Program structure & Detailed Syllabus

2023

For

Under Graduate Programme (B.Tech)

ELECTRICAL AND ELECTRONICS ENGINEERING

(Applicable For Batches Admitted From 2023 – 2024)

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY
(AUTONOMOUS)

DUVVADA - VISAKHAPATNAM – 530 049

(An Autonomous Institute, Accredited by NAAC, Affiliated to JNTUGV, Vizianagaram, AP)

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY(A)
VISAKHAPATNAM
Academic Regulations (VR23) for B. Tech (Regular/Honors)

(Effective for the students admitted into I year from the Academic Year **2023-24** onwards)

The admissions of the students into B.Tech. course shall be as per the Govt. of Andhra Pradesh rules.

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 program of study for not less than four academic years and not more than eight 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 (Eight years).

   (ii) Registers for 160 credits and secures all 160 credits.
   For lateral entry scheme admission: Pursue a program of study
   For not less than three academic years and not more than six Academic years.

   (iii) Lateral entry candidate has to register for 120 credits from second year onwards and shall secure 120 credits.

   (b) Award of B.Tech. degree 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., 160 credits.
   (ii) Registering for Honors is optional.
   (iii) Honors is to be completed simultaneously with B.Tech. programme.

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. Program related terms

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. Programs of Study

The following B.Tech. Programs are offered:

S. No.	Program Code	Program & Abbreviation
01	01	Civil Engineering (CE)
02	02	Electrical and Electronics Engineering (EEE)
03	03	Mechanical Engineering (ME)
04	04	Electronics and Communication Engineering (ECE)
05	05	Computer Science and Engineering (CSE)
06	12	Information Technology (IT)
07	19	Electronics and Computer Engineering (E. Com E)
08	54	Artificial Intelligence and Data Science (AI&DS)
09	43	CSE–Artificial Intelligence
10	44	CSE –Data Science
11	46	CSE–Cyber Security

And any other Programs as approved by the authorities of the Institute from time to time.

6. Registration:

A student shall register for courses in each semester as per the courses offered in the specific B.Tech Program.

7. Curricular Program

The Curriculum of the four-year B. Tech Program has been designed to achieve a Healthy balance between theory and laboratory courses and Skills required for Industry. Further, focus is given to develop technical skills, Inter disciplinary skillsetc.,

8. Semester/Credits:

i) A semester comprises 90 working days and an academic year is divided into two semesters.

ii) The summer term is for minimum 4 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 completed well in advance through MOOCs satisfying prerequisites for elective courses.

9. Structure of the Undergraduate Programme

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	-

10. Course Classification:

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

S.No.	Broad Course Classification	Course Category	Description
1.	Foundation Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses
2.	Core Courses	Professional Core Courses (PC)	Includes subjects related to the parent discipline/department/branch of 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 non- credit courses	Covering subjects of developing desired attitude among the learners

11. Programme Pattern

i. Total duration of the of B. Tech (Regular/Honors) Programme 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, 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 / Communityservice activities are made mandatory as credit courses for all the under graduate students.

vi. Courses like Environmental Sciences, Indian Constitution, 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 credit courses for all the undergraduate students.

viii. Increased flexibility for students through the elective component of the curriculum, with 5 Professional Elective courses and 5 Open Elective courses.

ix. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.

x. A total of 4 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 5 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 weeks duration at the end of second and third year of the programme. 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 programme along with the project work.

xv. Undergraduate degree with Honors is introduced by the Institute for the students having good academic record.

xvi. Institution take measures to implement Virtual Labs (https://www.vlab.co.in) 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. Faculty shall assign as 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. 25% of course work for the theory courses in every semester may be conducted in the blended mode of learning.

12 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 400 marks, mandatory courses with no credits shall be evaluated for 30 mid semester marks.

For any course, student is considered to be passed upon securing minimum 35% marks in the external examination alone and minimum 40% marks from both internal and external examination put together for the theory, practical, design, drawing subject or project etc. In case of a mandatory course, he/she should secure 40% of the total marks.

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 midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper, 15 marks for subjective paper and 5 marks for assignment.

ii) Objective paper shall contain for 05 short answer questions with 2 marks each for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

Note:

- The objective paper shall be prepared in line with the quality of competitive examinations questions.
- The 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 objective paper shall be conducted on the day of subjective paper test.
- 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 Two and Half units of syllabus with one either or type question from each unit. The second mid term examination shall be conducted for remaining two and half 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: (25x0.8) + (20x0.2) = 24

If the student is absent for any one mid term 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: Absent
Marks obtained in second mid: 25
Final mid semester Marks: (25x0.8) + (0x0.2) =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 I shall contain 10 compulsory short answer questions for a total of 20marks such that each question carries 2 marks.

iii) There shall be 2 short answer questions from each unit.
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 1mark. 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.

iii) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

Practical Courses

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

b) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.

c) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the record/viva and 15 marks for the internal test.

d) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.

- 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 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.

e) 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 with the syllabus.

f) 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 reexamination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

g) The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years and shall be produced to the Committees as and when the same are asked for.

13 Skill oriented Courses

a. There shall be five skill-oriented courses offered during III to VII semesters.

b. 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.

c. 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.

d. 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 the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.

e. 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 equivalent marks/grades.

f. The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the Institution at the beginning of the semester.

g. In case a student fails in any skill course, he/she may be permitted to register for same course or alternative course decided by department committee. For the course opted by department committee minimum 32 hrs of the class work will be conducted. The internal marks secured earlier will be nullified if the course is changed. The assessment procedure of skill-oriented course remains same.

h. 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 Institution.

14. 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 for 2 credits or 12 weeks for 3 credits) offered through 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 student needs 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 MOOCs platform 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 Institution

To award credits the student should get certificate after they have registered for written exam and successfully passed

(Or)

College will conduct the written examination / Viva – voce and award the credits and grades.

In case a student fails in any online course, he/she may be permitted to register for the same course or an alternate course decided by the department committee. For course opted by the department committee minimum 48 hours of class work will be conducted. The internal marks secured earlier will be nullified if the course is changed. The assessment procedure of MOOCs course remains same as general theory course.

Note:

1. The registered course must not be same as any of the courses listed in the program structure of their regulation till final year including electives.
2. Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

15. 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 Institution 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 learning courses.
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 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 to guide the students from registration till completion of the credit course.
vii. The Institution shall ensure no overlap of MOOC exams with that examination schedules.
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 maintain 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 the light 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 institution from time to time.

16. Academic Bank of Credits (ABC)

The institution has implemented Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to

i. provide option of mobility for learners across the institutes 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.

17. Mini project (EPICS/CSP):

It is to be carried out during the second year. Students have an option to choose their own area of interest related to problems impacting the society. It is evaluated for 50 marks.

i) Internal assessment - 20 marks

ii) Project submission and Viva-Voce - 30 marks

18. Mandatory Internships

Summer Internships:

Two summer internships either onsite or virtual each with a minimum of 4 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 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 50% 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 Institution.

Full Semester Internship and Project work:

In the final semester, the student should mandatorily register and undergo internship 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.

18.1. Evaluation Procedure for Main Project:

Main project work shall be carried out in the IV-year, second semester and evaluated for **200 marks**. Out of a total of **200 marks** for the project work, **80 marks** shall be for Internal Evaluation and **120 marks** for the End Semester Examination.

18.2. Evaluation Procedure for Internship:

Internship work shall be carried out in the IV-year, second semester and evaluated for **200** marks. Out of a total of **200 marks** for the project work, **80** marks shall be for Internal Evaluation and **120 marks** for the End Semester Examination.

19. Attendance Requirements:

a. It is desirable for a candidate to have 100% attendance in the class in all the courses. However, a candidate shall be permitted to appear for the end semester examination if he/she has a minimum of 75% aggregate attendance in the semester. Student will not be permitted to write Mid examination if the attendance percentage is less than 75 % during the stipulated instruction duration. However, Academic Committee in the institute level shall review the situation and take appropriate decision.

   Note: Special cases for students having extra ordinary performance at National and International level will be considered by the Academic Committee.

b. Condonation of shortage of attendance may be considered on Medical grounds maximum up to 10%, if the student provides the medical certificate to the HOD immediately after he /she recovers from the illness. Medical Certificate submitted afterwards shall not be permitted. Shortage of attendance equal to or above 65% and below 75%will be condoned on payment of fee as fixed by the competent authority and the student concerned will be permitted to take the end semester examination. ***This privilege is given only three times for regular student and only two times for lateral entry student during the entire program of study***.

c. Shortage of attendance may be considered for the students who participate in prestigious sports, co and extra-curricular activities if their attendance is in the minimum prescribed limit.

d. A student will be promoted to the next semester if satisfies attendance and credits requirement.

20. Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements. For any course, student is considered to be passed upon securing minimum 40% marks in the external examination alone and minimum 50% marks from both internal and external examination put together

21. Promotion Policy:

a. A student shall be promoted from first year to second year if he fulfills the minimum attendance requirements.

b. To promote to III year, a student has to secure minimum 40% of total credits from I &II- year courses

c. To promote to IV year, a student has to secure minimum 40% of total credits from I, II&III- year courses

d. In case of Lateral entry students, to promote to IV year, a student has to secure minimum 40% of total credits from II & III –year courses

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 programme /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. An evaluation committee constituted by the Institution 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. Supplementary examinations:

Supplementary examinations for the odd Semester shall be conducted with the regular examinations of even semester and vice versa. In case a student fails in online courses/ industrial lecture(s), he/she may be permitted to register for another course /lecture(s).

24. Transitory Regulations

i. The student has to continue the course work along with the regular students of the respective semester in which the student getsre-admission.

ii. The student has to register for Substitute / Compulsory courses offered in place of courses studied earlier.

iii. The mode of internal evaluation and end-semester examinations shall be on par with the regular students, i.e., the student has to follow the mode of

internal evaluation and the then question paper model for the end – semester examinations along with the regular students of the respective semester in which the student gets re-admission. The marks secured in the internal and end-semester examinations will be pro-rated in accordance with the regulations under which the student was first admitted.

iv. For the courses studied under earlier regulations but failed, the student has to appear, pass and acquire credits from the supplementary examinations as and when conducted. The question paper model shall remain same as theone in which the student took examination during previous regulations.

v. The promotion criteria based on attendance as well as credits shall be in accordance with the regulations under which the student was first admitted.

vi. All other academic requirements shall be in accordance with the regulations under which the student was first admitted.

vii. The decision of the Principal is final on any other clarification in this regard.

viii. Transcripts: After successful completion of the entire program of study, a transcript containing performance of all academic years willbe issued as a final record. Partial transcript will also be issued up toany point of study to a student on request, after payment of requisitefee.

25. Minimum Instruction Days

The minimum instruction days for each semester shall be 16 weeks.

There shall be no branch transfers after the completion of the admission process.

26. Examinations and Evaluation

a. General guidelines

i. All the semester end examinations are conducted for duration of three hours

ii. External examination shall be conducted for 70 marks consist of five questions of internal choice carrying 12 marks each.

iii. For laboratory examinations, the evaluation is done by internal examiner and an external examiner.

b. Revaluation There is a provision for revaluation of theory courses if student fulfils the following norms.

The request for revaluation must be made in the prescribed format duly recommended by the Chief Superintendent of Examinations through Additional Controller along with the prescribed revaluation fee.

27. Grading System:

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade Point 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
	Ab (Absent)	0

Computation of SGPA

The following procedure is to be adopted to compute the Semester Grade Point Average.

(SGPA) and Cumulative Grade Point Average (CGPA):

The 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 under gone by a student,i.e.

SGPA (Si) = Σ (CixGi)/ΣCi

Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th}course.

Computation of CGPA

- The CGPA is also calculated in the same manner considering all the courses undergone by a student overall the semesters of a programme, i.e.

CGPA=Σ(CixSi)/Σ Ci

Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

Conversion of CGPA to Percentage:

Equivalent Percentage= (CGPA– 0.75) X 10

28. 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 three classes:

Regular:

Class Awarded	CGPA to be secured	From the CGPA secured from160 Credits.
First Class with Distinction	≥7.75with no failures	
First Class	≥ 6.75	
Second Class	≥5.75to<6.75	

Lateral – entry scheme

Class Awarded	CGPA to be secured	From the CGPA secured
First Class with Distinction	≥7.75with no failures	
First Class	≥ 6.75	From 121 credits from II Year to IV Year
Second Class	≥5.75to<6.75	

29. General Instructions

i. Where the words 'he', 'him', 'his', occur, they imply 'she','her', 'hers', also.

ii. The academic regulations should be read as a whole for the purpose of any interpretation.

iii. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman, Academic Council is final.

iv. The college may change or amend the academic regulations or syllabi from time to time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the institution.

30. With holding of Results

If the student has not paid the dues, if any, to the institute or in any case of indiscipline is pending against him, the result of the student will be withheld. His degree will be withheld in such cases.

Note: All other regulations including attendance requirements related to four year **B.Tech Regular program will be applicable for B.Tech. Lateral Entry Scheme.**

31. Malpractices Rules

DISCIPLINARY ACTION FOR MAL PRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/ Improper conduct	Punishment
1(a)	If the candidate possesses or keep accessible in examination hall, any paper, note book, programmable calculators,Cell phones, pager, palm computers or any other form of material concerned withor related to the course 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 course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	If the candidate 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 course 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	If the candidate has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester/year.
		The Hall Ticket of the candidate is to be cancelled.

3	If the candidate impersonates any other candidate in connection with the examination.	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 courses of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester / year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection withfor feature of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	If the candidate 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.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester / year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with for feature of seat.
5	If the candidate uses objection able, 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.	Cancellation of the performance in that course.
6	If the candidate refuses too by the orders of the Chief Superintendent/Assistant - Superintendent / any Officer on dutyor misbehaves or creates disturbance of any kind in and around the examination hall or organizes a Walkout or instigates others to walkout,	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester / year. The candidates also

	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 in dulges in any other act of mis conduct 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.	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.
7	If the candidate leaves the exam hall taking away answer script or intentionally tears of the script or any part there of inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester / year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with for feature of seat.
8	If the candidate possesses any lethal weapon or fire are min the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses 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 6to8.	Student of the college, expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses

		of that semester / year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and. A police case will be registered against them.
10	If the candidate comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester / year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during specials crutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester / year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Academic committee of the Institute for further action to award suitable punishment.	

32. UGC RECOMMENDED PUNISHMENT FOR RAGGING

i. Suspension from attending classes and academic privileges
ii. With holding / withdrawing scholarships / fellowship and other benefits.
iii. Debarring from appearing in any test / examination or other evaluation process with holding results
iv. Debarring from representing the institution in any regional, national or international meet, tournament, youth festival etc.
v. Suspension / expulsion from the hostel
vi. Cancellation of admission
vii. Rustication from the institution for period ranging from 1 to 4 semesters.
viii. Expulsion from the institution and consequent debarring from admission to any other institution for a specified period.
ix. Fine may extend upto Rs. 2.5lakh.

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B.TECH. -EEE –COURSE STRUCTURE–VR23

	I Year I Semester						
S.No.	**Course Code**	**Category**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	1000231101	BS	Linear Algebra & Calculus	3	0	0	3
2.	1000231102	BS	Engineering Physics	3	0	0	3
3.	1000231105	HS	Communicative English	2	0	0	2
4.	1001231101	ES/CIVIL	Basic Civil & Mechanical Engineering	3	0	0	3
5.	1002231101	ES/EEE	Basic Electrical &Electronics Engineering	3	0	0	3
6.	1002231111	HS	Communicative English Lab	0	0	2	1
7.	1000231110	BS	Engineering Physics Lab	0	0	2	1
8.	1002231110	ES/EEE	Electrical &Electronics Engineering workshop	0	0	3	1.5
9.	1005231110	PC/CSE	IT Workshop	0	0	2	1
10.	1000231120	MC	NSS/NCC/Scouts &Guides/Community Service	0	0	1	0.5
Total Credits							**19**

	I Year II Semester						
S.No.	**Course Code**	**Category**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	1002231201	PC/EEE	Electrical Circuit Analysis – I	3	0	0	3
2.	1003231101	ES/MECH	Engineering Graphics	1	0	4	3
3.	1000231103	BS	Chemistry	3	0	0	3
4.	1000231201	BS	Differential Equations and Vector calculus	3	0	0	3
5.	1005231101	ES/CSE	Introduction to Programming	3	0	0	3
6.	1000231112	BS	Chemistry Lab	0	0	2	1
7.	1002231210	PC/EEE	Electrical Circuits Lab	0	0	3	1.5
8.	1005231111	ES/CSE	Computer Programming Lab	0	0	3	1.5
9.	1003231110	ES/MECH	Engineering Workshop	0	0	3	1.5
10.	1000231121	MC	Health and Wellness,Yoga and Sports	0	0	1	0.5
Total Credits							**21**

I Year I Semester

SYLLABUS

I Year – I Semester	LINEAR ALGEBRA& CALCULUS (Common to All Branches of Engineering)	L	T	P	C
Course Code (1000231101)		3	0	0	3

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

- Develop matrix algebra techniques that is needed by engineers for practical applications.
- Familiarize with functions of several variables which is useful in optimization.
- Learn important tools of calculus in higher dimensions.
- Familiarize with double and triple integrals of functions of several variable sin two and three dimensions.

UNIT I Matrices

Rank of a matrix by echelon form, normal form. 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), and problems on the above theorems.

UNIT IV Partial differentiation and Applications

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 Multiple Integrals

Double integrals, triple integrals, change of order of integration, change of variables to polar coordinates. Finding areas and volumes in Cartesian coordinates.

Textbooks:

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

Reference Books:

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

I Year – I Semester		L	T	P	C
Course Code (1000231102**)**	**ENGINEERING PHYSICS (Common for all branches of Engineering)**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

1. Bridging the gap between the Physics in school at 10+2 level and UG level engineering courses.
2. To identify the importance of the optical phenomenon. interference, diffraction and polarization related to its Engineering applications
3. Enlighten the periodic arrangement of atoms in Crystalline solids by Bragg's law
4. To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
5. 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.
6. To Understand the Physics of Semiconductors and their working mechanism, Concept utilization of transport phenomenon of charge carriers in semiconductors.

COURSE OUTCOMES

CO1. **Explain** the need of coherent sources and the conditions for sustained interference (L2).
Identify the applications of interference in engineering (L3).
Analyze the differences between interference and diffraction with applications (L4).
Illustrate the concept of polarization of light and its applications (L2).
Classify ordinary refracted light and extraordinary refracted rays by their states of polarization (L2)

CO2. **Classify** various crystal systems (L2).
Identify different planes in the crystal structure (L3). **Analyze** the crystalline structure by Bragg's X-ray diffractometer (L4).

CO3. **Explain** the concept of dielectric constant and polarization in dielectric materials (L2).
Summarize various types of polarization of dielectrics (L2).
Interpret Lorentz field and Claussius-Mosotti relation in dielectrics (L2).
Classify the magnetic materials based on susceptibility and them temperature dependence (L2).

CO4**.** **Describe** the dual nature of matter (L1).
Explain the significance of wave function (L2). **Identify** the role of Schrodinger's time independent wave equation in studying particle in one- dimensional infinite potential well (L3).
Identify the role of classical and quantum free electron theory in the study of electrical conductivity (L3).

CO5**.** **Classify** the crystalline solids (L2).
Outline the properties of charge carriers in semiconductors (L2).
Identify the type of semiconductor using Hall Effect (L2).
Apply the concept of effective mass of electron (L3).

Unit-I: Wave Optics

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colors 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 & Diffraction Grating (Qualitative).

Polarization: Introduction -Types of polarization - Polarization by reflection, and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

Unit Outcomes:

The students will be able to

- **Explain** the need of coherent sources and the conditions for sustained interference (L2)
- **Identify** engineering applications of interference (L3)
- **Illustrate** the concept of polarization of light and its applications (L2)
- **Classify** ordinary polarized light and extraordinary polarized light (L2)

Unit II: Crystallography

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. Bragg's law - X-ray Diffractometer.

Unit Outcomes:

The students will be able to

- **Classify** various crystal systems (L2)
- **Identify** different planes in the crystal structure (L3)
- **Analyze** the crystalline structure by Bragg's X-ray diffractometer (L4)

Unit-III: Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation.

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

Unit Outcomes:

The students will be able to

- **Explain** the concept of dielectric constant and polarization in dielectric materials (L2)
- **Summarize** various types of polarization of dielectrics (L2)
- **Interpret** Lorentz field and Claussius- Mosotti relation in dielectrics(L2)
- **Classify** the magnetic materials based on susceptibility and their temperature dependence(L2)

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 and its temperature dependence.

Unit Outcomes:

The students will be able to

- **Explain** the concept of dual nature of matter (L2)
- **Understand** the significance of wave function (L2)
- **Interpret** the concepts of classical and quantum free electron theories (L2)

Unit – V: Semiconductors

Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Extrinsic semiconductors: density of charge carriers - Drift and diffusion currents – Einstein's equation - Hall effect and its Applications.

Unit Outcomes:

The students will be able to

- **Outline** the properties of charge carriers in semiconductors (L2)
- **Understand** the carrier transportation in semiconductors (L2)
- **Identify** the type of semiconductor using Hall effect (L2)

Text books:

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

Reference Books:

- "Fundamentals of Physics" - Halliday, Resnick and Walker, John Wiley &Sons.
- "Engineering Physics" - M.R. Srinivasan, New Age international publishers (2009).
- "Engineering Physics" - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
- "Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
- "Semiconductor physics and devices: Basic principle" - A. Donald, Neamen, Mc GrawHill.
- "Engineering Physics" - B.K. Pandey and S. Chaturvedi, Cengage Learning
- "Solid state physics" – A.J.Dekker ,Pan Macmillan publishers
- "Introduction to Solid State Physics" -Charles Kittel, Wiley

I Year – I Semester	COMMUNICATIVE ENGLISH (Common to All Branches of Engineering)	L	T	P	C
Course Code: (1000231104)		2	0	0	2

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

- **By the end of the course the students will have** Learned how to understand the context, topic, and specificinformation from social or transactional dialogues.
- Remedially learn applying grammatical structures to formulate sentence sand use appropriate words andcorrect word forms.
- Using discourse markers to speak clearly on a specific topic in formal as well as informal discussions.
  (notrequired)
- Improved communicative competence in formal and informal contexts and for social and academicpurposes.
- Critically comprehending and appreciating reading/listening texts and to write summaries and reviews based on global comprehension of these texts.
- Writing coherent paragraphs, paraphrase, 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 class work for the students can be to discuss and critically evaluate the texts based on the context, purpose or writing the text and understandingit from the author's as well as reader's point of view.
3. Reading as habit for both academic and non-academic (pleasure) purposes has 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 unitand 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 know 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: E-Mail writing

Mechanics of Writing-Capitalization, Spellings, and 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 and Book/movie/article review.

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 to.

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 specificcontext 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 graphical elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters

Grammar: 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 contexts.

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.

Text books:

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

Web Resources:

GRAMMAR:

1. **www.bbc.co.uk/learningenglish**

https://dictionary.cambridge.org/grammar/british-grammar/

I Year – I Semester	BASIC CIVIL & MECHANICAL ENGINEERING (Common to CE, ME, IT, CSE, CSE(DS), CSE(CS), CSE(AI))	L	T	P	C
Course Code (1001231101)		3	0	0	3

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.

UNITI

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.

UNITII

Surveying: Objectives of Surveying - Horizontal Measurements – Angular Measurements-Introduction to Bearings leveling instruments used for level ling-Simpleproblem son leveling and bearings-Contour mapping.

UNITIII

Transportation Engineering Importance of Transportation in Nation's economicdevelopment-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– Rain water 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.
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 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi.2016
3. Irrigation Engineering and Hydraulic Structures-Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S. K. Khanna, C.E.G. Justoand Veeraraghavan, Nemchandand Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500 -2012.

PARTB: 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, and 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 application so frobotics.(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.
2. A Tear book of Theory of Machines by S.S.Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

Reference Books:

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

I Year – II Semester	BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to All branches of Engineering)	L	T	P	Credits
Course Code 1002231101		3	0	0	3

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: After the completion of the course students will be able to

	Course Outcome
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 (8 Hours)

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 (8 Hours)

Machines: Construction, principle and operation of (i) DC Generator, (ii) Single Phase Transformer and (iii) Three Phase Induction Motor, 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: Electricity Bill & Safety Measures (8 Hours)

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), meritsand demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Text 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

Reference Books:

1. *Basic Electrical Engineering*, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, FourthEdition
2. *Principles of Power Systems*, V.K. Mehtha, 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. Bhatacharya, Person Publications, 2018,Second Edition.

E-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 digitalelectronics

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.

UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

Rectifiers and power supplies: Block diagram description of a dc power supply, working ofa full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system. 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, XORand XNOR. Simple combinational circuits–Half and Full Adders.

Textbooks:

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

Reference Books:

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

I Year – I Semester	COMMUNICATIVE ENGLISH LAB (Common to All Branches of Engineering)	L	T	P	C
Course Code: (1000231111)		0	0	2	1

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. (That can be for theory paper) is to train the students in oral communication skills in real situations. Students will get trained in the basic communication skills and also make them ready to face job interviews. They will be helped to overcome the mother tongue/local language influence and neutralize their accent which makes their speech more intelligible to all listeners.

Course Outcomes:

By the end of the course, the students will be having

- Understand the different aspects of the English language oral communication with emphasis on Listening and Speaking Skills.
- Apply communication skills through various language learning activities.
- Analyze the English speech sounds, stress, rhythm and intonation for better listening and speaking comprehension.
- Evaluate and exhibit professionalism in participating in debates and group discussions with polite turn taking strategies and sound more professional while communicating with others.
- Create effective resonate and prepare them to face interviews communicate appropriately in corporate settings.

List of Topics:

1. Vowels & Consonants (Not rules but use of them in various syllable structures)
2. Neutralization/Accent Rules (No rules again, required more practice)
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. Resume Writing
6. Group Discussions-Methods & Practice
7. Debates- Methods & Practice
8. PPT Presentations/ Poster Presentation
9. Interviews Skills

Suggested Software:

- Walden InfoTech
- Young India Films

Reference Books:

1. Meenakshi Raman, Sangeeta-Sharma. Technical Communication. Oxford Press.2018. (This can be for theory and not for lab)
2. Samson T: Innovate with English, Foundations
3. Grant Taylor: English Conversation Practice, Tata McGraw-Hill Education India, 2016.
4. Jaya shree, M Let's Hear them speak: Developing Listening-Speaking skills in English. Sage Publications.
5. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012. (T h a t is for reading and writing and can be used in theory classes but not in Lab)
6. T.Bala Subramanyam, A Textbook of English Phonetics for Indian Students,(3rd Ed) Trinity Press. (This is all theory and can be for MA English students but not for B.Tech students)

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
12. https://www.linguahouse.com/en-GB
13. https://www.ted.com/watch/ted-ed

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/UCNfm92h83W2i2ijc5XwpIA

I Year – I Semester		L	T	P	C
Course Code: (1000231110**)**	**ENGINEERING PHYSICS LAB** **(Common to All Branches of Engineering)**	**0**	**0**	**2**	**1**

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

CO1: Identify the mechanical behavior and mechanical parameters of materials.
CO2: Interpret some of the physical parameters based on optical phenomena.
CO3: Identify the characteristics of semiconducting materials, magnetic materials and dielectrics.
CO4: Estimate the parameters by diffraction techniques

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 for a dielectric substance using dielectric constant apparatus
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 photo cell.
8. Determination of the resistivity of semiconductors by four probe methods.
9. To study V-I characteristics of a PN junction diode in forward and reverse biasing conditions.
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.
19. Study of V-I characteristics of solar cell
20. Determine of laser bean divergence and spot size of a diode laser beam

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

References:

- A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.
- Physics Laboratory Manual for Undergraduate students – Dr. Santosh Kumar Alla, Dr. Ch. V. V. Ramana, Dr. T. Lakshmana Rao, Dr. R. Hanumantha Rao.

Web Resources

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

I Year – I Semester	ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP (Common to All branches of Engineering)	L	T	P	Credits
Course Code: 1002231110		0	0	3	1.5

Course Objectives:

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

Course Outcomes:

	Course Outcome
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:

1. 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.
2. 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.
3. 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:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. 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 andfundamentals of electron devices & its applications.

Course Outcomes: At the end of the course, the student willbe able to

CO1: Identify & testing of various electronic components.
CO2: Understand the usage of electronic measuring instruments.
CO3: Plot and discuss the characteristics ofvarious electron devices.
CO4: Explain the operation of adigital 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. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
6. 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, PearsonEducation, 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: All the experiments shall be implementedusing both Hardware and Software

I Year – I Semester		L	T	P	C
Course Code: (1005231110)	**IT WORKSHOP** (Common to All branches of Engineering)	**0**	**0**	**2**	**1**

Course Objectives:

To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables

- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of 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 Outcomes:

CO1: Perform Hardware troubleshooting.
CO2: Understand Hardware components and inter dependencies.CO3: Safeguard computer systems from viruses/worms.
CO4: Document/ Presentation preparation. CO5: Perform calculations using spreadsheets.

PC Hardware & Software Installation

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.

Task 2: 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. Avideo would be given as part of the course content.

Task 3: 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 (VMWare) 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 (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: 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 accessthe 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 withthe 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 studentsfor which they need to search on Google. This should be demonstrated to theinstructors 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 toavoid viruses and/or worms.

LaTeX and WORD

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

Task 2: Using La TeX 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 TeX 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.

Task 4: Creating a Newsletter: Features to be covered: - Table of Content, Newspaper 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 excel files, 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 helpthem create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, 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.

AI TOOLS – Chat GPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see howthe model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginningof 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 newreality."

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, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech,2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and KenQuamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, PatrickRegan– CISCO Press, Pearson Education, 3rd edition

I Year – I Semester		L	T	P	C
Course Code: (1000231120)	**NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE (Common to All branches of Engineering)**	**0**	**0**	**1**	**0.5**

Course Objectives:
The objective of introducing this course is to impart discipline, character, fraternity,team work, social consciousness among the students and engaging them in selfless service.

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

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

UNIT II Nature & Care Activities:

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

UNIT III Community Service Activities:

i) 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.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.

iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.

v) Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* 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. Davis M. L. and Cornwell D. A., ―Introduction to Environmental Engineering‖, 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. Ram Ahuja. *Social Problems in India*, 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, totaling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voice on the subject.

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I Year II Semester

SYLLABUS

I Year – II Semester	ELECTRICAL CIRCUIT ANALYSIS – I	L	T	P	Credits
Course Code: 1002231201		3	0	0	3

Course Objectives:
To develop an understanding of the fundamental laws, elements of electrical circuits and to apply circuit analysis to DC and AC circuits.

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

	Course Outcome
CO1	Remembering the basic electrical elements and different fundamental laws.
CO2	Understand the network reduction techniques, transformations, concept of self-inductance and mutual inductance, phasor diagrams, resonance and network theorems.
CO3	Apply the concepts to obtain various mathematical and graphical representations.
CO4	Analyse nodal and mesh networks, series and parallel circuits, steady state response, different circuit topologies (with R, L and C components).
CO5	Evaluation of Network theorems, electrical, magnetic and single-phase circuits.

UNIT-I: INTRODUCTION TO ELECTRICAL CIRCUITS (10 Hours)
Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources, node and mesh analysis.

UNIT-II: MAGNETIC CIRCUITS (10 Hours)
Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention – coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits.

UNIT-III: SINGLE PHASE CIRCUITS (10 Hours)
Characteristics of periodic functions, Average value, R.M.S. value, form factor, representation of a sine function, concept of phasor, phasor diagrams, and node and mesh analysis. Steady state analysis of R, L and C circuits to sinusoidal excitations-response of pure resistance, inductance, capacitance, series RL circuit, series RC circuit, series RLC circuit, parallel RL circuit, parallel RC circuit.

UNIT-IV: RESONANCE AND LOCUS DIAGRAMS (10 Hours)
Series Resonance: Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies; Parallel resonance: Q-factor, selectivity and bandwidth; Locus diagram: RL, RC, RLC with R, L and C variables.

UNIT-V: NETWORK THEOREMS (DC & AC EXCITATIONS) (10 Hours)
Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem.

Text Books:

1) *Engineering Circuits Analysis*, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.
2) *Network Analysis*, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition

Reference Books:

1. *Fundamentals of Electrical Circuits*, Charles K. Alexander and Mathew N.O. Sadiku, Mc Graw Hill Education (India), 2013, Fifth Edition
2. *Electric Circuits* (Schaum's outline Series), Mahmood Nahvi, Joseph Edminister, and K. Rao, Mc Graw Hill Education, 2017, Fifth Edition.
3. *Electric Circuits*, David A. Bell, Oxford University Press, 2009, Seventh Edition.
4. *Introductory Circuit Analysis*, Robert L Boylestad, Pearson Publications, 2023, Fourteenth Edition.
5. *Circuit Theory: Analysis and Synthesis*, A. Chakrabarti, Dhanpat Rai & Co., 2018, Seventh Revised Edition.

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ee81/preview
2. https://nptel.ac.in/courses/108104139
3. https://nptel.ac.in/courses/108106172
4. https://nptel.ac.in/courses/117106108

I Year – II Semester	ENGINEERING GRAPHICS (Common to All branches of Engineering)	L	T	P	C
Course Code (1003231101)		1	0	4	3

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.

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. Kannaiah, 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,TataMcGraw Hill, 2017.

I Year – II Semesters	Chemistry (Common to EEE, ECE, CSE, IT & allied branches)	L	T	P	C
Course Code (1000231103)		3	0	0	3

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 Ψ2, particle in one dimensional box, molecular orbital theory – bonding in homo- and hetero nuclear 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), Polyl 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. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University
Press, 2010.

Reference Books:

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

I Year – II Semester	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common to All Branches of Engineering)	L	T	P	C
Course Code: (1000231201)		3	0	0	3

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 into advanced level by handling various real-world applications.

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

- Solve the differential equations related to various engineering fields.
- Identify solution methods for partial differential equations that model physical processes.
- Interpret the physical meaning of different operators such as gradient, curl and divergence.
- 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 Higher order linear differential equations with Constant Coefficients

Definitions, homogenous and non-homogenous, complimentary function – particular integral ($(x) = e^{ax}$, $\sin ax$, $\cos a$, x^m), general solution, method of variation of parameters. Simultaneous linear equations.

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. Second order Homogeneous Linear Partial differential equations with constant coefficients.

UNIT IV Vector differentiation

Scalar and vector point functions, del operator, Gradient – unit normal vector, angle between surfaces, directional derivative, Divergence - Solenoidal vector and Curl– irrotational., scalar potential.

UNIT V Vector integration

Linear integral – circulation – work done, - flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), Divergence theorem (without proof) and problems on above theorems.

Text books:

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.Zilland Warren S.Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Michael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
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	INTRODUCTION TO PROGRAMMING	L	T	P	C
Course Code: (1005231101)	(Common to All branches of Engineering)	3	0	0	3

Course Objectives:

The objectives of this course are to acquire knowledge on the

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

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 andNotations.

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, Pointerto Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments.

UNIT-IV Functions:

Introduction Function: Declaration, Function Definition, Function Call, Categories ofFunctions, 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 — Enum variables, Using Typedef keyword, Bit Fields. Data Files: Introduction to Files, UsingFiles 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**.**

Course Outcomes:

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

i. Illustrate the Fundamental concepts of Computers and basics of computer programming and problem-solving approach
ii. Understand the Control Structures, branching and looping statements
iii. Use of Arrays and Pointers in solving complex problems.
iv. Develop Modular program aspects and Strings fundamentals.
v. Demonstrate the ideas of User Defined Data types, files. Solve real world problems using the concept of Structures, Unions and File operations.

Text Books:

1. A Structured Programming Approach Using C, Forouzan, Gilberg, Cengage.
2. How to solve it by Computer, R. G. Dromey, and Pearson Education.
3. Programming in C A-Practia1 Approach. Ajay Mittal, Pearson

References:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. Computer Programming. Reema Thareja, Oxford University Press
3. The C Programming Language, Dennis Richie And Brian Kernighan, Pearson Education.
4. Programming In C, Ashok Kamthane, Second Edition, Pearson Publication.
5. Let us C ,YaswanthKanetkar, 16th Edition,BPB Publication.
6. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education,2008

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 – II Semesters	Chemistry Laboratory (Common to EEE, ECE, CSE, IT & allied branches)	L	T	P	C
Course Code (1000231112)		0	0	2	1

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 nanomaterials 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. Siva sankar

I Year – II Semesters	ELECTRICAL CIRCUITS LAB	L	T	P	Credits
Course Code: 1002231210		0	0	3	1.5

Course Objectives:

To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics. It also gives practical exposure to the usage of different circuits with different conditions.

Course Outcomes:

	Course Outcome
CO1	**Understand the concepts of network theorems, node and mesh networks, series and parallel resonance and Locus diagrams.**
CO2	Apply various theorems to compare practical results obtained with theoretical calculations.
CO3	Determine self, mutual inductances and coefficient of coupling values, parameters of choke coil.
CO4	Analyse different circuit characteristics with the help of fundamental laws and various configurations.
CO5	Create locus diagrams of RL, RC series circuits and examine series and parallel resonance.

List of Experiments:

1. Verification of node and mesh analysis.
2. Verification of network reduction techniques.
3. Determination of cold and hot resistance of an electric lamp
4. Determination of Parameters of a choke coil.
5. Determination of self, mutual inductances, and coefficient of coupling
6. Series and parallel resonance
7. Locus diagrams of R-L (L Variable) and R-C (C Variable) series circuits
8. Verification of Thevenin's and Norton's Theorems
9. Verification of Maximum power transfer theorem
10. Verification of Compensation theorem
11. Verification of Reciprocity and Millman's Theorems

Reference Books:

1. *Engineering Circuits Analysis*, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc
   Graw Hill Education, 2005, sixth edition.
2. *Network Analysis*, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition

I Year – II Semester	COMPUTER PROGRAMMING LAB (Common to All branches of Engineering)	L	T	P	C
Course Code (1005231111)		0	0	3	1.5

Course Objectives:

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

Course Outcomes:

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.

UNIT I

WEEK 1
Objective: Getting familiar with the programming environment on the computer and writingthe first program.

Suggested Experiments/Activities:
Tutorial 1: Problem-solving using Computers.
Lab1: Familiarization with programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Exposure to Turbo C, gcc
iii) Writing simple programs using printf(), scanf()

WEEK 2
Objective: Getting familiar with how to formally describe a solution to a problem in aseries of finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:
Tutorial 2: Problem-solving using Algorithms and Flow charts.
Lab 1: Converting algorithms/flow charts into C Source code.
Developing the algorithms/flowcharts for the following sample programs

i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) 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

WEEK 4

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:

Tutorial4: Operators and the precedence and as associativity:

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

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:

Lab 5: 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 on1D 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 alongwith 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: Bit fields, Self-Referential Structures, Linked lists
Lab10: Bit fields, linked lists
Read and print a date using dd/mm/yyyy format using bit-fields and differentiate thesame 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 bit fields.
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 numericalintegration

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 l cm 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.

WEEK14:

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() andfwrite()
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-linearguments.
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. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

Reference Books:

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

I Year – II Semester	ENGINEERING WORKSHOP	L	T	P	C
Course Code: (1003231110)	(Common to All branches of Engineering)	**0**	**0**	**3**	**1.5**

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 includingfitting, carpentry, and foundry and welding.
CO3: Apply fitting operations in various applications.
CO4: Apply basic electrical engineering knowledge for House Wiring Practice

SYLLABUS

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
   a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring**: Familiaritywith different types of basic electrical circuits and make the following connections.
   a) Parallel and series b) Two-way switch c) Godown lighting
   d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **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. & UpadhyayP.A.; AtulPrakashan, 2021-22.

I Year – II Semester	HEALTH AND WELLNESS, YOGA AND SPORTS (Common to All branches of Engineering)	L	T	P	C
Course Code (1000231121)		0	0	1	0.5

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,Volley ball, 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:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones &Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The UltimateGuide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. --3rd Ed.
6. 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 fivechoices 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 01activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voice on the subject.

II Year I Semester

II Year – I Semester

S. No.	Category	Course Code	Name of the Course	L	T	P	Credits
1	Basic Science	1000232102	Complex Variables and Numerical Methods	3	0	0	3
2	Basic Science	1099232101	Universal Human Values – Understanding Harmony and Ethical Human Conduct	2	1	0	3
3	Engineering Science	1002232101	Electromagnetic Field Theory	3	0	0	3
4	Professional Core	1002232102	Electrical Circuit Analysis – II	3	0	0	3
5	Professional Core	1002232103	DC Machines and Transformers	3	0	0	3
6	Professional Core	1002232110	Electrical Circuit Analysis – II and Simulation Lab	0	0	3	1.5
7	Professional Core	1002232111	DC Machines and Transformers Lab	0	0	3	1.5
8	Skill Course	1002232180	Data Structures Lab	0	1	2	2
9	Engineering Science	1003232104	Design Thinking and Innovation	1	0	2	2
			Total:	**16**	**2**	**8**	**22**

Course Code	COMPLEX VARIABLES AND NUMERICAL METHODS	L	T	P	C
1000232102		3	0	0	3

COURSE OBJECTIVES:

This course aims to equip students with a deep understanding of complex variable theory and numerical methods for solving mathematical problems. Students will learn to analyze the behavior of complex functions, evaluate complex integrals using various theorems, and apply numerical techniques to solve algebraic, transcendental, and differential equations. Emphasis is placed on practical applications of numerical methods in engineering through curve fitting, interpolation, and integration, with a strong foundation in both theoretical and computational aspects.

COURSE OUTCOMES:

COs	At the end of the course, the student will have the ability to:
CO1	**Analyze** the limit, continuity, and differentiation of functions of complex variables and **apply** Cauchy-Riemann equations to identify analytic functions.
CO2	**Evaluate** complex contour integrals using Cauchy's theorems and integral formulas, and **classify** singularities, poles, and residues to solve complex integrals with the residue theorem.
CO3	**Apply** numerical methods to **solve** algebraic and transcendental equations, and **construct** interpolating polynomials using interpolation formulae.
CO4	**Solve** differential and integral equations using appropriate numerical techniques and **evaluate** the accuracy of the results.

UNIT-I:

Complex Variable – Differentiation **(10 Hours)**

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions harmonic functions, finding harmonic conjugate construction of analytic function by Milne Thomson method.

UNIT-II:

Complex Variable –Integration **(10 Hours)**

Line integral-Contour integration, Cauchy's integral theorem(Simple Case), Cauchy Integral formula, Power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

UNIT-III:

Solution of Algebraic & Transcendental Equations and Interpolation **(10 Hours)**

Solution of Algebraic & Transcendental Equations: Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton Raphson method.

Interpolation: Finite differences-Newton's forward and backward interpolation formulae-Lagrange's formulae.

UNIT-IV:

Curve fitting and Numerical Differentiation & Integration (10 Hours)

Curve fitting: Fitting of straight line, second-degree and Exponential curve by method of least squares.
Numerical Differentiation and Integration-Trapezoidal rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule

UNIT-IV:

Solution of Initial value problems to Ordinary differential equations (10 Hours)

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's and modified Euler's methods-Runge-Kutta methods (second and fourth order).

Text Books:

1) B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 44th ed., 2017.
2) S S Sastry, *Introductory Methods of Numerical Analysis*, PHI Learning Private Limited.

Reference Books:

1) Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 10th edition, 2018.
2) B.V.Ramana, *Higher Engineering Mathematics*, by Mc Graw Hill publishers
3) R.K.Jainand S.R.K.Iyengar, *Advanced Engineering Mathematics*, Alpha Science International Ltd., 5th Edition (9th reprint), 2021.

Subject Code	Universal Human Values – Understanding Harmony and Ethical Human Conduct	L	T	P	C
1099232101		2	1	0	3

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 Objectives:

	Course Outcome
CO1	Define and understand the concepts of natural acceptance, happiness, and prosperity, and identify the self in relation to family, society, and nature.
CO2	Apply learned human values to everyday situations and real-life scenarios.
CO3	Relate human values to human relationships and societal interactions, emphasizing their importance in a harmonious existence.
CO4	Justify the need for universal human values and develop as socially and ecologically responsible individuals and engineers.

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) (9 Hours)

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

UNIT-II:

Harmony in the Human Being (6 lectures and 3 tutorials for practice session) (9 Hours)

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) (9 Hours)

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) (6 Hours)

Lecture 19: Understanding Harmony in the Nature

Lecture 20: Interconnectedness, self-regulation and Mutual Fulfillment 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) (6 Hours)

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

b. The Teacher's Manual: R R Gaur, R Asthana, G P Bagaria, *Teachers' Manual for A Foundation Course in Human Values and Professional Ethics*, 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
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
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/UHVII%20Class%20Notes%20&%20Handouts/UHV%20Handout%201Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHVII%20Class%20Notes%20&%20Handouts/UHV%20Handout%202Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHVII%20Class%20Notes%20&%20Handouts/UHV%20Handout%203Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHVII%20Class%20Notes%20&%20Handouts/UHV%20Handout%205Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDPSI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicteindia.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%202325%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-humanvalues/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

Subject Code	Electromagnetic Field Theory	L	T	P	C
1002232101		3	0	0	3

Pre-requisite: Concepts of Differential Equations, Vector Calculus and Basic Electrical Circuits

Course Objectives:

- To study the production of electric field and potentials due to different configurations of static charges.
- To study the properties of conductors and dielectrics, calculate the capacitance of different configurations. Understand the concept of conduction and convection current densities.
- To study the magnetic fields produced by currents in different configurations, application of Ampere's law and the Maxwell's second and third equations, magnetic force and torque through Lorentz force equation in magnetic field environment like conductors and other current loops.
- To develop the concept of self and mutual inductances and the energy stored. • To study time varying and Maxwell's equations in different forms and Maxwell's fourth equation for the induced EMF.

Course Objectives:

	Course Outcome
CO1	Compute electric fields and potentials using Gauss's law, and solve Laplace's or Poisson's equations for various charge distributions.
CO2	Analyze the behavior of conductors in electric fields, evaluate electric dipoles, and assess capacitance and energy stored in dielectrics.
CO3	Calculate the magnetic field intensity due to current-carrying conductors, and apply Ampere's law and Maxwell's equations to magnetic forces.
CO4	Estimate self and mutual inductances, understand Faraday's laws, displacement current, and the Poynting theorem, and evaluate energy storage in magnetic fields.

UNIT-I:

Vector Analysis and Electrostatics **(10 Hours)**

Vector Analysis: Vector Algebra: Scalars and Vectors, Unit vector, Vector addition and subtraction, Position and distance vectors, Vector multiplication, Components of a vector. Coordinate Systems: Rectangular, Cylindrical and Spherical coordinate systems. Vector Calculus: Differential length, Area and Volume. Del operator, Gradient of a scalar, Divergence of a vector and Divergence theorem (definition only). Curl of a vector and Stoke's theorem (definition only).

Electrostatics: Coulomb's law and Electric field intensity (EFI) – EFI due to Continuous charge distributions (line and surface charge), Electric flux density, Work done in moving a point charge in an electrostatic field, Electric Potential- properties of potential function, Potential gradient, Gauss's law (Maxwell's first equation,), Laplace's and Poison's equations.

UNIT-II **(10 Hours)**

Conductors – Dielectrics and Capacitance: Behaviour of conductor in Electric field, Electric dipole and dipole moment – Potential and EFI due to an electric dipole, Torque on an Electric dipole placed in an electric field, Current density conduction and convection current densities, Ohm's law in point form, Behaviour of conductors in an electric field, Polarization, dielectric constant and strength, Continuity equation and relaxation time, Boundary conditions between conductor to dielectric, dielectric to dielectric and conductor to free space, Capacitance of parallel plate, coaxial and spherical capacitors, Energy stored and density in a static electric field.

UNIT-III **(10 Hours)**

Magneto statics, Ampere's Law and Force in magnetic fields: Biot-Savart's law and its applications viz. Straight current carrying filament, circular, square, rectangle and solenoid current carrying wire – Magnetic flux density and Maxwell's second Equation ( ), Ampere's circuital law and its applications viz. MFI due to an infinite sheet, long filament, solenoid, toroidal current carrying conductor, point form of Ampere's circuital law, Maxwell's third equation ( ). Magnetic force, moving charges in a magnetic field – Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors, Magnetic dipole, Magnetic torque, and moment.

UNIT-IV **(8 Hours)**

Self and mutual inductance: Self and mutual inductance – determination of self-inductance of a solenoid, toroid, coaxial cable and mutual inductance between a straight long wire and a square loop wire in the same plane – Energy stored and energy density in a magnetic field.

UNIT-V **(8 Hours)**

Time Varying Fields: Faraday's laws of electromagnetic induction, Maxwell's fourth equation, integral and point forms of Maxwell's equations, statically and dynamically induced EMF, Displacement current, Modification of Maxwell's equations for time varying fields, Poynting theorem and Poynting vector.

Text Books:

1. Matthew N O Sadiku, *Elements of Electromagnetics*, Oxford Publications, 7th Edition, 2018.
2. William H. Hayt& John. A. Buck, *Engineering Electromagnetics*, Mc. Graw-Hill, 9th Editon, 2020.

Reference Books:

1. D J Griffiths, *Introduction to Electro Dynamics*, Prentice-Hall of India Pvt. Ltd., 4th Edition, 2020.
2. Yaduvir Singh, *Electromagnetic Field Theory*, Pearson India, 1st edition, 2011.
3. Sunil Bhooshan, *Fundamentals of Engineering Electromagnetics*, Oxford University Press, 2012.

4. Joseph A. Edminister, Mahamood Navi, *Schaum's Outline of Electromagnetics*, 4th Edition, 2014.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/106/108106073/https://nptel.ac.in/courses/117103065

Course Code	ELECTRICAL CIRCUIT ANALYSIS-II	L	T	P	Credits
1002232102		3	0	0	3

Course Objectives:

- To understand three phase circuits
- To analyze transients in electrical systems
- To evaluate network parameters of given electrical network
- To apply Fourier analysis to electrical systems
- To understand graph theory for circuit analysis and to understand the behaviour of filter

Course Outcomes: At the end of this course students will demonstrate the ability to

	Course Outcome
CO1	Analyze three-phase circuits to measure the power supply in both balanced and unbalanced systems.
CO2	Determine the transient response of RL, RC, and RLC circuits using differential equations and Laplace transforms, and assess their behavior in time-domain analysis.
CO3	Evaluate two-port network parameters using various input and output excitation/response methods to characterize electrical systems.
CO4	Apply the concept of Fourier series to decompose and analyze electrical signals, and understand the significance and application of filters in electrical networks.

UNIT-I: Three phase circuits **(10 Hours)**

Analysis of three phase balanced circuits: Phase sequence – Star-delta connection of sources and loads – Relations between Line and Phase voltages and currents – Analysis of balanced three phase circuits – Measurement of Active and Reactive power.

Analysis of three phase unbalanced circuits: Loop method – Star-Delta transformation technique – Two-wattmeter method for measurement of three phase power.

UNIT-II: Transients analysis **(12 Hours)**

D.C. Transients analysis: Transient response of first order (R-L, R-C) and second order (R-L-C) circuits using differential equations approach and Laplace transform approach – time constant for R-L, R-C and R-L-C circuits.

A.C. Transients analysis: Transient response of first order (R-L, R-C) and second order (R-L-C) circuits using differential equations approach

UNIT-III: Two-Port Network **(10 Hours)**

Two-Port networks: Z, Y, T and H parameters of two port networks – conversion of Parameters from one form to other – Conditions for Symmetry and Reciprocity – Inter connection of Two Port networks.

UNIT-IV: Fourier Analysis **(10 Hours)**

Trigonometric and exponential form of Fourier series, evaluation of Fourier coefficients, Symmetry in Fourier Series – Even Symmetry, Odd Symmetry, Half Wave Symmetry, Quarter Wave Symmetry, Average & RMS values of periodic waveforms.

UNIT-V: Filters **(8 Hours)**

Need of Filters – Classification (based on frequency characteristics) – Low pass, High pass, Band pass and Band Elimination filters - Constant-k Low pass filter and Constant-k High pass filter - Design of Filters (Low pass and High pass).

Text Books:

1) *Circuit Theory: Analysis and Synthesis*, A. Chakrabarti, Dhanpat Rai & Co., 2018, 7th Revised Edition.
2) Alexander Ch. K. and Sadiku M.N.O., *Fundamentals of Electrical Circuits*, McGraw-Hill 5th ed.
3) *Network Analysis*, M. E. Van Valkenburg, 3rd Edition, PHI, 2019.

Reference Books:

1) William Hart Hayt, Jack Ellsworth Kemmerly and Steven M. Durbin, *Engineering Circuit Analysis*, McGraw-Hill Higher Education 7th ed. 2007.
2) Gopal G. Bhise, *Engineering Network Analysis and Filter design*, Umesh Publications.
3) *Network Theory*, N. C. Jagan and C. Lakshminarayana, 3rd Edition, B. S. Publications, 2015.
4) *Circuits and Networks Analysis and Synthesis*, A. Sudhakar, Shyam Mohan S. Palli, 5th Edition, Tata McGraw-Hill, 2017.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/117/106/117106108/
2. https://archive.nptel.ac.in/courses/108/105/108105159/

Course Code	D.C. MACHINES AND TRANSFORMERS	L	T	P	Credits
1002232103		3	0	0	3

Course Objectives:

1. To analyze the construction of DC generators, DC motors and transformers.
2. To elaborate the characteristics, methods of speed control and testing methods of DC machines and transformers
3. To predetermine the performance of single phase transformers with equivalent circuits and also find regulation and efficiency.
4. To describe poly-phase transformers and auto transformers and achieve three phase to two phase conversion.

Course Outcomes:

	Course Outcome
CO1	Understand the working principle and construction of DC machine and Transformers
CO2	Analyze the characteristics and testing methods of DC Machines and Transformers to assess the losses and efficiency.
CO3	Illustrate the need of starters, speed control methods and applications of DC machines.
CO4	Develop equivalent circuit and phasor diagrams of transformer with different load conditions

UNIT-I: INTRODUCTION TO DC MACHINES (10 Hours)

Construction and principle of operation of DC generator – Armature Windings-EMF equation for generator – Classification of DC machines based on excitation – OCC and External characteristics of DC shunt generator. Armature reaction and commutation– DC motor-principle of operation-Torque and back-emf equation of DC motors.

UNIT-II: PERFORMANCE AND TESTING OF D.C. MACHINES (10 Hours)

Characteristics of separately-excited and self excited motors (shunt, series and compound) - losses and efficiency- applications of dc motors. Necessity of starter – Starting by 3 point and 4 point starters – Speed control by armature rheostat and field control – Testing of DC machines - brake test, Swinburne's method – Hopkinson's test- retardation test.

UNIT-III: SINGLE-PHASE TRANSFORMERS (10 Hours)

Types and constructional details - principle of operation - EMF equation - operation on no load and operation on load –phasor diagrams on load and no load– equivalent circuit(Exact and approximate) – regulation – losses and efficiency-All day efficiency

UNIT-IV: SINGLE-PHASE TRANSFORMERS TESTING (10 Hours)

Tests on single phase transformers – open circuit and short circuit tests – Sumpner's test – separation of losses- -parallel operation with equal voltage ratios and problems

UNIT-V: AUTO TRANSFORMERS AND 3-PHASE TRANSFORMERS (10 Hours)

Basic principle of operation of Auto transformers, Construction of 3-PhaseTransformers-Connections Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ- On load and off load tap changers -Scott connection

Text Books:

1. *Electrical Machinery* by Dr. P S Bimbhra, Fully Revised edition, Khanna Publishers, New Delhi,2021.
2. *Performance and analysis of AC machines* by M.G. Say, CBS, 2002.

Reference Books:

1. *Electrical Machines* by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition, 2017.
2. *Electrical Machinery Fundamentals* by Stephen J Chapman McGraw Hill education 2017
3. *Generalized Theory of Electrical Machines* by Dr. P S Bimbhra, 7th Edition, Khanna Publishers, 2021.
4. *Theory & Performance of Electrical Machines* by J. B. Gupta, S. K. Kataria & Sons, 2013.
5. *Electric Machinery* by Fitzgerald, A.E.,Kingsley, Jr.,C.,& Umans, S. D, 7th edition, McGraw-Hill Education, 2014.

Online Learning Resources:

1. https://nptel.ac.in/courses/108/105/108105112
2. https://nptel.ac.in/courses/108/105/108105155

Course Code	ELECTRICAL CIRCUIT ANALYSIS-II AND SIMULATION LAB	L	T	P	Credits
1002232110		0	0	3	1.5

Course Objectives:

1. To measure three phase Active and Reactive power
2. To analyze transient behavior of circuits
3. To determine 2-port network parameters
4. To analyze electrical circuits using simulation tools

Course Outcomes:

	Course Outcome
CO1	Measure the three-phase power in both balanced and unbalanced circuits, and analyze the results to understand power distribution and consumption.
CO2	Determine the transient response of RL, RC, and RLC circuits, and examine the implications of these responses on circuit behavior over time.
CO3	Evaluate the two-port network parameters for various circuits, and characterize their performance using standard network analysis techniques.
CO4	Apply Kirchhoff's Voltage Law (KVL), Kirchhoff's Current Law (KCL), mesh, and nodal analysis techniques, and verify the validity of different electrical theorems using simulation tools.

Any 10 of the following experiments are to be conducted

S.No.	Title of the experiment
1	Measurement of Active Power and Reactive Power for balanced loads.
2	Measurement of Active Power and Reactive Power for unbalanced loads.
3	Determination of Z and Y parameters.
4	Determination of ABCD and hybrid parameters
5	Verification of Kirchhoff's current law and voltage law using simulation tools.
6	Verification of mesh and nodal analysis using simulation tools.
7	Verification of super position and maximum power transfer theorems using simulation tools.
8	Verification of Reciprocity and Compensation theorems using simulation tools.
9	Verification of Thevenin's and Norton's theorems using simulation tools.
10	Verification of series and parallel resonance using simulation tools.
11	Simulation and analysis of transient response of RL, RC and RLC circuits.
12	Verification of self-inductance and mutual inductance by using simulation tools.

Text Books:

1) Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co., 2018, 7th Revised Edition.
2) Alexander Ch. K. and Sadiku M.N.O., *Fundamentals of Electrical Circuits*, McGraw-Hill 5th ed.
3) Network Analysis, M. E. Van Valkenburg, 3rd Edition, PHI, 2019.

Reference Books:

1) William Hart Hayt, Jack Ellsworth Kemmerly and Steven M. Durbin, *Engineering Circuit Analysis*, McGraw-Hill Higher Education 7th ed. 2007.
2) Gopal G. Bhise, *Engineering Network Analysis and Filter design*, Umesh Publications.
3) Network Theory, N. C. Jagan and C. Lakshminarayana, 3rd Edition, B. S. Publications, 2015.
4) Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyam Mohan S. Palli, 5th Edition, Tata McGraw-Hill, 2017.

Course Code	DC MACHINES AND TRANSFORMERS LAB	L	T	P	Credits
1002232111		0	0	3	1.5

COURSE OBJECTIVES:

1. To plot the magnetizing characteristics of DC shunt generator and understand the mechanism of self-excitation.
2. To control the speed of the DC motors.
3. Determine and predetermine the performance of DC machines.
4. To predetermine the efficiency and regulation of transformers and assess their performance.

COURSE OUTCOMES:

COs	At the end of the course, the student will have the ability to:
CO1	To determine and predetermine the performance of DC machines
CO2	To control the speed of DC motor
CO3	To achieve three phase to two phase transformation
CO4	To determine and predetermine the performance of 1-phase Transformers 1-phase Transformers

Any 10 of the following experiments are to be conducted

S.No.	Name of the experiment
1	Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2	Brake test on DC shunt motor. Determination of performance curves.
3	Swinburne's test and Predetermination of efficiencies as Generator and Motor.
4	Speed control of DC shunt motor by Field and armature Control.
5	Retardation test on DC shunt motor. Determination of losses at rated speed.
6	OC & SC test on single phase transformer.
7	Sumpner's test on single phase transformer.
8	Scott connection of transformers
9	Parallel operation of Single phase Transformers
10	Separation of core losses of a single phase transformer
11	Brake test on DC compound motor-Determination of performance curves.
12	Load test on DC compound generator-Determination of characteristics.

Text Books:

1. Electrical Machinery by Dr. P S Bimbhra, Fully Revised edition, Khanna Publishers, New Delhi,2021.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition, 2017.
2. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2017
3. Generalized Theory of Electrical Machines by Dr. P S Bimbhra, 7th Edition, Khanna Publishers, 2021.
4. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria& Sons,2013.
5. Electric Machinery by Fitzgerald, A.E.,Kingsley, Jr.,C.,& Umans, S. D, 7th edition, McGraw-Hill Education, 2014.

Online Learning Resources:

1. nptel.ac.in/courses/108/105/108105112
2. nptel.ac.in/courses/108/105/108105155

Course code	DATA STRUCTURES LAB	L	T	P	C
1002232180		0	1	2	2

Pre-requisite: Fundamentals in C Programming.

Course Objectives:

- To provide the knowledge of basic data structures and their implementations.
- To understand importance of data structures in context of writing efficient programs.
- To develop skills to apply appropriate data structures in problem solving.

Course Outcomes:

At the end of the course, Student will be able to

CO1: Identify the role of data structures in organizing and accessing data.

CO2: Design, implement, and apply linked lists for dynamic data storage.

CO3: Develop applications using stacks and queues.

CO4: Design and implement algorithms for operations on binary trees and binary search trees.

CO5: Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.

UNIT I

Introduction to Data Structures: Definition and importance of Data structures, Abstract data types (ADTs) and its specifications, **Arrays**: Introduction, 1-D, 2-D Arrays, accessing elements of array, Row Major and Column Major storage of Arrays, **Searching Techniques**: Linear & Binary Search, **Sorting Techniques**: Bubble sort, Selection sort, Quick sort.

Sample Experiments:

1. Program to find min & max element in an array.
2. Program to implement matrix multiplication.
3. Find an element in given list of sorted elements in an array using Binary search.
4. Implement Selection and Quick sort techniques.

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.

Sample Experiments:

1. Write a program to implement the following operations.
   a. Insert b. Deletion c. Traversal
2. Write a program to store name, roll no, and marks of students in a class using circular double linked list.
3. Write a program to perform addition of given two polynomial expressions using linked list.

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.

Sample Experiments:

1. Implement stack operations using
   a. Arrays b. Linked list
2. Convert given infix expression into post fix expression using stacks.
3. Evaluate given post fix expression using stack.
4. Write a program to reverse given linked list using stack.

UNIT IV

Queues: Introduction to queues: properties and operations, Circular queues, implementing queues using arrays and linked lists, Applications of queues scheduling, etc.

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

Sample Experiments:

1. Implement Queue operations using
   a. Arrays b. Linked list
2. Implement Circular Queue using
   a. Arrays b. Linked list
3. Implement Dequeue using linked list.

UNIT V

Trees: Introduction to Trees, Binary trees and traversals, Binary Search Tree – Insertion, Deletion & Traversal.

Sample Experiments:

1. Implement binary tree traversals using linked list.
2. Write program to create binary search tree for given list of integers. Perform in-order traversal of the tree. Implement insertion and deletion operations.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
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.
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft.
3. Problem Solving with Algorithms and Data Structures by Brad Miller and David Ranum.
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick.

Course Code	DESIGN THINKING & INNOVATION	L	T	P	C
1003232104		1	0	2	2

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:

- Define the concepts related to design thinking. (L1, L2)
- Explain the fundamentals of Design Thinking and innovation (L1, L2)
- Apply the design thinking techniques for solving problems in various sectors. (L3)
- Analyse to work in a multidisciplinary environment (L4)
- Evaluate the value of creativity (L5)
- Formulate specific problem statements of real time issues (L3, 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

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

Reference Books:

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

II Year II Semester

II Year – II Semester

S. No.	Category	Course Code	Name of the Course	L	T	P	Credits
1	Management Course	1099232201	Managerial Economics and Financial Analysis	2	0	0	2
2	Engineering Science	1002232201	Analog Circuits	3	0	0	3
3	Professional Core	1002232202	Power Systems – I	3	0	0	3
4	Professional Core	1002232203	Induction and Synchronous Machines	3	0	0	3
5	Professional Core	1002232204	Control Systems	3	0	0	3
6	Professional Core	1002232210	Induction and Synchronous Machines Lab	0	0	3	1.5
7	Professional Core	1002232211	Control Systems Lab	0	0	3	1.5
8	Skill Course	1012232180	Python Programming	0	1	2	2
9	Audit Course	1001232125	Environmental Science	2	0	0	0
			Total:	**15**	**1**	**10**	**19**

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	L	T	P	C
1099232201		2	0	0	2

COURSE OBJECTIVES:

- To inculcate the basic knowledge of microeconomics and financial accounting.
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost.
- To Know the Various types of market structure and pricing methods and strategy.
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

COURSE OUTCOMES:

Cos	At the end of the course, the student will have the ability to:
CO1	**Explain** the principles of demand, production, cost analysis, and market structures, demonstrating their relevance to managerial decision-making.
CO2	**Apply** the concepts of cost behavior and break-even analysis to solve business problems and make informed production and pricing decisions.
CO3	**Analyze** investment opportunities using capital budgeting techniques, including Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period, to assess financial viability.
CO4	**Prepare** and **interpret** financial statements and performance metrics through ratio analysis to evaluate the financial health of a business.

UNIT-I: Managerial Economics **(8 Hours)**

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting-Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

UNIT-II: Production and Cost Analysis **(8 Hours)**

Introduction – Nature, meaning, significance, functions and advantages. Production Function–Least- cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

UNIT-III: Business Organizations and Markets **(8 Hours)**

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition– Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT-IV: Capital Budgeting **(8 Hours)**

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

UNIT-V: Financial Accounting and Analysis **(8 Hours)**

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1) Varshney & Maheswari, *Managerial Economics*, Sultan Chand.
2) Aryasri, *Business Economics and Financial Analysis*, 4/e, MGH.

Reference Books:

1. Ahuja Hl, *Managerial economics*, Schand.
2. S.A. Siddiqui and A.S. Siddiqui, *Managerial Economics and Financial Analysis*, New Age International.
3. Joseph G. Nellis and David Parker, *Principles of Business Economics*, Pearson, 2/e, New Delhi.
4. Domnick Salvatore, *Managerial Economics in a Global Economy*, Cengage.

Online Learning Resources:

1. https://www.slideshare.net/123ps/managerial-economics-ppt
2. https://www.slideshare.net/rossanz/production-and-cost-45827016
3. https://www.slideshare.net/darkyla/business-organizations-19917607
4. https://www.slideshare.net/balarajbl/market-and-classification-of-market
5. https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
6. https://www.slideshare.net/ashu1983/financial-accounting

Course Code	Analog Circuits	L	T	P	Credits
1002232201		3	0	0	3

Course Objectives:

1. To acquire the basic knowledge on clippers, clampers & biasing circuits.
2. To determine the h-parameters of a transistor circuit & understand the concepts of feedback amplifiers.
3. To know the operation of oscillators and operational amplifier.
4. To understand the applications of operational amplifier.
5. To acquire the knowledge on IC 555 timer and their applications.

Course Outcomes: At the end of this course students will demonstrate the ability to

	Course Outcome
CO1	Analyze diode clipping and clamping circuits. Understand different types of biasing circuits of a transistor.
CO2	Use small signal modeling for transistor circuit analysis and illustrate the operation of feedback amplifiers
CO3	Understand operation of oscillators, operational amplifiers and analyze the op-amp applications, comparators and wave form generators.
CO4	Use 555 timers in multi-vibrators, Schmitt Trigger and PLL applications

UNIT-I: **(12 Hours)**

Diode clipping and clamping circuits: Diode Clippers-Positive and Negative clippers, Diode Clampers - Positive and Negative Clampers.

DC biasing of BJTs: Load lines, Operating Point, Bias Stability, Collector-to-Base Bias, Self-Bias, Stabilization against Variations in VBE and β for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, Thermal Stability.

UNIT-II: **(12 Hours)**

Small Signals Modelling of BJT: Analysis of a Transistor Amplifier Circuit using h-parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers

Feedback Amplifiers: Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback.

UNIT-III: **(12 Hours)**

Oscillator Circuits: Barkhausen Criterion of oscillation, Oscillator operation, R-C phase shift oscillator, Wien bridge Oscillator, Crystal Oscillator

Operational Amplifiers: Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.

UNIT-IV: **(12 Hours)**

OP-AMPS Applications: Introduction, Basic linear Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Differentiator, integrator.

Comparators and Waveform Generators: Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators

UNIT-V: **(10 Hours)**

Timers and Phase Locked Loop: Introduction to 555 timer, functional diagram, Monostable and A stable operations and applications, Schmitt Trigger, PLL block schematic, principles and description of individual blocks, 565 PLL, Applications of VCO (566).

Text Books:

1. J. Millman, C.Halkias, *Electronic Devices and Circuits*, Tata Mc-Graw Hill, 4th Edition, 2015.
2. D. Roy Choudhury, *Linear Integrated Circuits*, New Age International (p) Ltd, 5th Edition, 2018.

Reference Books:

1. Robert L.Boylestad and Lowis Nashelsky, *Electronic Devices and Circuit Theory*, Pearson Edition, 2021.
2. G.K. Mithal, *Electronic Devices and Circuits*, Khanna Publisher, 23rd Edition, 2017.
3. Malvino, Albert Paul, and David J. Bates, *Electronic Principles*, McGraw-Hill/ Higher Education, 9th Edition 2021.
4. Gayakwad R.A, *Operational Amplifiers and Linear Integrated Circuits*, Pearson, 4th edition, 2021.

Course Code	Power Systems – I	L	T	P	Credits
1002232202		3	0	0	3

Course Objectives:

1. To study the principle of operation of different components of thermal power stations.
2. To study the principle of operation of different components of nuclear and hydro power stations.
3. To study the principle of operation of solar Photovoltaic (PV) system and its operational characteristics.
4. To study the principle of operation of wind energy, ocean energy, and tidal energy.
5. To study different types of load curves and tariffs applicable to consumers.

Course Outcomes:

	Course Outcome
CO1	Understand the operation of thermal and nuclear power plants and functions of their components.
CO2	Analyze the operation of PV cells.
CO3	Understand the operation of Hydro, Wind, Tidal, Wave Power Plants.
CO4	Analyze different economic factors of power generation and tariffs

UNIT-I: THERMAL POWER STATIONS (8 Hours)

Energy scenario in India, Selection of site, Characteristics of coal, Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gases - Brief description of TPS Components: Boilers, Super heaters, Economizers, Air pre-heaters, Steam Turbines, Condensers, Cooling towers and Chimney, Electrostatic precipitator, Turbo-Generator features, Efficiency of TPP.

UNIT-II: NUCLEAR AND HYDROELECTRIC POWER PLANTS (10 Hours)

Nuclear Power Stations: Nuclear Fission, Fusion and Chain reaction – Nuclear fuels - Principle of operation of nuclear reactor - Reactor Components: Moderators, Control rods, Reflectors and Coolants. Radiation hazards and nuclear waste disposal.

Hydroelectric Power Stations: Selection of site, Hydroelectric Power Plant Layout, Brief description of components, Classification of Hydroelectric Power Plants, Calculation of available Power.

UNIT-III: SOLAR PHOTOVOLTAIC CELLS (10 Hours)

Photovoltaic (PV) Cell, Module, Array, Materials used for PV cell, Construction and working principle, I-V characteristics, Equivalent circuit of solar cell, Efficiency of solar cells, Series and Parallel connection, effect of shading on PV Array Output. Concept of Maximum Power Point Tracking (MPPT), Solar PV applications, Batteries used in PV applications.

UNIT-IV: WIND, OCEAN AND TIDAL ENERGY (10 Hours)

Wind Energy, Types of forces acting on wind turbines, Betz Criteria (no proof), power in wind, Types of Wind turbines: Based on Axis of rotation and number of blades, Block diagram of WECS. Ocean Thermal Energy, Tidal Energy, Wave energy-Principle of operation only.

UNIT-V: ECONOMICS OF POWER GENERATION AND TARIFF METHODS (12 Hours)

Load curve, load duration and integrated load duration curves - Connected load, Maximum Demand, Demand factor, Load factor Diversity factor, Plant capacity factor, and plant use factor - Numerical Problems. Costs of Generation and their division into Fixed, Semi-fixed and Running Costs, Desirable Characteristics of a Tariff Method, Tariff Methods- Flat Rate, Block-Rate, two-part, three–part, and power Factor tariff methods, Numerical Problems.

Text Books:

1. B. H. Khan, *Non-Conventional Energy Resources*, 3rd ed. New York, NY, USA: McGraw Hill Education, [Unit-1, 2, 3, 4].
2. M. L. Soni, P. V. Gupta, U. S. Bhatnagar, and A. Chakraborti, *A Text Book on Power System Engineering*, 2nd ed. New Delhi, India: Dhanpat Rai & Co. Pvt. Ltd., 2010. [Unit-5].

Reference Books:

1. D. P. Kothari, K. C. Singal, and R. Ranjan, *Renewable Energy Sources and Emerging Technologies*, 2nd ed. New Delhi, India: PHI Learning Private Limited, 2011.
2. M. V. Deshpande, *Elements of Power Station Design and Practice*, New Delhi, India: Wheeler Publishing, 1979.
3. G. D. Rai, *Non-Conventional Energy Sources*, 5th ed. New Delhi, India: Khanna Publishers.

NPTEL/MOOC:

1. Steam and Gas Power Systems - Course (nptel.ac.in)
2. Electric Power Systems | Coursera
3. GATE & ESE - Course on Power System Generation by Unacademy

Course Code	Induction and Synchronous Machines	L	T	P	Credits
1002232203		3	0	0	3

COURSE OBJECTIVES:

1. To discuss the principle of operation and performance of three-phase induction motor and synchronous machines
2. To explain the torque producing mechanism of a single phase induction motor.
3. To describe the principle of operation, effect of armature reaction and predetermination of voltage regulation in synchronous generators.
4. To elaborate the operation, performance and starting methods of synchronous motors.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the construction and operation of synchronous and asynchronous machines
CO2	Interpret the torque producing mechanism and testing methods of synchronous and asynchronous machines
CO3	Analyze various starting methods, phasor diagrams and equivalent circuit of synchronous and asynchronous machines
CO4	Evaluate the performance of synchronous and asynchronous machines

UNIT-I: 3-PHASE INDUCTION MOTORS: (10 hours)

Construction details of cage and wound rotor machines - production of rotating magnetic field - principle of operation - rotor emf and rotor frequency - rotor current and pf at standstill and during running conditions - rotor power input, rotor copper loss and mechanical power developed and their interrelationship – equivalent circuit – phasor diagram, numerical , Applications

UNIT-II: CHARACTERISTICS AND TESTING METHODS OF INDUCTION MOTORS (10 hours)

Torque equation - expressions for maximum torque and starting torque - torque slip characteristic - crawling and cogging –no load and blocked rotor tests - circle diagram for predetermination of performance.

UNIT-III: STARTING METHODS OF 3-PHASE INDUCTION MOTORS AND 1-PHASE IM MOTORS (10 hours)

Methods of starting – starting current and torque calculations – induction generator operation (Qualitative treatment only), Single phase induction motors – Constructional features - Double revolving field theory–Starting methods - Equivalent circuit

UNIT-IV: CONSTRUCTION, OPERATION AND VOLTAGE REGULATION OF SYNCHRONOUS GENERATOR (10 hours)

Constructional features of non–salient and salient pole type – Armature windings– Distribution– Pitch and winding factors –E.M.F equation-Armature reaction-Voltage regulation by synchronous impedance method–and Potier (ZPF) triangle method–Phasor diagrams– Two reaction analysis of salient pole machines and phasor diagram.

UNIT-V: PARALLEL OPERATION OF SYNCHRONOUS GENERATOR, SYNCHRONOUS MOTOR – OPERATION, STARTING AND PERFORMANCE (10 hours)

Parallel operation with infinite bus and other alternators – Synchronizing power – Load sharing- Control of real and reactive power-Synchronous Motor principle and theory of operation– Methods of starting – Phasor diagram – Starting torque– Variation of current and power factor with excitation –Synchronous condenser –Hunting and its suppression, Applications

Text Books:

1. Electrical Machinery, Dr. P.S. Bhimbra, Khanna Publishing, New Delhi, Fully Revised Edition, 2021.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference Books:

1. Electrical machines, D.P. Kothari and I.J. Nagrath, McGraw Hill Education, 2017, Fifth Edition.
2. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria & Sons, 2013.
3. Electric Machinery, A.E.Fitzgerald, Charles kingsley, Stephen D.Umans, McGrawHill, 2020, Seventh edition.

Online Learning Resources:

1. nptel.ac.in/courses/108/105/108105131
2. https://nptel.ac.in/courses/108106072

Course Code	Control Systems	L	T	P	Credits
1002232204		3	0	0	3

Pre-requisite: Basic Engineering Mathematics

Course Objectives:

1. To obtain the mathematical models of physical systems and derive transfer function.
2. To determine the time response of systems and analyse system stability.
3. To analyse system stability using frequency response methods.
4. To design compensators using Bode diagrams.
5. To obtain the mathematical models of physical systems using state space approach and determine the response.

Course Outcomes:

COs	At the end of the course, the student will be able to:
CO1	*Analyze* the mathematical models of physical systems and *construct* transfer functions using block diagram reduction techniques and signal flow graphs.
CO2	*Evaluate* the time-domain response of first and second-order systems, *calculate* steady-state error constants, and *assess* system stability using Routh's stability criterion and root locus techniques.
CO3	*Examine* the frequency response of linear time-invariant systems, *determine* stability margins, and *interpret* results using Bode plots, Nyquist plots, and polar plots.
CO4	*Design* compensators such as Lag, Lead, and Lag-Lead to *enhance* system performance using Bode diagrams, and *verify* the impact on system stability and performance.

UNIT-I: Mathematical Modeling of Control Systems (10 Hours)

Classification of control systems, Open Loop and closed loop control systems and their differences, Feed Back Characteristics, transfer function of linear system, Differential equations of electrical networks, Translational and Rotational mechanical systems, Transfer Function of DC Servo motor - AC Servo motor- Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

UNIT-II: Time Response Analysis (10 Hours)

Standard test signals - Time response of first and second order systems - Time domain specifications - Steady state errors and error constants –Effects of PI,PD and PID.

Stability and Root Locus Technique

The concept of stability – Routh's stability criterion –limitations of Routh's stability –Root locus concept - construction of root loci (Simple problems)-Effect of additional open loop pole and zero on root locus.

UNIT-III: Frequency Response Analysis (10 Hours)

Introduction-Sinusoidal transfer function - Frequency domain specifications- Bode diagrams-transfer function from the Bode Diagram- Polar Plots, Nyquist Stability criterion – Relative stability analysis -Phase margin and Gain margin.

UNIT-IV: Classical Control Design Techniques **(8 Hours)**

Lag, Lead, Lag-Lead compensators, design of compensators using Bode plots.

UNIT-V: State Space Analysis of LTI Systems **(10 Hours)**

Concepts of state, state variables and state model, state space representation of transfer function, Solving the time invariant state equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

Text Books:

1. Kotsuhiko Ogata, *Modern Control Engineering*, Prentice Hall of India, 5th edition, 2015.
2. Benjamin C.Kuo, *Automatic control systems*, Prentice Hall of India, 9th Edition,2014.

Reference Books:

1. M.Gopal, *Control Systems principles and design*, Tata Mc Graw Hill education Pvt. Ltd., 4th Edition.
2. Norman S. Nise, *Control Systems Engineering*, Wiley Publications, 7th edition.
3. Manik Dhanesh N, *Control Systems*, Cengage publications.
4. I.J.Nagarath and M.Gopal, *Control Systems Engineering*, Newage International Publications, 5th Edition.
5. S.Palani, *Control Systems Engineering*, Tata Mc Graw Hill Publications

NPTEL/MOOC:

1. https://archive.nptel.ac.in/courses/107/106/107106081/
2. https://archive.nptel.ac.in/courses/108/106/108106098/
3. https://nptelvideos.com/video.php?id=1423&c=14

Course Code	INDUCTION AND SYNCHRONOUS MACHINES LAB	L	T	P	Credits
1002232210		0	0	3	1.5

COURSE OBJECTIVES:

1. To control the speed of three phase induction motors.
2. To determine the performance three phase and single phase induction motors.
3. To improve the power factor of single phase induction motor.
4. To predetermine the regulation of three–phase alternator by various methods and find Xd and Xq values of alternator and also asses the performance of three–phase synchronous motor.

COURSE OUTCOMES:

COs	At the end of the course, the student will have the ability to:
CO1	Evaluate the efficiency and control the speed of induction motor
CO2	Analyze the equivalent circuit and improve power factor of single phase induction motor
CO3	Determine the regulation and Xd and Xq values of alternators
CO4	Assess the performance of synchronous and asynchronous machines

Any 10 of the following experiments are to be conducted

S.No.	Name of the experiment
1	Brake test on Three phase induction motor
2	No–load & Blocked rotor tests on three phase Induction motor
3	Brake test on single phase induction motor
4	Equivalent circuit of single phase induction motor
5	Power factor improvement of single phase induction motor by using capacitors and load test on single phase induction motor.
6	Regulation of a three–phase alternator by synchronous impedance
7	Regulation of three phase alternator by Potier method.
8	Determination of efficiency of three phase alternator by loading with three phase induction motor.
9	Determination of X_d, X_q & Regulation of a salient pole synchronous generator.
10	V and Inverted V curves of a three—phase synchronous motor
11	Parallel operation of three-phase alternator under no-load condition.
12	V/F Speed control of Three phase induction motor.

Text Books:

1. Electrical Machinery by Dr. P S Bimbhra, Fully Revised edition, Khanna Publishers, New Delhi,2021.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition, 2017.
2. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2017
3. Generalized Theory of Electrical Machines by Dr. P S Bimbhra, 7th Edition, Khanna Publishers, 2021.
4. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria& Sons,2013.
5. Electric Machinery by Fitzgerald, A.E.,Kingsley, Jr.,C.,& Umans, S. D, 7th edition, McGraw-Hill Education, 2014.

Online Learning Resources:

1. nptel.ac.in/courses/108/105/108105131
2. https://nptel.ac.in/courses/108106072

Course Code	CONTROL SYSTEMS LAB	L	T	P	Credits
1002232211		0	0	3	1.5

COURSE OBJECTIVES:

1. To impart hands on experience to understand the performance of basic control system components such as magnetic amplifiers, D.C. servo motors, A.C. Servo motors and Synchro's.
2. To understand time and frequency responses of control system with and without controllers and compensators.
3. To know the different logic gates and Boolean expressions using PLC.

COURSE OUTCOMES:

COs	At the end of the course, the student will have the ability to:
CO1	*Analyze* the time-domain response of first-order and second-order systems to various inputs and *evaluate* system performance parameters.
CO2	*Design* and *implement* PID controllers and compensators to modify system dynamics and *improve* performance.
CO3	*Model* and *determine* the transfer function of DC motors and *interpret* their behavior in control applications.
CO4	*Assess* system stability using root locus, Bode plot, and Nyquist techniques and *apply* Kalman's test to analyze controllability and observability using MATLAB.

Any 10 of the following experiments are to be conducted

S.No.	Name of the experiment
1	Characteristics of AC servo motor & DC servo motor.
2	Potentiometer as an error detector.
3	Transfer function of DC motor
4	DC position control system
5	Time response of first and second order system
6	Effect of P, PD, PI, PID Controller on a first and second order systems.
7	Characteristics of magnetic amplifiers.
8	Drawing Bode plot, Root Locus, and Nyquist plot of a system in MATLAB.
9	Design of Lag and lead compensators for a system in frequency domain using MATLAB.
10	Test the Controllability and Observability for any system using MAT LAB.
11	Characteristics of Synchro Transmitter & Receiver.
12	Obtain state space model for any given system using MATLAB Software

Text Books:

1. Kotsuhiko Ogata, *Modern Control Engineering*, Prentice Hall of India, 5th edition, 2015.
2. Benjamin C.Kuo, *Automatic control systems*, Prentice Hall of India, 9th Edition,2014.

Reference Books:

1. M.Gopal, *Control Systems principles and design*, Tata Mc Graw Hill education Pvt. Ltd., 4th Edition.
2. Norman S. Nise, *Control Systems Engineering*, Wiley Publications, 7th edition
3. Manik Dhanesh N, *Control Systems*, Cengage publications.
4. I.J.Nagarath and M.Gopal, *Control Systems Engineering*, Newage International Publications, 5th Edition.
5. S.Palani, *Control Systems Engineering*, Tata Mc Graw Hill Publications

NPTEL/MOOC:

1. https://archive.nptel.ac.in/courses/107/106/107106081/
2. https://archive.nptel.ac.in/courses/108/106/108106098/
3. https://nptelvideos.com/video.php?id=1423&c=14

Course Code	PYTHON PROGRAMMING (Skill Course)	L	T	P	Credits
1012232180		0	1	2	2

Pre-requisite: Fundamentals of Programming Language

Course Objectives: The main objectives of the course are to

1. Introduce core programming concepts of Python programming language.
2. Apply built-In functions, strings and lists.
3. Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries.
4. Implement Modules and Regular Expressions in Python Programming and to create practical and contemporary applications.
5. Apply basic functional data science programming with python

Course Outcomes:

COs	At the end of the course, the student will have the ability to:
CO1	*Apply* core concepts of Python programming, including conditional statements, loops, and operators, to *develop* basic programs efficiently.
CO2	*Implement* and *manipulate* Python data structures such as lists, dictionaries, tuples, and sets to solve computational problems effectively.
CO3	*Design* Python programs using functions, modules, and file handling techniques to *process* and *manage* data efficiently.
CO4	*Analyze* data using Python libraries like NumPy and Pandas, and *visualize* relationships between attributes through data plotting and manipulation.

UNIT-I: **(9 Hours)**

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter 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-elif-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.
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: **(9 Hours)**

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: **(9 Hours)**

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, Frozenset ()

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.

UNIT-IV: **(9 Hours)**

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: **(9 Hours)**

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, dtype.
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 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.
7. 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. Gowri Shankar S, Veena A., *Introduction to Python Programming*, CRC Press.
2. S Sridhar, J Indumathi, V M Hariharan, *Python Programming*, 2nd Edition, Pearson, 2024.
3. Y. Daniel Liang, *Introduction to Programming Using Python*, Pearson.

Online Learning Resources/Virtual Labs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://nptel.ac.in/courses/106106182

Course Code	ENVIRONMENTAL SCIENCE	L	T	P	Credits
1001232125	**(Audit Course)**	2	0	0	0

Course Objectives:

1. To make the students to get awareness on environment.
2. 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.
3. To save earth from the inventions by the engineers.

Course Outcomes:

COs	At the end of the course, the student will be able to:
CO1	*Explain* the importance of environmental studies, *describe* natural resources and their sustainable management, and *analyze* the impact of human activities on natural systems.
CO2	*Classify* ecosystems based on structure and function, *illustrate* energy flow through ecological models, and *propose* methods for biodiversity conservation at local and global levels.
CO3	*Identify* major types of environmental pollution, *evaluate* their causes and effects, and *design* strategies for solid waste management and pollution control.
CO4	*Assess* the impact of population growth and social issues on the environment, *apply* environmental legislation for sustainable development, and *formulate* solutions for global environmental challenges such as climate change and resource depletion.

UNIT-I **(6 Hours)**

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 **(6 Hours)**

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)

Biodiversity and its Conservation: Introduction – 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-sports 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 **(6 Hours)**

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 **(6 Hours)**

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 **(6 Hours)**

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

References:

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

III Year I Semester

III Year – I Semester

S. No.	Category	Course Code	Name of the Course	L	T	P	Credits
1	Professional Core	1002233101	Power Electronics	3	0	0	3
2	Professional Core	1002233102	Digital Circuits	3	0	0	3
3	Professional Core	1002233103	Power Systems – II	3	0	0	3
4	**Professional Elective – 1**			3	0	0	3
		1002233130	Signals and Systems				
		1002233131	Computer Architecture and Organization				
		1002233132	Communication Systems				
5	**Open Elective – 1**			3	0	0	3
		1054232101	Database management systems				
		1019233150	Fundamentals of internet of things				
6	Professional Core Lab	1002233110	Power Electronics Lab	0	0	3	1.5
7	Professional Core Lab	1002233111	Analog and Digital Circuits Lab	0	0	3	1.5
8	Skill Course	1002233180	Soft Skills	0	1	2	2
9	Engineering Science	1002233112	Tinkering Lab	0	0	2	1
10	Internship	1002233170	Evaluation of Community Service Project Internship (Done during II-II Summer Vacation – 8 Weeks)	0	0	0	2
11	Audit Course	1002233125	Technical Paper Writing & IPR	2	0	0	0
Total:				**17**	**1**	**10**	**23**

Subject Code	POWER ELECTRONICS	L	T	P	Credits
1002233101		3	0	0	3

Course Objectives:

1. To introduce the characteristics and switching behavior of power semiconductor devices such as SCR, MOSFET, and IGBT.
2. To provide knowledge on the operation and analysis of single-phase and three-phase AC-DC converters.
3. To explain the working principles of AC voltage controllers and their control techniques.
4. To illustrate the operation and design considerations of switched-mode DC-DC converters in different conduction modes.
5. To impart knowledge on the functioning and modulation techniques of single-phase and three-phase inverters.

Course Outcomes:

	Course Outcome
CO1	Analyze the static and dynamic characteristics of SCR, MOSFET, and IGBT and design appropriate driver circuits.
CO2	Evaluate the performance of single-phase and three-phase AC-DC converters for different types of loads under various conduction modes.
CO3	Compare and compute the output characteristics of buck, boost, and buck-boost converters in both CCM and DCM using control techniques.
CO4	Design and simulate inverter circuits using various PWM techniques for single-phase and three-phase systems.

UNIT-I: Power Semiconductor Devices **(8 Hours)**

Silicon controlled rectifier (SCR) – Two transistor analogy - Static and Dynamic characteristics – Turn on and Turn off Methods - Triggering Methods (R, RC and UJT) – Snubber circuit design.

Static and Dynamic Characteristics of Power MOSFET and Power IGBT - Gate Driver Circuits - Numerical problems.

UNIT-II: Single-Phase AC-DC Converters **(8 Hours)**

Applications of AC to DC converters - 1-ph. Diode controlled rectifiers – R and RL loads with and without freewheeling diode - Single-phase half-wave controlled rectifiers - R and RL loads with and without freewheeling diode - Single-phase fully controlled bridge converter with R, RL and RLE loads - Continuous and Discontinuous conduction - Effect of source inductance in Single-phase fully controlled bridge rectifier – Expression for output voltages – Single-phase Semi-Converter with R load-RL load and RLE load – Continuous and Discontinuous conduction - Numerical Problems.

UNIT-III: Three-phase AC-DC Converters & AC – AC Regulators **(8 Hours)**

Three-phase AC-DC Converters: 3- Ph. Full Wave Uncontrolled Rectifier with R & RL Loads

AC – AC Regulators: Single-phase AC-AC power control by phase control with R and RL loads - Expression for rms output voltage –Numerical Problems.

UNIT-IV: Switched Mode DC–DC Converters **(8 Hours)**

Analysis of Buck, Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) - Output voltage equations using volt-sec balance in CCM & DCM – Expressions for output voltage ripple and inductor current ripple – control techniques – Introduction to PWM control -Numerical Problems.

UNIT-V: DC–AC Converters **(8 Hours)**

Introduction - Single-phase half-bridge and full-bridge inverters with R and RL loads – PWM with bipolar voltage switching, PWM with unipolar voltage switching - Three-phase square wave inverters 120° conduction and 180° conduction modes of operation - Sinusoidal Pulse Width Modulation - Numerical Problems.

Text Books:

1. Ned Mohan, Tore M Undeland, *Power Electronics: Converters, Applications and Design*, William P Robbins, John Wiley & Sons, 2002.
2. M. H. Rashid, *Power Electronics: Circuits, Devices and Applications*, Prentice Hall of India, 2nd edition, 2017.
3. L.Umanand, *Power Electronics: Essentials & Applications*, Wiley, Pvt. Limited, India, 2009.

Reference Books:

1. Philip T.Krein, *Elements of Power Electronics*, Oxford University Press; Second edition, 2014.
2. P.S.Bhimbra, *Power Electronics*, Khanna Publishers.
3. G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, *Thyristorised Power Controllers*, New Age International (P) Limited Publishers, 1996.
4. Daniel W.Hart, *Power Electronics*, Mc Graw Hill, 2011.

Online Learning Resources:

1. https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007
2. https://archive.nptel.ac.in/courses/108/101/108101126

Subject Code	Digital Circuits	L	T	P	Credits
1002233102		3	0	0	3

Course Objectives:

1. To know the simplification methods of Boolean functions
2. To understand the realization of arithmetic, data routing and memory logic circuits.
3. To know the operation and design of various counters and registers.
4. To understand the analysis and design of synchronous sequential circuits.
5. To understand the basic concepts of digital integrated circuits.

Course Outcomes:

	Course Outcome
CO1	Explain the concepts of Boolean algebra, K-map, tabulation method in minimization of switching functions and able to design the arithmetic combinational circuits.
CO2	Realize different types of data routing combinational circuits and PLDs.
CO3	Apply knowledge of flip-flops in designing of registers and counters.
CO4	Analyze synchronous sequential circuits and understand the logic families.

UNIT-I: Combinational logic circuits – I **(10 Hours)**

Number system and representation of negative no's, Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, simplification of logic functions using Boolean theorems, NAND and NOR implementations, Karnaugh maps – 3 and 4 variables, Incompletely specified functions (Don't care terms), Simplifying Max term equations, Quine-McCluskey minimization technique, General approach to combinational logic design, Look ahead carry adder, 4-bit adder-subtractor circuit, BCD adder circuit, Binary comparators.

UNIT-II: Combinational logic circuits – II **(10 Hours)**

Decoders, , 7 segment decoder, higher order decoder, multiplexer, higher order multiplexing, de-multiplexers, higher order de-multiplexing, realization of Boolean functions using decoders, multiplexers, encoders, priority encoder, Programmable ROM, PAL, PLA-Basics structures, programming tables of PROM, PAL, PLA, realization of Boolean functions.

UNIT-III: Sequential logic circuits **(10 Hours)**

Timing considerations of flip-flops, master-slave flip-flop, edge triggered flip-flops, characteristic equations, flip-flops with reset and clear terminals, excitation tables, conversion from one flip-flop to another flip-flop, design of asynchronous and synchronous counters, design of modulus-N counters, Johnson counter, ring counter, design of registers, shift register, bi- directional shift register, universal shift register.

UNIT-IV: Sequential Circuit Design **(10 Hours)**

Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, Analysis of clocked sequential circuits, realization of sequence detector circuit, state reduction and assignments,

UNIT-V: Digital integrated circuits **(10 Hours)**

Logic levels, propagation delay time, power dissipation, fan-out and fan-in, noise margin, logic families – RTL and DTL Circuits, TTL, Emitter-Coupled Logic, Metal-Oxide Semiconductor.

Textbooks:

1. Switching and finite automata theory Zvi. Kohavi, 3rd edition, Cambridge University Press, 2010.
2. M. Morris Mano and M. D. Ciletti, “Digital Design”, 4th Edition, Pearson Education,2006.

Reference Books:

1. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers, 5th Edition, 1992.
2. Switching Theory and Logic Design by A. Anand Kumar, Prentice Hall India Pvt., Limited, Third Edition, 2016.

Subject Code	POWER SYSTEMS-II	L	T	P	Credits
1002233103		3	0	0	3

Course Objectives:

1. To understand the concepts of GMD & GMR to compute inductance& capacitance of transmission lines.
2. To distinguish the models of short, medium and long length transmission lines and analyzes their performance.
3. To learn the effect of travelling waves on transmission lines with different terminal conditions.
4. To learn the concepts of corona, the factors effecting corona and effects of transmission lines.
5. To design the sag and tension of transmission lines as well as to learn the performance of line insulators.

Course Outcomes:

	Course Outcome
CO1	Compute the inductance/capacitance of transmission lines for different circuit configurations.
CO2	Analyze the performance of short, medium and long transmission lines.
CO3	Estimate the effects of corona in transmission lines.
CO4	Calculate sag and tension of transmission lines and design the line insulators.

UNIT-I: Transmission Line Parameters **(10 Hours)**

Conductor materials - Types of conductors – Calculation of resistance for solid conductors – Calculation of inductance for single phase and three phase, Single and double circuit lines– Concept of GMR and GMD – Symmetrical and asymmetrical conductor configuration with transposition –Bundled conductors, Numerical Problems–Calculation of capacitance for 2 wire and 3 wire systems, Capacitance calculations for symmetrical single and three phase– Single and double circuit lines- Bundled conductors–Numerical Problems.

UNIT-II: Short & Medium Transmission Lines **(10 Hours)**

Classification of Transmission Lines – Short, medium, long line and their model representations –Nominal-T–Nominal-Pie and A, B, C, D Constants for symmetrical and Asymmetrical Networks– Numerical Problems– Mathematical Solutions to estimate regulation and efficiency of all types of lines – Numerical Problems.

UNIT-III: Long Transmission Lines **(10 Hours)**

Long Transmission Line–Rigorous Solution – Evaluation of A,B,C,D Constants– Interpretation of the Long Line Equations, regulation and efficiency–Representation of Long Lines – Equivalent-T and Equivalent Pie network models (Numerical Problems). Long Transmission Lines– Incident, Reflected and Refracted Waves –Surge Impedance and SIL of

Long Lines–Wave Length and Velocity of Propagation of Waves, Power Line Carrier Communication (PLCC).

UNIT-IV: Various Factors Governing the Performance of Transmission Line and Underground Cables (10 Hours)

Skin and Proximity effects – Description and effect on Resistance of Solid Conductors – Ferranti effect - Corona – Description of the phenomenon, Critical voltages and power loss – Numerical Problems-Advantages and Disadvantages of Corona - Factors affecting corona

Underground Cables: Types of cables, capacitance of single-core cable, grading of cables, capacitance of 3-core belted cable, Location of faults in ac Cables.

UNIT-V: Sag and Tension Calculations and Overhead Line Insulators (10 Hours)

Sag and Tension calculations with equal and unequal heights of towers–Effect of Wind and Ice on weight of Conductor–Numerical Problems.

Types of Insulators– Voltage distribution in suspension insulators–Calculation of string efficiency and Methods for String efficiency improvement –Capacitance grading and Static Shielding.

Text Books:

1. Electrical power systems – by C.L.Wadhwa, New Age International (P) Limited, Publishers, 1998.
2. Modern Power System Analysis by I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 2ndEdition

Reference Books:

1. Power system Analysis–by John J Grainger William D Stevenson, TMC Companies, 4thedition.
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.BhatnagarA.Chakrabarthy, DhanpatRai& Co Pvt. Ltd. Electrical Power Systems by P.S.R. Murthy.

Subject Code	Signals and Systems (Professional Elective – I)	L	T	P	Credits
1002233130		3	0	0	3

Course Objectives:

1. Characterize the signals and systems and Concept of orthgonality.
2. Analyze the continuous-time signals and continuous-time systems using Fourier series, Fourier transform and Laplace transform.
3. Apply sampling theorem to convert continuous-time signals to discrete-time signal and reconstruct back.
4. Understand the relationships among the various representations of LTI systems
5. Apply z-transform to analyze discrete-time signals and systems.

Course Outcomes:

	Course Outcome
CO1	Distinguish between various types of signals and systems
CO2	Understand the conversion of continuous time signals to discrete time signals and vice versa.
CO3	Analyze continuous time LTI systems
CO4	Analyze discrete time LTI systems

Unit-I: INTRODUCTION (10 Hours)

Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Impulse response, Transfer function of a LTI system. Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function. Condition for Orthogonality

UNIT -II: FOURIER SERIES AND FOURIER TRANSFORM (10 Hours)

Fourier series representation of continuous time periodic signals(without derivations), properties of Fourier series(without proofs), Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series (without derivations), Complex Fourier spectrum. Application of Fourier series analysis to simple electric circuits .Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms (with proofs), Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform. Parseval's theorem

UNIT –III: SAMPLING THEOREM & ANALYSIS OF LINEAR SYSTEMS (10 Hours)

Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing.

Concept of convolution in time domain and frequency domain, Graphical representation of convolution. Filter characteristics of linear systems. Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics relationship between bandwidth and rise time. Cross-correlation and auto-correlation of functions. Properties of correlation function. Relation between convolution and correlation

UNIT -IV: Analysis of continuous time systems (10 Hours)

Review of Laplace transforms, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of LT(with proofs), Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis, Analysis and characterization of continuous LTI systems using LT.

UNIT -V: Analysis of Discrete time systems (10 Hours)

Discrete time signal representation- using complex exponential and sinusoidal, Periodicity of discrete time signals, properties of Z-transforms(with proofs), Z- Transforms of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, Analysis and characterization of discrete LTI systems using ZT.

Text Books:

1. Author(s) Initial(s). Surname(s), *Title of the Book*, xth ed. City of Publisher, (U.S. State or Country if the City is not 'well known'): Publisher, Year of Publication.
2. R. E. Ziemer and W. H. Tranter, *Principles of Communications: Systems, Modulation, and Noise*, 7th ed. Hoboken, NJ: Wiley, 2015.

Reference Books:

1. Author(s) Initial(s). Surname(s), *Title of the Book*, xth ed. City of Publisher, (U.S. State or Country if the City is not 'well known'): Publisher, Year of Publication.
2. R. E. Ziemer and W. H. Tranter, *Principles of Communications: Systems, Modulation, and Noise*, 7th ed. Hoboken, NJ: Wiley, 2015.

Subject Code	Computer Architecture and Organization (Professional Elective – I)	L	T	P	Credits
1002233131		3	0	0	3

Pre-requisite: Basic knowledge in digital electronics, fundamentals of computers.

Course Objectives:

1. To explain the basic working of a digital computer.
2. To understand the register transfer language and micro operators.
3. To learn various addressing modes supported by the processors.
4. To be familiar with peripheral interfacing with processors.
5. To understand memory hierarchy in computers.

Course Outcomes:

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

CO1: Demonstrate the instruction cycle of a computer.

CO2: Understand various micro operations and register transfer language.

CO3: Describe parallel processing and pipelining.

CO4: Interface different peripherals with processors.

CO5: Know the advantages of cache and virtual memory.

UNIT-I **(8 hours)**

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

UNIT-II **(8 hours)**

Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit. Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

UNIT-III **(8 hours)**

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC) Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISK Pipeline, Vector Processing, Array Processors.

UNIT-IV **(8 hours)**

Input/output Organization: Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access, Input-Output Processor (IOP), Serial Communication.

UNIT-V **(8 hours)**

Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Hardware.

Text Books:

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., 3rd Edition, Sept. 2008.

References Books:

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.
2. Computer Organization and Architecture, Linda Null, Julia Lobur, Narosa Publications ISBN 81- 7319-609-5
3. Computer System Organization by John. P. Hayes.

Subject Code	Communication Systems (Professional Elective – I)	L	T	P	Credits
1002233132		3	0	0	3

Course Objectives:

1. To provide a comprehensive understanding of the principles of analog and digital communication systems.
2. To analyze the performance of modulation and demodulation techniques.
3. To understand the impact of noise on communication systems and study signal-to-noise ratio (SNR).
4. To explore the fundamentals of information theory and source/channel coding.
5. To examine various multiplexing and multiple access techniques used in modern communication systems.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Explain the fundamental concepts of communication systems and modulation techniques.

CO2: Analyze and compare analog and digital modulation schemes based on performance metrics.

CO3: Understand and apply noise analysis to communication systems.

CO4: Interpret key concepts of information theory, source and channel coding.

CO5: Demonstrate understanding of multiplexing and multiple access schemes in modern communication networks.

Unit I: Introduction to Communication Systems (8 hours)

Elements of communication systems, Types of communication: Analog and digital, Electromagnetic spectrum, signal types (deterministic, random, periodic, aperiodic),Time domain and frequency domain analysis, Amplitude Modulation (AM): Generation, demodulation, spectrum, power relations

Unit II: Angle Modulation (8 hours)

Frequency Modulation (FM) and Phase Modulation (PM): Principles and mathematical representation, Generation and demodulation of FM signals, Bandwidth of FM signals (Carson's Rule), Comparison between AM and FM, Noise in AM and FM systems

Unit III: Pulse and Digital Modulation (8 hours)

Sampling theorem, aliasing, Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), Pulse Code Modulation (PCM) and Delta Modulation (DM), Digital modulation schemes: ASK, FSK, PSK, QPSK, Comparison of digital modulation techniques

Unit IV: Noise and Information Theory (8 hours)

Noise: Internal and external noise, signal-to-noise ratio (SNR), noise figure, Information theory basics: Entropy, mutual information, Source coding: Huffman coding, Channel capacity and Shannon's theorem, Error control coding: Parity checks, CRC, Hamming codes

Unit V: Multiplexing and Multiple Access (8 hours)

Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM), Code Division Multiple Access (CDMA), Orthogonal Frequency Division Multiplexing (OFDM),

Spread spectrum techniques, Communication system examples: Radio, television, cellular systems, satellite communications

Textbooks:

1. Simon Haykin, Communication Systems, Wiley.
2. B.P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press.

Reference Books:

1. Taub and Schilling, Principles of Communication Systems, McGraw-Hill.
2. John G. Proakis and Masoud Salehi, Fundamentals of Communication Systems, Pearson.
3. Roddy and Coolen, Electronic Communications, Pearson Education.
4. Kennedy and Davis, Electronic Communication Systems, McGraw-Hill.

Subject Code	Database Management Systems (Open Elective – I)	L	T	P	Credits
1054232101		3	0	0	3

Course Objectives:

The main objectives of the course is to

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

Course Outcomes:

After completion of the course, students will be able to

1. Understand the basic concepts of database management systems (L2).
2. Analyze a given database application scenario to use ER model for conceptual design of the database (L4).
3. Utilize SQL proficiently to address diverse query challenges (L3).
4. Employ normalization methods to enhance database structure (L3).
5. Assess and implement transaction processing, concurrency control and database recovery protocols in databases. (L4)

UNIT I **(8 hours)**

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 scheme 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 **(8 hours)**

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).

UNIT III **(8 hours)**

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 **(8 hours)**

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-Codd normal form (BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V **(8 hours)**

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Dead locks, 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, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3,4)
2. Database System Concepts, 5th edition, Silberschatz, Korth, Sudarsan, TMH (ForChapter1 and Chapter 5)

Reference Books:

1. Introduction to Database Systems, 8th edition, CJ Date, Pearson.
2. Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, 10th edition, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning, 2022

Web-Resources:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066728202245 6_shared/overview

Subject Code	Fundamentals of Internet of Things (Open Elective – I)	L	T	P	Credits
1019233150		3	0	0	3

Course Objectives:

1. To study the fundamentals about IoT.
2. To study about IoT Access technologies.
3. To study the design methodology and different IoT hardware platforms.
4. To study the basics of IoT Data Analytics and supporting services.
5. To study about various IoT case studies and industrial applications.

Course Outcomes:

CO's	After completion of the course, the student will be able to
CO1	Understand the basics of IoT.
CO2	Implement the state of the Architecture of an IoT.
CO3	Understand design methodology, hardware platforms and data organisation involved in IoT.
CO4	Interpret IOT Applications in Industrial & real world.

UNIT I: Fundamentals of IOT **(8 hours)**

Evolution of Internet of Things, Enabling Technologies,M2M Communication, IoT World Forum (IoTWF) standardized architecture,Simplified IoTArchitecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks ofan IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II: IOT Protocols **(8 hours)**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer: IP versions, Application Layer Protocols: CoAP and MQTT.

UNIT III: Design and Development **(8 hours)**

Design Methodology, IoT system building blocks, IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details.

UNIT IV: Data Analytics and Supporting Services **(8 hours)**

Data Analytics: Introduction, Structured Versus Unstructured Data, Data in Motion versus Data at Rest, IoT Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M, Supporting Services: Computing Using a Cloud Platform for IoT/M2M Applications/ Services.

UNIT V: Case Studies/Industrial Applications **(8 hours)**

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment's, Industry 4.0 concepts.

Textbooks:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet ofThings, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry,Cisco Press, 2017.
2. Internet of Things – A hands-on approach, ArshdeepBahga, Vijay Madisetti, UniversitiesPress, 2015.
3. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education.

Reference Books:

1. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit2).
2. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence",Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
3. Architecting the Internet of Things,Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer,2011.
4. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition,Michael Margolis,Arduino Cookbook and O"Reilly Media,2011.

e-resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs65
2. The Internet of Things in the Cloud | A Middleware Perspective | Honbo (taylorfrancis.com)

Subject Code	Power Electronics Lab	L	T	P	Credits
1002233110		0	0	3	1.5

Course Objectives:

1. To study the characteristics of various power electronic devices and analyze firing circuits and commutation circuits of SCR.
2. To analyze the performance of single–phase and three–phase full–wave bridge converters with both resistive and inductive loads.
3. To understand the operation of AC voltage regulator with resistive and inductive loads.
4. To understand the working of Buck converter, Boost converter and inverters.
5. To understand the operation of 3-Phase un controlled rectifier

Course Outcomes:

	Course Outcome
CO1	Explain about characteristics of various power semiconductor devices and firing circuits.
CO2	Analyze the performance of single–phase and three–phase full–wave bridge converters with both resistive and inductive loads.
CO3	Illustrate the working of Buck converter, Boost converter, single–phase square wave inverter and PWM inverter.
CO4	Describe the operation of single-phase AC voltage regulator with resistive loads.

Any 10 of the following experiments are to be conducted

S.No.	Title of the experiment
1	Study of Characteristics of SCR, MOSFET & IGBT.
2	Verification of a firing circuit for SCR.
3	Verification of gate drive circuits for IGBT and MOSFET.
4	Single -Phase Half controlled converter with R and RL load.
5	Single -Phase fully controlled bridge converter with R and RL loads.
6	Single -Phase AC Voltage Regulator with R and RL Loads.
7	Single -Phase square wave bridge inverter with R and RL Loads.
8	Three- Phase fully Uncontrolled Diode Rectifier with R and RL Loads.
9	Determination of voltage and current ripples of Boost converter in Continuous Conduction Mode (CCM) and Discontinuous Conduction Mode (DCM).
10	Determination of voltage and current ripples and in buck converter in CCM and DCM operation.
11	Determination of voltage and current ripples in buck-Boost converter in CCM and DCM operation.
12	Single -phase PWM inverter with sine triangle PWM technique.

Text Books:

1. M. H. Rashid, *Power Electronics: Circuits, Devices and Applications*, Prentice Hall of India, 2nd edition, 1998.
2. L.Umanand, *Power Electronics: Essentials & Applications*, Wiley Pvt. Limited, India.

Reference Books:

1. Philip T.Krein, *Elements of Power Electronics*, Oxford publications.
2. P.S.Bhimbra, *Power Electronics*, Khanna Publishers.
3. G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, *Thyristorised Power Controllers*, New Age International (P) Limited Publishers, 1996.

Subject Code	Analog and Digital Circuits Lab	L	T	P	Credits
1002233111		0	0	3	1.5

Course Objectives:

1. Analysis of transistor amplifiers
2. Analysis of feedback amplifiers and oscillators
3. Realization of digital circuits such data routing, registers and counters

Course Outcomes:

	Course Outcome
CO1	Analyze diode clipper/clamper circuits and transistor biasing.
CO2	Illustrate the operation of oscillator circuits. and analyze the applications of linear IC's
CO3	Demonstrate the operation of digital circuits such as arithmetic, data routing, registers and counters.
CO4	Analyze diode clipper/clamper circuits and transistor biasing.

Any 10 of the following experiments are to be conducted

S. No.	Title of the experiment
1	Analysis of clipper and clamper circuits.
2	Analysis of RC-phase shift oscillator.
3	Analysis of Integrator Circuits using IC 741.
4	Analysis of mono stable and astable multi vibrator operation using IC 555 Timer.
5	Analysis of Schmitt Trigger Circuits using IC 741 and IC 555.
6	Design of Full adder using logic gates.
7	Realization of parallel adder/subtract or using IC 7483.
8	Implementation of 3 to 8 line decoder using logic gates and IC 7445.
9	Implementation of 8 to 1 multiplexer using logic gates and IC 74151.
10	Verify the operation of master-slave JK flip-flop using IC7476.
11	Analysis of self-bias to a transistor.
12	Implementation of Mod-10 ripple counter using flip-flops and IC 7490

Subject Code	Soft Skills	L	T	P	Credits
1002233180	(Skill Enhancement Course)	0	1	2	2

Course Objectives:

1. To help students understand and develop key personal and interpersonal skills required in professional environments.
2. To improve communication skills, emotional intelligence, and public speaking ability.
3. To instill confidence, teamwork, and leadership skills for effective workplace behavior.
4. To enhance time management, adaptability, and problem-solving capabilities.
5. To prepare students for interviews, group discussions, and career advancement.

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Communicate effectively in verbal and written formats in professional settings.
2. Demonstrate improved interpersonal skills and emotional intelligence.
3. Work collaboratively in teams and lead group activities or discussions.
4. Manage time efficiently and adapt to changing work environments.
5. Present themselves professionally during interviews, presentations, and group discussions.

Unit I: Communication Skills (6 hours)

Verbal and non-verbal communication, Listening skills and feedback techniques, Barriers to communication and how to overcome them, Email and business writing etiquette, Public speaking and group communication

Unit II: Interpersonal & Team Skills (6 hours)

Building interpersonal relationships, Conflict resolution and negotiation, Leadership styles and team dynamics, Group behavior and decision-making, working in diverse environments

Unit III: Emotional Intelligence & Stress Management (6 hours)

Understanding emotional intelligence (EQ), Self-awareness, empathy, and social skills, Stress and anxiety: causes and coping strategies, Work-life balance and mental well-being, Assertiveness and self-confidence,

Unit IV: Professional Etiquette & Ethics (6 hours)

Grooming and professional image, Business and social etiquette, Time management and goal setting, Ethics and values in the workplace, Respect for diversity and inclusion

Unit V: Interview Skills & Career Planning (6 hours)

Resume writing and cover letter drafting, Job search strategies and career planning, Interview techniques (HR and technical rounds), Group discussions and mock interviews, Feedback and improvement strategies

Text books:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press.
2. Meenakshi Raman & Sangeeta Sharma, Technical Communication: Principles and Practice, Oxford University Press.
3. Goleman, Daniel, Emotional Intelligence, Bantam Books.

Reference Books:

1. Alex K., Soft Skills: Know Yourself & Know the World, S. Chand Publishing.
2. P. Subba Rao, Management and Organizational Behavior, Himalaya Publishing.
3. Pease, Allan & Barbara, The Definitive Book of Body Language, Bantam.
4. Carnegie, Dale, How to Win Friends and Influence People, Simon & Schuster.
5. Online platforms like NPTEL, Coursera, and LinkedIn Learning for video-based learning and activities.

Subject Code	Tinkering Lab (Engineering Science)	L	T	P	Credits
1002233112		0	0	2	1

Course Objectives:

1. To develop a mindset for innovation, creativity, and problem-solving through hands-on activities.
2. To introduce students to basic tools, components, and systems used in prototyping (electronics, mechanical, software).
3. To encourage interdisciplinary thinking and collaborative project development.
4. To provide exposure to modern tools such as Arduino, Raspberry Pi, sensors, 3D printing, and simple mechanical assemblies.
5. To build confidence in experimenting with ideas and transforming them into working prototypes.

Course Outcomes:

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

1. Identify and use basic electronic components and prototyping tools.
2. Design and implement simple circuits and embedded systems using microcontrollers.
3. Use sensors and actuators to create interactive systems.
4. Apply mechanical fabrication techniques using 3D printers and simple mechanical tools.
5. Collaborate effectively to build innovative, interdisciplinary prototypes or mini-projects.
6. Present and communicate their design ideas and implementation clearly.

List of Experiments

1. Familiarization with lab tools – Breadboard, multimeter, soldering station, power supply.
2. Basic electronic circuits – Series, parallel circuits, use of resistors, capacitors, LEDs.
3. Introduction to Arduino – Writing and uploading simple sketches.
4. Sensor interfacing – Temperature, light, motion, ultrasonic sensors.
5. Actuator control – Servo motor, DC motor, relay modules.
6. Serial communication – Between Arduino and PC.
7. Simple IOT application – Sending data to cloud (e.g., using ThingSpeak or Blynk).
8. Mobile App Integration – Basic app to control devices using Bluetooth.
9. Mechanical prototyping – Introduction to 3D printing and simple CAD modeling.

Text books:

1. "Getting Started with Arduino" – Massimo Banzi and Michael Shiloh.
2. "Make: Electronics – Learning Through Discovery" – Charles Platt.\
3. "Exploring Arduino" – Jeremy Blum.

Reference Books:

1. "Practical Electronics for Inventors" – Paul Scherz and Simon Monk.
2. "Arduino Cookbook" – Michael Margolis and Brian Jepson.
3. "Make: Sensors" – Tero Karvinen, Kimmo Karvinen, and Ville Valtokari.
4. "Python Programming for Raspberry Pi" – Tim Cox (if Raspberry Pi is included).

E resources: Arduino (www.arduino.cc), Raspberry Pi (www.raspberrypi.org), Instructables (www.instructables.com), and Tinkercad.

Subject Code	Technical Paper Writing and IPR	L	T	P	Credits
1002233125	(Audit Course)	2	0	0	0

Course Objectives

1. To develop an understanding of the structure, style, and ethics of technical and scientific writing.
2. To train students in effective academic communication, including research paper, thesis, and project report writing.
3. To create awareness about various forms of intellectual property and the process of securing IP rights.
4. To provide foundational knowledge on patents, copyrights, trademarks, and design rights.
5. To sensitize students about innovation, commercialization, and legal aspects of research.

Course Outcomes

Upon successful completion of the course, students will be able to:

1. Write effective technical papers and reports that conform to academic and professional standards.
2. Present technical information clearly and ethically in various formats (papers, posters, presentations).
3. Understand the process of peer review and publishing in journals/conferences.
4. Identify and explain different types of intellectual property and how they are protected.
5. Apply knowledge of IPR to protect and commercialize their innovations responsibly.

Unit I: Fundamentals of Technical Writing (3 hours)

Basics of technical communication, Types of technical documents: research papers, project reports, theses, Structure and components of a technical paper (Abstract, Introduction, Methods, Results, Discussion), Clarity, precision, and language usage in scientific writing, Ethics in writing: plagiarism, data falsification, multiple submissions

Unit II: Writing for Publication (3 hours)

Selection of journal/conference, understanding journal impact factor, indexing, and scope, Manuscript preparation and formatting guidelines, Submission process and peer review system, Responding to reviewers and revisions

Unit III: Presentation and Dissemination (3 hours)

Preparing abstracts, posters, and oral presentations, Tools for formatting and referencing (LaTeX, MS Word, EndNote, Mendeley, Zotero), Best practices for graphical and tabular data representation, Collaboration and authorship ethics, Copyright and open-access publishing

Unit IV: Introduction to IPR (3 hours)

Definition and need for Intellectual Property, Categories: Patents, Copyrights, Trademarks, Trade Secrets, Industrial Designs, Basic principles of patentability: novelty, non-obviousness, utility, National and international IPR organizations (WIPO, IPO, USPTO, EPO), IPR protection mechanisms in India

Unit V: Patent Filing and Innovation Management (3 hours)

Patent filing process in India and abroad, Patent search using free databases (Google Patents, Espace net, WIPO), Patent drafting basics: claims, specifications, drawings, Technology transfer and commercialization of IP, Role of incubation centers and start-up policy

Text books:

1. M. Ashok Kumar & R. Murugesan, Research Methodology and IPR, Charulatha Publications.
2. R. N. Khandare, Research Methodology & IPR, S. Chand Publishing.
3. Michael Alley, The Craft of Scientific Writing, Springer.

Reference Books

1. B.L. Wadehra, Law Relating to Intellectual Property, Universal Law Publishing Co.
2. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets, Cengage Learning.
3. Day & Gastel, How to Write and Publish a Scientific Paper, Cambridge University Press.
4. Robin Jeffery & Michael Wilkinson, Publishing Research Successfully, SAGE.
5. Government of India: IPR Policy Documents and Patent Office Guidelines (available on https://ipindia.gov.in)