINEERING GRAPHICS (Common to All branches of Engineering)					

Course Objectives:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

Course Outcomes:

- CO1:** Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.
- CO2:** Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
- CO3:** Understand and draw projection of solids in various positions in first quadrant.
- CO4:** Explain principles behind development of surfaces.
- CO5:** Prepare isometric and perspective sections of simple solids.

UNIT I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

UNIT II

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT III

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.



UNIT IV

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT V

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

Textbook:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiyah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.



I Year – II Semester		L 3	T 0	P 0	C 3
BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to All branches of Engineering)					

Course Objectives

- To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

Course Outcomes:

- CO1:** Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.
- CO2:** Understand the problem solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.
- CO3:** Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.
- CO4:** Analyze different electrical circuits, performance of machines and measuring instruments.
- CO5:** Evaluate different circuit configurations, Machine performance and Power systems operation.

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I: DC & AC Circuits

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II: Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

UNIT III: Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of —unit used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.



Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Textbooks:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, First Edition 2019.
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, Third Edition, 2014.

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, Fourth Edition, 2019.
2. Principles of Power Systems, V.K. Mehta, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhattacharya, Person Publications, Second Edition, 2018.

Web Resources:

1. <https://nptel.ac.in/courses/108105053>
2. <https://nptel.ac.in/courses/108108076>

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

- To teach the fundamentals of semiconductor devices and its applications, principles of digital electronics.

UNIT I: SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor

— CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT II: BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III: DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits—Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)



Textbooks:

1. Electronic Devices & Circuit Theory, R. L. Boylestad & Louis Nashlesky, Pearson Education, 2021.
2. Modern Digital Electronics, R. P. Jain, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. A Textbook of Electronic Devices and Circuits, R. S. Sedha, S. Chand & Co, 2010.
2. Basic Electronics- Devices, Circuits and IT Fundamentals, Santiram Kal, Prentice Hall, India, 2002.
3. Introductory Electronic Devices & Circuits – Conventional Flow Version, R. T. Paynter, Pearson Education, 2009.



I Year – II Semester		L	T	P	C
		3	0	0	3

DATA STRUCTURES
 (Common to CSE, IT & allied branches)

Course Objectives:

- Understand the significance of linear data structures in problem-solving and basic time/space complexity analysis.
- Create and manage linked lists to efficiently organize and manipulate data, emphasizing memory efficiency.
- Implement and apply stacks to manage program flow and solve problems involving expression evaluation and backtracking.
- Utilize queues to model real-world scenarios, such as process scheduling and breadth-first search algorithms and understand the versatility of deques and prioritize data management using priority queues.
- Impart basic understanding of non-linear data structures such as trees.
- Explore basic concepts of hashing and apply it to solve problems requiring fast data retrieval and management.

Course Outcomes:

- CO1:** Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
- CO2:** Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
- CO3:** Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
- CO4:** Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.
- CO5:** Devise novel solutions to small-scale programming challenges involving data structures such stacks, queues, Trees. Recognize scenarios where hashing is advantageous, and design hash- based solutions for specific problems.

UNIT I

Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. **Searching Techniques:** Linear & Binary Search, **Sorting Techniques:** Bubble sort, Selection sort, Insertion Sort

UNIT II

Linked Lists: Singly linked lists, representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

UNIT III

Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.



UNIT IV

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.

Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.

UNIT V

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversals

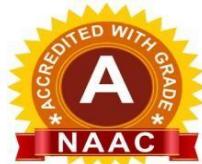
Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.2001.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders, 2011.
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft, 2006.
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum, 2010.
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, 2015.
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick, 2012.



I Year – II Semester	L	T	P	C
	0	0	2	1

CHEMISTRY LAB
(Common to EEE, ECE, CSE, IT & allied branches)

Course Objectives:

- Verify the fundamental concepts with experiments.

Course Outcomes: At the end of the course, the students will be able to

CO1: Determine the cell constant and conductance of solutions.

CO2: Prepare advanced polymer Bakelite materials.

CO3: Measure the strength of an acid present in secondary batteries.

CO4: Analyse the IR spectra of some organic compounds.

CO5: Calculate strength of acid in Pb-Acid battery.

List of Experiments:

1. Measurement of 10Dq by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nano materials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

Reference:

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar



I Year – II Semester		L 0	T 0	P 3	C 1.5
ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP (Common to All branches of Engineering)					

Course Objectives:

- To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

Course Outcomes:

- CO1:** Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
- CO2:** Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
- CO3:** Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
- CO4:** Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.
- CO5:** Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.

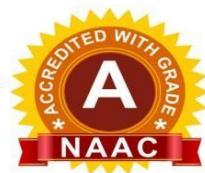
Activities:

- Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
- Provide some exercises so that hardware tools and instruments are learned to be used by the students.
- Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
- Provide some exercises so that measuring instruments are learned to be used by the students.
- Components:
 - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
 - Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

- Verification of KCL and KVL
- Verification of Superposition theorem
- Measurement of Resistance using Wheat stone bridge



4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Note: Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB

Course Objectives:

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

Course Outcomes: At the end of the course, the student will be able to CO1: Identify & testing of various electronic components.

CO2: Understand the usage of electronic measuring instruments. CO3: Plot and discuss the characteristics of various electron devices. CO4: Explain the operation of a digital circuit.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

References:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.



I Year – II Semester	L	T	P	C
	0	0	3	1.5

DATA STRUCTURES LAB

Course Objectives:

- Understand the significance of linear data structures in problem-solving and basic time/space complexity analysis.
- Create and manage linked lists to efficiently organize and manipulate data, emphasizing memory efficiency.
- Implement and apply stacks to manage program flow and solve problems involving expression evaluation and backtracking.
- Utilize queues to model real-world scenarios, such as process scheduling and breadth-first search algorithms and understand the versatility of deques and prioritize data management using priority queues.
- Impart basic understanding of non-linear data structures such as trees.
- Explore basic concepts of hashing and apply it to solve problems requiring fast data retrieval and management.

Course Outcomes:

- CO1:** Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
- CO2:** Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
- CO3:** Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
- CO4:** Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.
- CO5:** Devise novel solutions to small-scale programming challenges involving data structures such as stacks, queues, Trees. Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

List of Experiments:

Exercise 1: Array Manipulation

- Write a program to reverse an array.
- C Programs to implement the Searching Techniques – Linear & Binary Search
- C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

Exercise 2: Linked List Implementation

- Implement a singly linked list and perform insertion and deletion operations.
- Develop a program to reverse a linked list iteratively and recursively.
- Solve problems involving linked list traversal and manipulation.



Exercise 3: Linked List Applications

- i) Create a program to detect and remove duplicates from a linked list.
- ii) Implement a linked list to represent polynomials and perform addition.
- iii) Implement a double-ended queue (deque) with essential operations.

Exercise 4: Double Linked List Implementation

- i) Implement a doubly linked list and perform various operations to understand its properties and applications.
- ii) Implement a circular linked list and perform insertion, deletion, and traversal.

Exercise 5: Stack Operations

- i) Implement a stack using arrays and linked lists.
- ii) Write a program to evaluate a postfix expression using a stack.
- iii) Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations

- i) Implement a queue using arrays and linked lists.
- ii) Develop a program to simulate a simple printer queue system.
- iii) Solve problems involving circular queues.

Exercise 7: Stack and Queue Applications

- i) Use a stack to evaluate an infix expression and convert it to postfix.
- ii) Create a program to determine whether a given string is a palindrome or not.
- iii) Implement a stack or queue to perform comparison and check for symmetry

Exercise 8: Binary Search Tree

- i) Implementing a BST using Linked List.
- ii) Traversing of BST.

Exercise 9: Hashing

- i) Implement a hash table with collision resolution techniques.
- ii) Write a program to implement a simple cache using hashing.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition, 2001.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders, 2000.
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft, 2010.
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum, 2005.
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, 2001.
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms by Robert Sedgewick.2012.



I Year – II Semester		L	T	P	C
		0	0	1	0.5
NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE (Common to All branches of Engineering)					

Course Objectives:

- The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

Course Outcomes:

- CO1:** Understand the importance of discipline, character and service motto.
- CO2:** Solve some societal issues by applying acquired knowledge, facts, and techniques.
- CO3:** Explore human relationships by analyzing social problems.
- CO4:** Determine to extend their help for the fellow beings and downtrodden people.
- CO5:** Develop leadership skills and civic responsibilities.

UNIT I: Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

- Conducting—ice breaking sessions-expectations from the course-knowing personal talents and skills
- Conducting orientations programs for the students –future plans-activities-releasing road map etc.
- Displaying success stories-motivational biopics- award winning movies on societal issues etc.
- Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II: Nature & Care Activities:

- Best out of waste competition.
- Poster and signs making competition to spread environmental awareness.
- Recycling and environmental pollution article writing competition.
- Organising Zero-waste day.
- Digital Environmental awareness activity via various social media platforms.
- Virtual demonstration of different eco-friendly approaches for sustainable living.
- Write a summary on any book related to environmental issues.

UNIT III: Community Service Activities:

- Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts- etc.
- Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
- Conducting consumer Awareness. Explaining various legal provisions etc.
- Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
- Any other programmes in collaboration with local charities, NGOs etc.



Reference Books:

1. *A Text Book of National Service Scheme*, Nirmalya Kumar Sinha & Surajit Majumder, Vol;I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps – Standing Instructions Vol I & II*, Directorate General of NCC, Ministry of Defence, New Delhi
3. *Introduction to Environmental Engineering*, Davis M. L. and Cornwell D. A., —McGraw Hill, New York 4/e 2008
4. *Masters G. M., Joseph K. and Nagendran R. —Introduction to Environmental Engineering and Science*, Pearson Education, New Delhi. 2/e 2007
5. *Social Problems in India*, Ram Ahuja. Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.



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II Year – I Semester	L	T	P	C
	3	0	0	3
DISCRETE MATHEMATICS & GRAPH THEORY				

Course Objectives:

- To understand mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic, and truth tables.
- To understand about elementary of combinatorics, the principle of inclusion and exclusion and the pigeonhole principle.
- To expose the students to Binary relations, posets, Hasse diagram, lattice, and discuss various properties of relations.
- To understand Algebraic structures like groups, semigroups, monoids.
- To introduce generating functions and recurrence relations.

Course Outcomes:

- CO1:** Identify and evaluate logical statements using truth tables and normal forms. **(L2)**
CO2: Apply predicate logic with quantifiers and rules of inference. **(L3)**
CO3: Solve problems using counting principles, relations, and lattices. **(L3)**
CO4: Analyze algebraic structures like groups and their properties. **(L4)**
CO5: Solve recurrence relations using characteristic roots and generating functions. **(L3)**

UNIT-I:

Mathematical Logic & Statement Calculus Statements and Connectives:

statements, connectives, compound statements (Formulas), well-formed formulas, truth tables, tautologies, equivalence of formulas, converse, contrapositives& inverse of an implication, duality law, tautological implications, Normal forms: Principal disjunctive and conjunctive normal forms; Statement calculus: Validity of an argument using truth tables and rules of inference, consistency of premises, indirect method of proof.

UNIT-II:

Predicates & Predicate Calculus Predicate calculus:

Predicates, statement of functions, variables and quantifiers, predicate formulas, free and bound variables, universe of discourse, valid formulas and equivalences involving quantifiers, rules of inference, theory of inference for predicate calculus

UNIT-III:

Combinatorics, Set Theory, Posets and Lattices Combinatorics:

Principles of counting (product and sum rules), Pigeonhole principle and its applications, Principle of Inclusion-Exclusion and its applications.

Relations: Binary relation, properties, equivalence relation, partition of a set, equivalence classes Partial ordering: Partial order relation, partially ordered set(poset), Chanhassen diagrams, Lattices.



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UNIT-IV:

Algebraic Structures Algebraic Systems (Structures):

Binary operation, algebraic structures such as Semi group, Monoid, Group, commutative group with suitable examples, properties satisfied by the algebraic structures and the elements; Special group structures: Sub group and its criteria, order of an element, Cosets ,index of sub group ,properties of cosets, order of a group,

UNIT-V:

Recurrence Relations & Generating Functions Recurrence Relations:

Formation, iterative method of solving recurrence relations, solving homogeneous and non-homogeneous recurrence relations by characteristic roots method; Generating Functions: Generating functions of sequences, calculation of coefficients of expansions, solving recurrence relations by generating functions

Textbooks:

1. Discrete Mathematical Structures with Applications to CSc, J.P.Tremblay and R.Manohar, TataMcGrawHill,1997
2. Mathematical Foundations for Computer Science, S. Santha and EV Prasad, CENG AGE Publishers, 2005.

Reference Books:

1. Discrete Mathematics and its Applications, Kenneth. H.Rosen,6/e, Tata McGraw-Hill, 2009.
2. Mathematical Foundations of Computer Science , Dr.D S Chandra sekharaiyah, Prism Book Pvt Ltd. 2012
3. Mathematical Foundation of Computer Science, Swapan Kumar Sarkar, 9th Edition, SChand Publishers.2011.



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II Year – I Semester	L	T	P	C
	2	1	0	3
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT				

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- CO1:** Define the terms like Natural Acceptance, Happiness and Prosperity (**L2**)
- CO2:** what they have learnt to their own self in different day-to-day settings in real life (**L3**)
- CO3:** Relate human values with human relationship and human society. (**L4**)
- CO4:** Justify the need for universal human values and harmonious existence (**L5**)
- CO5:** Develop as socially and ecologically responsible engineers (**L6**)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1- hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I

Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself Lecture 3: self-exploration as the Process for Value Education

Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations Tutorial 2: Practice Session PS2 Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario Lecture 6: Method to Fulfill the Basic Human Aspirations Tutorial 3: Practice Session PS3 Exploring Natural Acceptance



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UNIT II

Harmony in the Human Being (6 lectures and 3 tutorials for practice session) Lecture 7: Understanding Human being as the Co-existence of the self and the body. Lecture 8: Distinguishing between the Needs of the self and the body

Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body. Lecture 9: The body as an Instrument of the self

Lecture 10: Understanding Harmony in the self

Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self Lecture 11: Harmony of the self with the body

Lecture 12: Programme to ensure self-regulation and Health

Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III

Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction Lecture 14: 'Trust' – the Foundational Value in Relationship

Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust Lecture 15: 'Respect' – as the Right Evaluation

Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture 16: Other Feelings, Justice in Human-to-Human Relationship Lecture 17: Understanding Harmony in the Society

Lecture 18: Vision for the Universal Human Order

Tutorial 9: Practice Session PS9 Exploring Systems to fulfill Human Goal

UNIT IV

Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session) Lecture 19: Understanding Harmony in the Nature

Lecture 20: Interconnectedness, self-regulation and Mutual Full filment among the Four Orders of Nature

Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature Lecture 21: Realizing Existence as Co-existence at All Levels

Lecture 22: The Holistic Perception of Harmony in Existence

Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT V

Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)

Lecture 23: Natural Acceptance of Human Values Lecture 24: Definitiveness of (Ethical) Human Conduct

Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture 26: Competence in Professional Ethics



Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education

Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case

Studies Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for

UNIT I – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness PS3 Exploring Natural Acceptance Practice Sessions for

UNIT II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society PS7 Exploring the Feeling of Trust PS8 Exploring the Feeling of Respect PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

Readings:

Textbook and Teachers Manual

a. The Textbook

A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews



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7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf>
2. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf>
3. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf>



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4. <https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf>
5. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf>
6. <https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%20D%20D3-S2A%20Und%20Nature-Existence.pdf>
7. <https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%202023-25%20Ethics%20v1.pdf>
8. <https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385>
https://onlinecourses.swayam2.ac.in/aic22_ge23/preview



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II Year – I Semester	L	T	P	C
	3	0	0	3
INTRODUCTION TO DATA SCIENCE				

Course Objectives:

From the course the student will learn

- Knowledge and expertise to become a data scientist.
- Essential concepts of statistics and machine learning that are vital for data science;
- Significance of exploratory data analysis (EDA) in data science.
- Critically evaluate data visualizations presented on the dashboards
- Suitability and limitations of tools and techniques related to data science process

Course Outcomes:

CO1: Remember and understand key data science concepts like data types and pre-processing. **(L2)**

CO2: Explain data wrangling, feature engineering, and model evaluation concepts. **(L2)**

CO3: Apply Python, R, or SQL to manipulate and analyze datasets. **(L3)**

CO4: Analyze datasets for patterns, trends, and relationships. **(L4)**

CO5: Evaluate models and design end-to-end data science solutions. **(L6)**

UNIT- I

Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science

Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

UNIT- II

Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modeling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning

Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

UNIT- III

No SQL movement for handling big data: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling



UNIT-IV

Tools and Applications of Data Science: Introducing Neo4j for dealing with graph databases, graph query language Cypher, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts

UNIT-V

Data Visualization and Prototype Application Development: Data Visualization options, Cross filter, the JavaScript MapReduce library, creating an interactive dashboard with dc.js, Dashboard development tools. Applying the Data Science process for real world problem solving scenarios as a detailed case study.

Text book:

- 1) Introducing to Data Science using Python tools, Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, Manning Publications Co, Dream tech press, 2016
- 2) Data Science with Jupiter, Prateek Gupta, BPB publishers, 2019 for basics

Reference Books:

- 1) Data Science from Scratch, Joel Grus, O'Reilly, 2019
- 2) Doing Data Science: Straight Talk from The Frontline, 1st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013



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II Year – I Semester		L 3	T 0	P 0	C 3
ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS					

Course Objectives:

The main objectives of the course is to

- provide knowledge on advance data structures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design

Course Outcomes:

CO1: Understand algorithm performance, asymptotic notation, and implement AVL and B-Trees with applications. **(L3)**

CO2: Implement heap trees, graph algorithms, and solve divide-and-conquer problems. **(L3)**

CO3: Apply greedy and dynamic programming algorithms for optimization problems. **(L3)**

CO4: Implement backtracking and branch-and-bound methods for problem solving. **(L3)**

CO5: Analyze NP-hard and NP-complete problems and solve related graph and scheduling problems. **(L4)**

UNIT – I

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.

AVL Trees – Creation, Insertion, Deletion operations and Applications B-Trees – Creation, Insertion, Deletion operations and Applications

UNIT – II

Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications

Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Disconnected Components, applications Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull.

UNIT – III

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths Dynamic Programming: General Method, All pair's shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem



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UNIT – IV:

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT – V:

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP) NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Text books:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, 2nd Edition, Universities Press, 2008.
2. Computer Algorithms/C++ Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran 2nd Edition, University Press, 2008.

Reference Books:

1. Data Structures and program design in C, Robert Kruse, 2e, Pearson Education Asia, 2006.
2. An introduction to Data Structures with applications, Trembley & Sorenson, 2 e , McGraw Hill,2017.
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison- Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs, N. Wirth, PHI, 1988.
6. Fundamentals of Data Structures in C++: Horowitz Sahni & Mehta, Galgotia Pub, 2008.
7. Data structures in Java, Thomas Standish, Pearson Education Asia, 2010.

Online Learning Resources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. <http://peterindia.net/Algorithms.html>
3. Abdul Bari, [1. Introduction to Algorithms \(youtube.com\)](https://www.youtube.com/watch?v=JzXWzvDfOjU)



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II Year – I Semester	L	T	P	C
	3	0	0	3
OBJECT-ORIENTED PROGRAMMING THROUGH JAVA				

Course

Objectives:

The learning objectives of this course are to:

- Identify Java language components and how they work together in applications
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java APIs for program development

Course Outcomes:

After completion of the course, students will be able to

- CO1:** Understand Java programming fundamentals, including OOP principles and program structure. **(L2)**
- CO2:** Implement OOP principles, advanced features, constructors, recursion, and access control. **(L3)**
- CO3:** Implement arrays and OOP concepts including vectors. **(L3)**
- CO4:** Demonstrate packages, exception handling, Java I/O, and file handling for applications. **(L3)**
- CO5:** Design and develop real-world Java applications with strings, multithreading, JDBC, and JavaFX GUI. **(L5)**

UNIT I:

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators: Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with print() Method, Static Variables and Methods, Attribute Final,

Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, for–each for Loop, Break Statement, Continue Statement.



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UNIT II:

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III:

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV:

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java. Lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java. time. Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class. **Exception Handling:** Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throw able, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java (Text Book 2)

UNIT V:

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.



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Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing My SQL and My SQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Text Books:

1. JAVA one step ahead, Anitha Seth, B. L. Juneja, 1e, Oxford, 2017.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson, 2018.

References Books:

1. The complete Reference Java, 11th edition, Herbert Schildt, TMH, 2012.
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson, 2008.

Online Resources:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview



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II Year – I Semester	L 0	T 0	P 3	C 1.5
DATA SCIENCE LAB				

Course Objectives:

- The main objective of the course is to inculcate the basic understanding of Data Science and its practical implementation using Python.

Course Outcomes:

CO1: Create, define, and manipulate operations on NumPy arrays. **(L3)**

CO2: Define and implement operations on pandas data structures. **(L3)**

CO3: Implement visualizations using matplotlib. **(L3)**

CO4: Define and implement machine learning and NLP techniques using scikit-learn and NLTK. **(L3)**

List of Experiments

- Creating a NumPy Array
 - Basic ndarray
 - Array of zeros
 - Array of ones
 - Random numbers in ndarray
 - An array of your choice
 - Imatrix in NumPy
 - Evenly spaced ndarray
- The Shape and Reshaping of NumPy Array
 - Dimensions of NumPy array
 - Shape of NumPy array
 - Size of NumPy array
 - Reshaping a NumPy array
 - Flattening a NumPy array
 - Transpose of a NumPy array
- Expanding and Squeezing a NumPy Array
 - Expanding a NumPy array
 - Squeezing a NumPy array
 - Sorting in NumPy Arrays
- Indexing and Slicing of NumPy Array
 - Slicing 1-D NumPy arrays
 - Slicing 2-D NumPy arrays
 - Slicing 3-D NumPy arrays
 - Negative slicing of NumPy arrays



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5. Stacking and Concatenating Numpy Arrays
 - a. Stacking ndarrays
 - b. Concatenating ndarrays
 - c. Broadcasting in Numpy Arrays
6. Perform following operations using pandas
 - a. Creating data frame
 - b. Concat()
 - c. Setting conditions
 - d. Adding a new column
7. Perform following operations using pandas Filling NaN with string
 - a. Sorting based on column values
 - b. Group by ()
8. Read the following file formats using pandas
 - a. Text files
 - b. CSV files
 - c. Excel files
 - d. JSON files
9. Read the following file formats
 - a. Pickle files
 - b. Image files using PIL
 - c. Multiple files using Glob
 - d. Importing data from database
10. Demonstrate web scraping using python
11. Perform following preprocessing techniques on loan prediction dataset
 - a. Feature Scaling
 - b. Feature Standardization
 - c. Label Encoding
 - d. One Hot Encoding
12. Perform following visualizations using matplotlib
 - a. Bar Graph
 - b. Pie Chart
 - c. Box Plot
 - d. Histogram
 - e. Line Chart and Subplots
 - f. Scatter Plot
13. Getting started with NLTK, install NLTK using PIP
14. Python program to implement with Python SciKit-Learn & NLTK
15. Python program to implement with Python NLTK/Spacy/Py NLPI.



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Web References:

1. <https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/>
2. <https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/>
3. <https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/>
4. <https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/>
5. <https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-exploration-python/6>
6. <https://www.nltk.org/book/ch01.html>



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II Year – I Semester	L	T	P	C
	0	0	3	1.5
OBJECT-ORIENTED PROGRAMMING THROUGH JAVA LAB				

Course Objectives:

The aim of this course is to

- Practice object-oriented programming in the Java programming language
- implement Classes, Objects, Methods, Inheritance, Exception, Polymorphism, User-defined Exception handling mechanism
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity
- Construct Threads, Event Handling, implement packages, Java FX GUI

Course Outcomes:

After completion of the course, students will be able to

- CO1:** Demonstrate understanding of Java syntax, data types, control structures, methods, classes, and objects. **(L2)**
- CO2:** Apply OOP principles and exception handling to solve programming problems. **(L3)**
- CO3:** Familiarize with Java libraries, APIs, threads, Collections Framework, I/O, and JDBC. **(L2)**
- CO4:** Design GUI applications proficiently using JavaFX. **(L4)**

Experiments covering the Topics:

- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

Sample Experiments:

Exercise – 1:

- a) Write a JAVA program to display default value of all primitive data type of JAVA
- b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise - 2

- a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
- b) Write a JAVA program to sort for an element in a given list of elements using bubble sort
- c) Write a JAVA program using String Buffer to delete, remove character.

Exercise - 3

- a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.



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- b) Write a JAVA program implement method overloading.
- c) Write a JAVA program to implement constructor.
- d) Write a JAVA program to implement constructor overloading.

Exercise - 4

- a) Write a JAVA program to implement Single Inheritance
- b) Write a JAVA program to implement multilevel Inheritance
- c) Write a JAVA program for abstract class to find areas of different shapes

Exercise - 5

- a) Write a JAVA program give example for “super” keyword.
- b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
- c) Write a JAVA program that implements Runtime polymorphism

Exercise - 6

- a) Write a JAVA program that describes exception handling mechanism
- b) Write a JAVA program Illustrating Multiple catch clauses
- c) Write a JAVA program for creation of Java Built-in Exceptions
- d) Write a JAVA program for creation of User Defined Exception

Exercise - 7

- a) Write a JAVA program that creates threads by extending Thread class. First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds, (Repeat the same by implementing Runnable)
- b) Write a program illustrating **is Alive** and **join()**
- c) Write a Program illustrating Daemon Threads.
- d) Write a JAVA program Producer Consumer Problem

Exercise – 8

1. Write a JAVA program that import and use the user defined packages
2. Without writing any code, build a GUI that display text in label and image in an Image View (use JavaFX)
3. Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

Exercise – 9

- a) Write a java program that connects to a database using JDBC
- b) Write a java program to connect to a database using JDBC and insert values into it.
- c) Write a java program to connect to a database using JDBC and delete values from it



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II Year – I Semester	L	T	P	C
	0	1	2	2
PYTHON PROGRAMMING				

Course Objectives:

The main objectives of the course are to

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

Course Outcomes:

After completion of the course, students will be able to

- CO1:** Understand Python programming basics including syntax, data types, operators, control flow, and exception handling. (**L2**)
- CO2:** Apply functions, string manipulations, and list operations using Python programming constructs. (**L3**)
- CO3:** Demonstrate knowledge of dictionaries, tuples, and sets for data storage and manipulation. (**L3**)
- CO4:** Implement file handling and object-oriented programming concepts including classes, inheritance, and polymorphism. (**L3**)
- CO5:** Utilize Python libraries and tools for data science tasks including JSON, NumPy, Pandas, and data visualization. (**L3**)

UNTI-I

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupiter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...else...else, Nested if statement, while

Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.



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4. Demonstrate the following Operators in Python with suitable examples.
 - i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators
 - v) Bit wise Operators vi) Ternary Operator vii) Membership Operators
 - viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT-II:

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments. **Strings:** Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
 - i. Addition
 - ii. Insertion
 - iii. slicing
6. Write a program to perform any 5 built-in functions by taking any list.

UNIT-III: Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple () Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, using zip () Function, Sets, Set Methods, Frozen set.

Sample Experiments:

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. Write a program to sum all the items in a given dictionary.



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UNIT-IV:

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python OS and OS path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

1. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.
5. Write a program to add, transpose and multiply two matrices
6. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V:

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array () function.
3. Python program to demonstrate use of ndim, shape, size, d-type.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Python program to find min, max, sum, cumulative sum of array
6. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas
7. data frame and explore the data through the data frame as follows:
 - a) Apply head () function to the pandas data frame
 - b) Perform various data selection operations on Data Frame
8. Select any two columns from the above data frame, and observe the change in one Attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books:

1. Introduction to Python Programming, Gowri Shankar S, Veena A., 1e,CRC Press,2019.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2ndEdition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, 1e,Pearson, 2017.



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Online Learning Resources/Virtual Labs:

1. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
2. <https://www.coursera.org/learn/python?specialization=python#syllabus>



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II Year – I Semester	L	T	P	C
	2	0	0	-
ENVIRONMENTAL SCIENCE				

Course Objectives:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

Course Outcomes

- CO1:** Explain the scope, importance of environmental studies, and issues related to natural resources. **(L2)**
- CO2:** Describe the structure and functions of ecosystems and conservation of biodiversity. **(L2)**
- CO3:** Identify types of pollution and suggest suitable control and management measures. **(L3)** **CO4:** Analyze environmental social issues, ethics, and related legislation. **(L4)**
- CO5:** Evaluate the impact of population on environment and human health. **(L5)**

UNIT I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem.
- b. Grassland ecosystem
- c. Desert ecosystem.
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)



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Biodiversity and its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III

Environmental Pollution: Definition, Cause, effects and control measures of :

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Textbooks:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.2012.
2. Environmental Studies, Palaniswamy, Pearson education,2014.



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3. Environmental Studies, S.Azeem Unnisa, Academic Publishing Company, 2015
4. Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus, K.Raghavan Nambiar, Scitech Publications (India), Pvt. Ltd. 2010.

References:

1. Textbook of Environmental Science, Deeksha Dave and E.Sai Baba Reddy, Cengage Publications., 2010.
2. Text book of Environmental Sciences and Technology, M.Anji Reddy, BS Publication, 2010.
3. Comprehensive Environmental studies, J.P.Sharma, Laxmi publications, 2005.
4. Environmental Sciences and Engineering, J. Glynn Henry and Gary W. Heinke, Prentice Hall of India Private limited, 2001.
5. A Text Book of Environmental Studies, G.R.Chatwal, Himalaya Publishing House, 2000.



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II Year – II Semester		L	T	P	C
		3	0	0	3
PROBABILITY & STATISTICS (Common to CSE, CSE (AI &ML), CSE(IoT), CSE(AI), AI &ML, CS, IT)					

Course Objectives:

- To introduce the basic concepts of data science and descriptive statistics for analyzing data characteristics.
- To provide a foundation in probability theory and commonly used probability distributions.
- To explain sampling techniques and estimation methods for making statistical inferences.
- To develop understanding of hypothesis testing procedures for decision-making based on sample data.
- To familiarize students with regression and correlation techniques for modeling and interpreting data relationships

Course Outcomes:

- CO1:** Describe basic statistical concepts and compute measures of central tendency and variability. **(L2)**
- CO2:** Apply probability concepts and solve problems using standard probability distributions. **(L3)**
- CO3:** Explain sampling theory and apply estimation techniques in statistical inference. **(L3)**
- CO4:** Perform hypothesis testing using various statistical tests for different sample types. **(L4)**
- CO5:** Apply regression techniques and compute correlation for data analysis. **(L3)**

UNIT I:

Descriptive statistics and methods for data science:

Data science – Statistics Introduction – Population vs Sample – Collection of data – primary and secondary data – Type of variable: dependent and independent Categorical and Continuous variables– Data visualization – Measures of Central tendency – Measures of Variability (spread or variance) – Skewness Kurtosis.

UNIT II:

Probability and Distributions:

Probability – Conditional probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution function – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

UNIT III:

Sampling Theory:

Introduction – Population and samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Introduction to t, chi-square and F- distributions – Point and Interval estimations –Standard error and Maximum error of estimate.



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UNIT IV:

Tests of Hypothesis:

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance- Confidence limits-Test of significance for large samples-single and two means – single and two proportions- Student's t- distribution- significance test of a sample mean – significance test of difference between sample means.F-test, chi-square test and test of goodness of fit.

UNIT V:

Regression analysis:

Method of least squares – Straight line – Parabola – Exponential – Power curves. Regression - Regression coefficients and properties – Curvilinear Regression, Multiple Regression - Correlation – Correlation coefficient – Rank correlation

Textbooks:

1. Probability and Statistics for Engineers, Miller and Freunds, 7/e, Pearson, 2008.
2. Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor, 11/e, Sultan Chand & Sons Publications, 2012.

Reference Books:

1. Probability and Statistics Engineers and the Scientists, Shron L. Myers, Keying Ye, Ronald E Walpole Edition, Pearson 2007.
2. A First Course in Probability, S. Ross, Pearson Education India, 2002.
3. An Introduction to Probability Theory and its Applications, W. Feller, 1/e, Wiley, 1968.
1. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
2. https://onlinecourses.nptel.ac.in/noc22_mg31/preview



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II Year – II Semester		L	T	P	C
		3	0	0	3
Statistical Methods for Data science					

Course Objectives:

- To introduce basic concepts of probability, random variables, and important probability distributions.
- To explain various methods of point estimation and their properties.
- To provide knowledge on interval estimation for population parameters.
- To develop the ability to test hypotheses using classical and modern methods.
- To equip students with skills to perform small sample tests in real-world applications.

Course Outcomes:

- CO1:** Understand the basic concepts of probability distributions and properties of estimators. **(L2)**
- CO2:** Apply various methods of point estimation to find suitable estimators. **(L3)**
- CO3:** Construct confidence intervals for population parameters using interval estimation techniques. **(L3)**
- CO4:** Analyze hypothesis testing procedures using likelihood and most powerful tests. **(L4)**
- CO5:** Perform small sample tests like t-test, F-test, and chi-square test for various applications. **(L3)**

UNIT I:

Basic Concepts

Random variables (discrete and continuous), probability density functions, properties, mathematical expectation. Probability distributions: Binomial, Poisson and Normal-their properties. Population, sample, parameter and statistic; characteristics of a good estimator; Consistency – Invariance property of Consistent estimator, Sufficient condition for consistency; Unbiasedness; Sufficiency.

UNIT II:

Point Estimation

Point Estimation- Estimator, Estimate, Methods of point estimation – Maximum likelihood method (the asymptotic properties of ML estimators are not included), Large sample properties of ML estimator (without proof)- applications, Method of moments, method of least squares, method of minimum chi-square and modified minimum chi-square-Asymptotic Maximum Likelihood Estimation and applications.

UNIT III:

Interval Estimation

Confidence limits and confidence coefficient; Duality between acceptance region of a test and a confidence interval; Construction of confidence intervals for population proportion (small and large samples) and between two population proportions(large samples); Confidence intervals for mean



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and variance of a normal population; Difference between the mean and ratio of two normal populations.

UNIT IV:

Testing of hypotheses

Types of errors, power of a test, most powerful tests; Neyman-Pearson Fundamental Lemma and its applications; Notion of Uniformly most powerful tests; Likelihood Ratio tests: Description and property of LR tests - Application to standard distributions.

UNIT V:

Small sample tests

Student's t-test, test for a population mean, equality of two population means, paired t-test, Ftest for Equality of two population variances, Chi-square test for goodness of fit and test for independence of attributes, χ^2 test for testing variance of a normal distribution.

Textbooks:

1. Probability and Statistics for Engineers, Miller and Freunds, 7/e, Pearson, 2008.
2. Statistical Inference – Testing of Hypotheses, Manoj Kumar Srivastava and Namita Srivastava, Prentice Hall of India, 2014

Reference Books:

1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
2. S. Ross, a First Course in Probability, Pearson Education India, 2002.
3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.
4. Robert V Hogg, Elliot A Tannis and Dale L.Zimmerman, Probability and Statistical Inference, 9th edition, Pearson publishers,2013.

Online Learning Resources:

1. [Https://onlinecourses.nptel.ac.in/noc21_ma74/preview](https://onlinecourses.nptel.ac.in/noc21_ma74/preview)
2. [Https://onlinecourses.nptel.ac.in/noc22_mg31/preview](https://onlinecourses.nptel.ac.in/noc22_mg31/preview)



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II Year – II Semester		L	T	P	C
		3	0	0	3
DATA ENGINEERING					

Course Objectives:

- Explain basic concepts of Data Engineering
- Discuss bout Data Engineering Life Cycle
- How to design Good Data Architecture

Course Outcomes:

- CO1:** Understand the fundamentals of data engineering, its lifecycle, and data engineer responsibilities and skills. (**L2**)
- CO2:** Analyze the data engineering lifecycle and key components including data generation, storage, ingestion, and transformation. (**L4**)
- CO3:** Design effective data architectures and practical data generation from various sources. (**L5**)
- CO4:** Evaluate storage systems, data ingestion methods, and considerations for efficient data engineering. (**L4**)
- CO5:** Apply and optimize data queries, transformations, and analytics for business and machine learning. (**L3**)

UNIT-I

Introduction to Data Engineering: Definition, Data Engineering Life Cycle, Evolution of Data Engineer, Data Engineering Versus Data Science, Data Engineering Skills and Activities, Data Maturity, Data Maturity Model, Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers and Other Technical Roles.

UNIT-II

Data Engineering Life Cycle: Data Life Cycle Versus Data Engineering Life Cycle, Generation: Source System, Storage, Ingestion, Transformation, Serving Data.

Major undercurrents across the Data Engineering Life Cycle: Security, Data Management, Data Ops, Data Architecture, Orchestration, Software Engineering.

UNIT-III

Designing Good Data Architecture: Enterprise Architecture, Data Architecture, Principles of Good Data Architecture, Major Architecture Concepts.

Data Generation in Source Systems: Sources of Data, Files and Unstructured Data, APIs, Application Databases (OLTP), OLAP, Change Data Capture, Logs, Database Logs, CRUD, Source System Practical Details.

UNIT-IV

Storage: Raw Ingredients of Data Storage, Data Storage Systems, Data Engineering Storage Abstractions, Data warehouse, Data Lake, Data Lakehouse.



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Ingestion: Data Ingestion, Key Engineering considerations for the Ingestion Phase, Batch Ingestion Considerations, Message and Stream Ingestion Considerations, Ways to Ingest Data

UNIT-V

Queries, Modeling and Transformation: Queries, Life of a Query, Query Optimizer, Queries on Streaming Data, Data Modelling, Modeling Streaming Data, Transformations, Streaming Transformations and Processing.

Serving Data for Analytics, Machine Learning and Reverse ETL: General Considerations for serving Data, Business Analytics, Operational Analytics, Embedded Analytics, Ways to serve data for analytics and ML, Reverse ETL.

Text Books:

1. Fundamentals of Data Engineering, Joe Reis, Matt Housley, O'Reilly Media, In., June 2022, ISBN:9781098108304

Reference Books:

1. Data Engineering with Python, Paul Crickard , Pack Publishing, October 2020.
2. The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Ralph Kimball, Margy Ross, Wiley, 3rd Edition, 2013
3. Data Pipelines Pocket Reference: Moving and Processing Data for Analytics, James Densmore, O'Reilly Media, 1st Edition, 2021



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II Year – II Semester	L	T	P	C
	3	0	0	3
DATABASE MANAGEMENT SYSTEMS				

Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

Course Outcomes:

CO1: Understand the basics of Database Management Systems including file systems, database models, architecture, and ER model. **(L2)**

CO2: Analyze the relational model, basic SQL commands, relational algebra, and relational calculus. **(L4)**

CO3: Construct SQL and relational algebra queries for CRUD operations, nested queries, aggregation, joins, and views. **(L3)**

CO4: Discuss functional dependency and normalization techniques with examples. **(L2)**

CO5: Describe transaction processing, concurrency control, and indexing techniques. **(L2)**

UNIT-I

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT-II:

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).



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UNIT-III

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion). Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view (updatable and non-updatable), relational set operations.

UNIT-IV

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce- Code normal form (BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT-V

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serialize ability, Recoverability, Implementation of Isolation, Testing for Serialize ability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Introduction to Indexing Techniques: B+ Trees, operations on B+ Trees, Hash Based Indexing:

Text Books:

- 1) Database Management Systems Raghurama Krishnan, Johannes Gehrke, , 3rd edition, TMH, 2002.(For Chapters 2, 3, 4)
- 2) Database System Concepts, Silberschatz, Korth, Sudarsan, 5th edition, TMH, 2005. (For Chapter 1 and Chapter 5)

Reference Books:

1. Introduction to Database Systems, C J Date, 8th edition, Pearson, 2006.
2. Database Management System, Ramez Elmasri, Shamkant B. Navathe, 6th edition, Pearson, 2010.
3. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning, 2012.

Web-Resources:

1. <https://nptel.ac.in/courses/106/105/106105175/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview



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II Year – II Semester		L 3	T 0	P 0	C 3
DIGITAL LOGIC & COMPUTER ORGANIZATION					

Course Objectives:

The main objectives of the course is to

- Provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals
- Describe memory hierarchy concepts
- Explain input/output (i/o) systems and their interaction with the cpu, memory, and peripheral devices

Course Outcomes:

CO1: Understand binary number systems, conversions, and basic combinational logic circuits. **(L2)**

CO2: Explain sequential circuits and the basic structure and organization of computers. **(L2)**

CO3: Perform arithmetic operations and describe processor organization techniques. **(L3)** **CO4:**

Analyze memory hierarchy, cache, and virtual memory organization. **(L4)**

CO5: Describe I/O organization, interfaces, and data transfer methods. **(L2)**

UNIT I:

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, components, Signed binary numbers, Binary codes

Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers

UNIT II:

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture

UNIT III:

Computer Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control

UNIT IV:

The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories,



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Memory Management Requirements, Secondary Storage

UNIT V:

Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces

Textbooks:

1. Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 6th edition, McGraw Hill, 2023.
2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education, 2018.
3. Computer Organization and Architecture, William Stallings, 11thEdition, Pearson, 2022.

Reference Books:

1. Computer Systems Architecture, M.Moris Mano, 3rdEdition, Pearson, 2017.
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier, 2004.
3. Fundamentals of Logic Design, Roth, 5thEdition, Thomson, 2003.

Online Learning Resources: <https://nptel.ac.in/courses/106/103/106103068/>



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II Year – II Semester		L	T	P	C
		0	0	3	1.5
DATA ENGINEERING LAB					

Course Objectives:

- The main objective of this course is to teach how build data engineering infrastructure and data pipelines.

Course Outcomes:

At the end of the course student will be able to:

- CO1:** Build data engineering infrastructure for effective data management. **(L3)**
- CO2:** Demonstrate reading and writing files using appropriate tools and techniques. **(L3)**
- CO3:** Build data pipelines and integrate them with dashboards for real-time insights. **(L3)**
- CO4:** Deploy data pipelines in production environments for operational use. **(L3)**

Experiments:

- Installing and configuring Apache NiFi, Apache Airflow
- Installing and configuring Elastic search, Kibana, PostgreSQL, pgAdmin 4
- Reading and Writing files
 - Reading and writing files in Python
 - Processing files in Airflow
 - NiFi processors for handling files
 - Reading and writing data to databases in Python
 - Databases in Airflow
 - Database processors in NiFi
- Working with Databases
 - Inserting and extracting relational data in Python
 - Inserting and extracting NoSQL database data in Python
 - Building database pipelines in Airflow
 - Building database pipelines in NiFi
- Cleaning, Transforming and Enriching Data
 - Performing exploratory data analysis in Python
 - Handling common data issues using pandas
 - Cleaning data using Airflow
- Building the Data Pipeline
- Building a Kibana Dash Board
- Perform the following operations
 - Staging and validating data
 - Building idempotent data pipelines



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- c. Building atomic data pipelines
- 9. Version Control with the NiFi Registry
 - a. Installing and configuring the NiFi Registry
 - b. Using the Registry in NiFi
 - c. Versioning your data pipelines
 - d. Using git-persistence with the NiFi Registry
- 10. Monitoring Data Pipelines
 - a. Monitoring NiFi in the GUI
 - b. Monitoring NiFi using processors
 - c. Monitoring NiFi with Python and the REST API
- 11. Deploying Data Pipelines
 - a. Finalizing your data pipelines for production
 - b. Using the NiFi variable registry
 - c. Deploying your data pipelines
- 12. Building a Production Data Pipeline
 - a. Creating a test and production environment
 - b. Building a production data pipeline
 - c. Deploying a data pipeline in production

Reference Books:

1. Data Engineering with Python, Paul Crickard, Packt Publishing, October 2020.



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II Year – II Semester	L	T	P	C
	0	0	3	1.5
DATABASE MANAGEMENT SYSTEMS LAB				

Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers,

Course Outcomes:

CO1: Understand the basics of Database Management Systems including file systems, database models, architecture, and ER model. (**L2**)

CO2: Analyze relational models, basic SQL commands, relational algebra, and relational calculus. (**L4**)

CO3: Construct SQL and relational algebra queries for CRUD operations, nested queries, aggregation, joins, and views. (**L3**)

CO4: Discuss functional dependencies, normalization techniques, transaction processing, concurrency control, and indexing techniques with examples (**L2**)

Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,
- Database connectivity- ODBC/JDBC

Sample Experiments:

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with subqueries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example :- Select the roll number and name of the student who Secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN),
4. GROUP BY, HAVING and Creation and dropping of Views.
5. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)



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6.

- i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
 - ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
7. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions
8. Program development using WHILE LOOPS, numeric FOR LOOPS, nested Loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION ERROR.
9. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
10. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
11. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
12. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
13. Create a table and perform the search operation on table using indexing and non-indexing techniques.
14. Write a Java program that connects to a database using JDBC
15. Write a Java program to connect to a database using JDBC and insert values into it
16. Write a Java program to connect to a database using JDBC and delete values from it

Text Books/ Suggested Reading:

1. Oracle: The Complete Reference, Oracle Press, 1997.
2. Database Systems Using Oracle, Nilesh Shah, PHI, 2007
3. Introduction to SQL, Rick F Vander Lans, 4th Edition, Pearson Education, 2007



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II Year – II Semester	L	T	P	C
	0	1	2	2

**EXPLORATORY DATA ANALYSIS USING PYTHON
(SKILL DEVELOPMENT COURSE)**

Course Objectives:

- This course introduces the fundamentals of Exploratory Data Analysis
- It covers essential exploratory techniques for understanding multivariate] data by summarizing it through statistical methods and graphical methods.

Course Outcomes:

- CO1:** Enumerate the fundamentals of Exploratory Data Analysis. (**L1**)
- CO2:** Visualize data using basic graphs and plots. (**L3**)
- CO3:** Apply different data transformation techniques. (**L3**)
- CO4:** Summarize data using descriptive statistics. (**L2**)
- CO5:** Evaluate models and select the best model. (**L5**)

UNIT-I

Exploratory Data Analysis Fundamentals: Understanding data science, the significance of EDA, Steps in EDA, Making sense of data, Numerical data, Categorical data, Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA, Getting started with EDA.

Sample Experiments:

1. a) Download Dataset from Kaggle using the following link:
<https://www.kaggle.com/datasets/sukhmanibedi/cars4u>
b) Install python libraries required for Exploratory Data Analysis (numpy, pandas, matplotlib, sea born)
2. Perform Numpy Array basic operations and Explore Numpy Built-in functions.
3. Loading Dataset into pandas data frame
4. Selecting rows and columns in the data frame

UNIT-II

Visual Aids for EDA: Technical requirements, Line chart, Bar charts, Scatter plot using seaborn, Polar chart, Histogram, Choosing the best chart

Case Study: EDA with Personal Email, Technical requirements, Loading the dataset, Data transformation, Data cleansing, Applying descriptive statistics, Data refactoring, Data analysis.

Sample Experiments:

1. Apply different visualization techniques using sample dataset
- a) Line Chart b) Bar Chart c) Scatter Plots d) Bubble Plot



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2. Generate Scatter Plot using seaborn library for iris dataset
3. Apply following visualization Techniques for a sample dataset
 - a) Area Plot b) Stacked Plot c) Pie chart d) Table Chart
4. Generate the following charts for a dataset.
 - a) Polar Chart b) Histogram c) Lollipop chart
5. Case Study: Perform Exploratory Data Analysis with Personal Email Data

UNIT-III

Data Transformation: Merging database-style data frames, concatenating along with an axis, Merging on index, Reshaping and pivoting, Transformation techniques, Handling missing data, Mathematical operations with NaN, Filling missing values, Discretization and binning, Outlier detection and filtering, Permutation and random sampling, Benefits of data transformation, Challenges.

Sample Experiments:

1. Perform the following operations
 - a) Merging Data frames
 - b) Reshaping with Hierarchical Indexing
 - c) Data Deduplication
 - d) Replacing Values
2. Apply different Missing Data handling techniques
 - a) NaN values in mathematical Operations
 - b) Filling in missing data
 - c) Forward and Backward filling of missing values
 - d) Filling with index values
 - e) Interpolation of missing values
3. Apply different data transformation techniques
 - a) Renaming axis indexes b) Discretization and Binning
 - c) Permutation and Random Sampling
 - d) Dummy variables

UNIT-IV

Descriptive Statistics: Distribution function, Measures of central tendency, Measures of dispersion, Types of kurtosis, Calculating percentiles, Quartiles, Grouping Datasets, Correlation, Understanding univariate, bivariate, multivariate analysis, Time Series Analysis

Sample Experiments:

1. Study the following Distribution Techniques on a sample data
 - a) Uniform Distribution
 - b) Normal Distribution
 - c) Gamma Distribution
 - d) Exponential Distribution
 - e) Poisson Distribution



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f) Binomial Distribution

2. Perform Data Cleaning on a sample dataset.
3. Compute measure of Central Tendency on a sample dataset
 - a) Mean b) Median c) Mode
4. Explore Measures of Dispersion on a sample dataset Variance b) Standard Deviation c) Skewness
d) Kurtosis
5. a) Calculating percentiles on sample dataset
b) Calculate Inter Quartile Range (IQR) and Visualize using Box Plots
6. Perform the following analysis on automobile dataset.
 - a. Bivariate analysis b) Multivariate analysis
7. Perform Time Series Analysis on Open Power systems dataset

UNIT-V

Model Development and Evaluation: Unified machine learning workflow, Data preprocessing, Data preparation, Training sets and corpus creation, Model creation and training, Model evaluation, best model selection and evaluation, Model deployment

Case Study: EDA on Wine Quality Data Analysis

Sample Experiments:

1. Perform hypothesis testing using stats models library
 - a) Z-Test b) T-Test
2. Develop model and Perform Model Evaluation using different metrics such as prediction score, R2 Score, MAE Score, and MSE Score.
3. Case Study: Perform Exploratory Data Analysis with Wine Quality Dataset

Text Book:

- a) Hands-On Exploratory Data Analysis with Python, Suresh Kumar Mukhiya, Usman Ahmed, Packt Publishing, 2020.

References:

1. Exploratory Data Analysis Using R, Ronald K. Pearson, CRC Press, 2020
2. Hands-On Exploratory Data Analysis with R: Become an expert in exploratory data analysis using R packages, Radhika Datar, Harish Garg, 1st Edition, Packt Publishing, 2019

Web References:

1. <https://github.com/PacktPublishing/Hands-on-Exploratory-Data-Analysis-with-Python>
2. <https://www.analyticsvidhya.com/blog/2022/07/step-by-step-exploratory-data-analysis-edu-using-python/#h-conclusion>
3. <https://github.com/PacktPublishing/Exploratory-Data-Analysis-with-Python-Cookbook>



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II Year – II Semester	L	T	P	C
	1	0	2	2
DESIGN THINKING & INNOVATION				

Course Objectives:

- The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes:

- CO1:** Define the concepts related to design thinking, the fundamentals of Design Thinking and innovation (**L2**)
- CO2:** Apply the design thinking techniques for solving problems in various sectors. (**L3**)
- CO3:** Analyse to work in a multidisciplinary environment (**L4**)
- CO4:** Evaluate the value of creativity (**L5**)
- CO5:** Formulate specific problem statements of real time issues (**L6**)

UNIT I

Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT II

Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT III

Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT IV

Product Design



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Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT V

Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes.

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Textbooks:

1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking for Strategic Innovation, Idris Mootee, John Wiley & Sons. 2013.

Reference Books:

1. Design Thinking in the Classroom, David Lee, Ulysses press, 2016.
2. Design the Future, Shruti N Shetty, Norton Press, 2021.
3. Universal Principles of Design- William Lidwell, Kritinaholden, Jill Butter, 2010.
4. The Era of Open Innovation Chesbrough. H, – 2013

Online Learning Resources:

- <https://nptel.ac.in/courses/110/106/110106124/>
- <https://nptel.ac.in/courses/109/104/109104109/>
- https://swayam.gov.in/nd1_noc19_mg60/preview