DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ACADEMIC REGULATIONS (R23)

FOR

B. Tech Four Year Degree Programme

(Applicable for the batches admitted from the A.Y. 2023-24)

PACE INSTITUTE OF TECHNOLOGY AND SCIENCES
(Autonomous)
Approved by AICTE and Govt. of Andhra Pradesh, Accredited by NAAC (A Grade)
Recognized under 2(f) & 12(B) of UGC, Permanently Affiliated to JNTUK, Kakinada
NH-16, Near Valluramma Temple, Ongole-523272
Andhra Pradesh, India.

Academic Regulations (R23) for B. Tech (Regular-Full time)
(Effective for the students admitted into I year from the Academic Year 2023-24 onwards)

1. **Award of the Degree**

   (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:

      i. Pursues a course of study for not less than 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.

   (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. **Courses of study:**
   The following courses of study are offered at Pace Institute of Technology and Sciences,Ongole

Sl No	Branch	Short name	Code
1	Civil Engineering	CE	01
2	Electrical and Electronics Engineering	EEE	02
3	Mechanical Engineering	ME	03
4	Electronics & Communication Engineering	ECE	04
5	Computer Science and Engineering	CSE	05
6	Computer Science and Information Technology	CSIT	07
7	Information Technology	IT	12
8	Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)	CSE(IoT&CSBT)	47
9	Artificial Intelligence and Data Science	AIDS	54
10	Artificial Intelligence and Machine Learning	AIML	61
11	Computer Science and Engineering (Indian Language)	CSE-R	63
12	Electronics Engineering (VLSI Design & Technology)	EE(VLSID&T)	66

4. **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.

5. **Program related terms**

   (a) **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.

   (b) **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

   (c) **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.

   (d) **Choice Based Credit System (CBCS):** The CBCS provides a choice for students to select from the prescribed courses.

6. **Semester/Credits:**

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

   (b) The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.

   (c) Regular courses may also be completed well in advance through MOOCs satisfying prerequisites.

7. **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	-

8. **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

9. **Programme Pattern**

(a) Total duration of the of B. Tech (Regular) Programme is four academic years.

(b) Each academic year of study is divided into two semesters.

(c) Minimum number of instruction days in each semester is 90 days.

(d) There shall be mandatory student induction program for freshers, with a three-week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.

(e) Health/wellness/yoga/sports and NSS /NCC /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduate students.

(f) Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.

(g) Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.

(h) Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.

(i) 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.

(j) A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for B.Tech. Degree with a Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.

(k) While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.

(l) A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.

(m) Students shall undergo mandatory summer internships, for a minimum of eight 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.

(n) There shall also be mandatory full internship in the final semester of the programme along with the project work.

(o) Undergraduate degree with Honors is introduced by the University for the students having good academic record.

(p) Each college shall 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.

(q) Each college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies /GATE /other competitive exams etc.

(r) Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

10. **Evaluation Process**

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

A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end

examination marks taken together for the theory, practical, design, drawing subject or project etc. In case of a mandatory course, he/she should secure 40% of the total marks.

(A) **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 (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.

ii. Objective paper shall contain for 05 short answer questions with 2 marks each or maximum of 20 bits 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 by the respective institution 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 midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.

v. Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

For Example:

* Marks obtained in first mid: 25
* Marks obtained in second mid: 20
* Final mid semester Marks: (25x0.8) + (20x0.2) = 24

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

⋆ Marks obtained in first mid: Absent
⋆ Marks obtained in second mid: 25
⋆ Final mid semester Marks: (25x0.8) + (0x0.2) =20

(b) **Semester 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 20 marks 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.

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

(B) **Practical Courses**

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

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

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

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

i. Procedure: 20 marks

ii. Experimental work & Results: 30 marks

iii. 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.

(d) For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination. Day-to-day work shall be evaluated for 15 marks

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

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.

(e) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re=examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

(f) The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

11. **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 principal at the beginning of the semester. The Head of the Department shall forward such proposals to the principal for approval.

(g) 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 principal.

12. **Massive Open Online Courses (MOOCs):**

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

A student shall register for the course (Minimum of either 8 weeks or 12 weeks) 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 college.

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

13. **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 institute 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.

(a) The institute shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online

learning courses.

(b) 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.

(c) Credit transfer policy will be applicable to the Professional & Open Elective courses only.

(d) The concerned department shall identify the courses permitted for credit transfer.

(e) The institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.

(f) The department shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

(g) The institution shall ensure no overlap of MOOC exams with that of the semester end examination schedule. In case of delay in results, the institution will re-issue the marks sheet for such students.

(h) 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.

(i) The department shall submit the following to the examination cell & systems:

  i. List of students who have passed MOOC courses in the current semester along with the certificate of completion.

  ii. Undertaking form filled by the students for credit transfer.

(j) 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 University from time to time.

14. **Academic Bank of Credits (ABC)**

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

(a) provide option of mobility for learners across the universities of their choice

(b) provide option to gain the credits through MOOCs from approved digital platforms.

(c) facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC

(d) execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students' account.

15. **Mandatory Internships**

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

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

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

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

nation conducted in the presence of internal examiner and external examiner appointed by the principal and is evaluated for 140 marks.

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

16. **Guidelines for offering a Minor**

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

(a) The Minor program requires the completion of 12 credits in Minor stream chosen.

(b) Two courses for 06 credits related to a Minor are to be pursued compulsorily for the minor degree, but maybe waived for students who have done similar/equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should complete the compulsory courses (or equivalents) before registering for the electives.

(c) Electives (minimum of 2 courses) to complete a total of 12 credits.

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

17. **Guidelines for offering Honors**

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

(a) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.

(b) A student shall earn additional 15 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).

(c) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.

(d) The concerned Head of The Department shall arrange separate class work and timetable of the courses offered under Honors program.

(e) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.

(f) Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.

(g) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.

(h) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.

(i) **A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors** degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme.

(j) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

(k) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

Enrolment into Honors:

(a) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline

(b) The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.

(c) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.

(d) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.

(e) Honors is to be completed simultaneously with a Major degree program.

Registration for Honors:

(a) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.

(b) The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.

(c) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

(d) There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

18. **Attendance Requirements:**

(a) A student shall be eligible to appear for the semester end examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

(b) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

(c) A stipulated fee shall be payable towards condonation of shortage of attendance to the University.

(d) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

(e) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.

(f) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

(g) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

(h) For induction programme attendance shall be maintained as per AICTE norms.

19. **Promotion Rules:**

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

(a) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university norms.

(b) student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any *decimal* fraction should be *rounded off* to *lower* digit) up to in the subjects that have been studied up to III semester.

(c) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any *decimal* fraction should be *rounded off* to *lower* digit) in the subjects that have been studied up to V semester.

And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

(d) When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

20. **Grading:**

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

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

Structure of Grading of Academic Performance

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

(a) A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

(b) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

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

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

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

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

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

$$CGPA = \frac{\sum(C_i \times S_i)}{\sum(C_i)}$$

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

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

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

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

Award of Class:

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

Class Awarded	CGPA Secured
First Class with Distinction	$\geq$ 7.5
First Class	$\geq$ 6.5 <7.5
Second Class	$\geq$ 5.5 <6.5
Pass Class	$\geq$ 5.0 <5.5

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

21. **With–holding of Results**

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

22. **Multiple Entry / Exit Option**

(a) **Exit Policy:** The students can choose to exit the four-year programme at the end of first/second/third year.

i. **UG Certificate in (Field of study/discipline) -** Programme duration: First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

ii. **UG Diploma (in Field of study/discipline) -** Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

iii. **Bachelor of Science (in Field of study/discipline) i.e., B.Sc. Engineering in (Field of study/discipline)-** Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

(b) **Entry Policy:**

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

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

23. **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. The Head of The Department shall forward such proposals submitted by the students to the principal. An evaluation committee constituted by the principal 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

24. **Transitory Regulations**

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled

academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

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

25. **Minimum Instruction Days for a Semester:**

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

26. **Medium of Instruction:**

The medium of instruction of the entire B. Tech undergraduate programme in Engineering & Technology (including examinations and project reports) will be in English only. Similarly, the medium of instruction and examinations in AICTE approved Indian language B.Tech programme are in Telugu and English.

27. **Student Transfers:**

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

28. **General Instructions:**

(a) The academic regulations should be read as a whole for purpose of any interpretation.

(b) Malpractices rules-nature and punishments are appended.

(c) Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.

(d) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the competent authorities of institution is final.

(e) The institution may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the institute.

(f) In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Head of the institution is final.

Academic Regulations (R23)
for B. Tech (Lateral Entry Scheme)

(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year 2024-25 onwards)

1. **Award of the Degree**

   (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:

      i. Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).
      ii. Registers for 120 credits and secures all 120 credits.

   (b) **Award of 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., 120 credits.
      ii. Registering for Honors is optional.
      iii. Honors is to be completed simultaneously with B.Tech. programme.

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

3. **Minimum Academic Requirements** The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.2

   (a) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.

   (b) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester.

   And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. **Course Pattern**

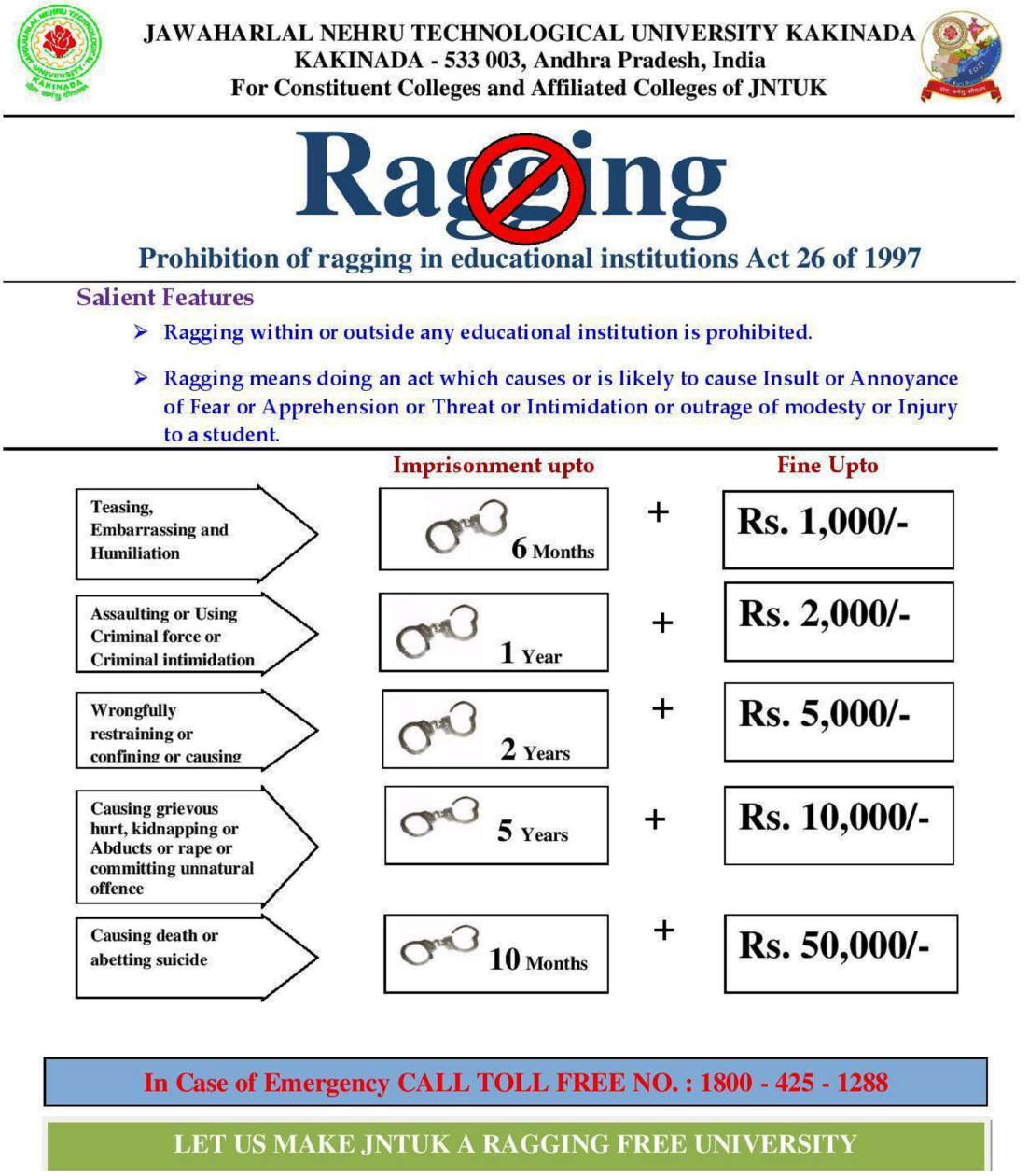
   (a) The entire course of study is three academic years on semester pattern.

(b) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.

(c) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

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

Annexure-I


JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India
For Constituent Colleges and Affiliated Colleges of JNTUK
Ragging
Prohibition of ragging in educational institutions Act 26 of 1997
Salient Features
Ragging within or outside any educational institution is prohibited.
Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student.
Imprisonment upto
Fine Upto
Teasing, Embarrassing and Humiliation
6 Months
+
Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation
1 Year
+
Rs. 2,000/-
Wrongfully restraining or confining or causing
2 Years
+
Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence
5 Years
+
Rs. 10,000/-
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KAKINADA - 533 003, Andhra Pradesh, India
For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

ABSOLUTELY NO TO RAGGING

1. **Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.**
2. **Ragging entails heavy fines and/or imprisonment.**
3. **Ragging invokes suspension and dismissal from the College.**
4. **Outsiders are prohibited from entering the College and Hostel without permission.**
5. **Girl students must be in their hostel rooms by 7.00 p.m.**
6. **All the students must carry their Identity Cards and show them when demanded**
7. **The Principal and the Wardens may visit the Hostels and inspect the rooms any time.**

Jawaharlal Nehru Technological University Kakinada
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

Induction Programme

S.No.	Course Name	Category	L-T-P-C
1	Physical Activities – Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	MC	2-0-2-0
3	Orientation to all branches – career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch – corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills – focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

I Year I Semester

S.No	Course Code	Course Title	L	T	P	C
1	P23BST04	Engineering Physics	3	0	0	3
2	P23BST02	Linear Algebra & Calculus	3	0	0	3
3	P23EST03	Basic Electrical and Electronics Engineering	3	0	0	3
4	P23EST04	Engineering Graphics	1	0	4	3
5	P23EST02	Introduction to Programming	3	0	0	3
6	P23ESL04	IT Workshop	0	0	2	1
7	P23BSL02	Engineering Physics Lab	0	0	2	1
8	P23ESL03	Electrical and Electronics Engineering Workshop	0	0	3	1.5
9	P23ESL02	Computer Programming Lab	0	0	3	1.5
10	P23BST08	NSS/NCC/Scouts & Guides/Community Service	-	-	1	0.5
Total Credits						20.5

I Year II Semester

S.No	Course Code	Course Title	L	T	P	C
1	P23BST01	Communicative English	2	0	0	2
2	P23BST06	Chemistry	3	0	0	3
3	P23BST03	Differential Equations & Vector Calculus	3	0	0	3
4	P23EST01	Basic Civil & Mechanical Engineering	3	0	0	3
5	P23EET02	Network Analysis	3	0	0	3
6	P23BSL01	Communicative English Lab	0	0	2	1
7	P23BSL04	Chemistry Lab	0	0	2	1
8	P23ESL01	Engineering Workshop	0	0	3	1.5
9	P23EEL02	Network Analysis and Simulation Lab	0	0	3	1.5
10	P23BST07	Health and wellness, Yoga and sports	-	-	1	0.5
Total Credits						19.5

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

II Year I Semester

S.No	Course Code	Course Title	L	T	P	C
1	P23BST11	Complex Variables and Random Processes	3	0	0	3
2	P23BST12	Universal Human Values – Understanding Harmony	2	1	0	3
3	P23EST08	Signals and Systems	3	0	0	3
4	P23ECT02	Switching Theory and Logic Design	3	0	0	3
5	P23ECT01	Electronic Devices and Circuits	3	0	0	3
6	P23ECL01	Electronic Devices & Circuits Lab	0	0	3	1.5
7	P23ECL02	Switching Theory & Logic Design Lab	0	0	3	1.5
8	P23ECS01	Data Structures using Python	0	1	2	2
9	P23ACT01	Environmental Science	2	0	0	-
Total Credits						20

II Year II Semester

S.No	Course Code	Course Title	L	T	P	C
1	P23MBT01	Managerial Economics and Financial Analysis	3	0	0	3
2	P23EST12	Linear Control Systems	3	0	0	3
3	P23ECT03	Electromagnetic Waves and Transmission Lines	3	0	0	3
4	P23ECT04	Electronic Circuit Analysis	3	0	0	3
5	P23ECT05	Analog Communications	3	0	0	3
6	P23ECL04	Electronic Circuit Analysis Lab	0	0	3	1.5
7	P23ECL03	Signals and Systems Lab	0	0	3	1.5
8	P23ECS02	Soft Skills	0	1	2	2
9	P23BST17	Design Thinking & Innovation	1	0	2	2
Total Credits						22

Note: Mandatory Community Service Project Internship of 08 weeks duration during summer vacation

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

III Year I Semester

S.No	Course Code	Course Title	L	T	P	C
1	P23ECT06	Analog and Digital IC Applications	3	0	0	3
2	P23ECT07	Digital Communications	3	0	0	3
3	P23ECT08	Antennas and Wave Propagation	3	0	0	3
4	P23ECEXX	Professional Elective - I	3	0	0	3
5	P23XXXXX	Open Elective - I	3	0	0	3
6	P23ECL06	Analog and Digital IC Applications Lab	0	0	3	1.5
7	P23ECL05	Analog and Digital Communications Lab	0	0	3	1.5
8	P23ECS03	Applications of LabVIEW for Instrumentation and Communications	0	1	2	2
9	P23ESL07	Design of PCB & Antennas Lab	0	0	2	1
10	P23ECXXX	Evaluation of Community Service Internship	-	-	-	2
Total Credits						23

III Year II Semester

S.No	Course Code	Course Title	L	T	P	C
1	P23ECT09	Digital Signal Processing	3	0	0	3
2	P23ECT10	Microprocessors and Microcontrollers	3	0	0	3
3	P23ECT11	VLSI Design	3	0	0	3
4	P23ECEXX	Professional Elective - II	3	0	0	3
5	P23ECEXX	Professional Elective - III	2	0	0	2
6	P23XXXXX	Open Elective - III	3	0	0	3
7	P23ECL07	VLSI Design Lab	0	0	2	1
8	P23ECL08	Microprocessors and Microcontrollers Lab	0	0	2	1
9	P23ECS04	Machine Learning Lab	0	1	2	2
10	P23XXXXX	Research Methodology and IPR	2	0	0	-
Total Credits						21
Note: Mandatory Industry Internship of 08 weeks duration during summer vacation						

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
R-23 UNDER GRADUATE (B.Tech) COURSE STRUCTURE

IV Year I Semester

S.No.	Category	Title	L	T	P	C
1	Professional Core		3	0	0	3
2	Professional Core		3	0	0	3
3	Management Course - II		2	0	0	2
4	Professional Elective - IV		3	0	0	3
5	Professional Elective - V		3	0	0	3
6	Open Elective - IV		3	0	0	3
7	Professional Core		0	0	2	1
8	Professional Core		0	0	2	1
9	Skill Enhancement Course		0	1	2	2
10	Audit Course	Constitution of India	2	0	0	-
11	Internship	Evaluation of Industry Internship	-	-	-	2
Total Credits			19	1	6	23

IV Year II Semester

S.No.	Category	Title	L	T	P	C
1	Internship & Project Work	Full semester Internship & Project Work	0	0	24	12

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST04	Engineering Physics (Common to All Branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

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

CO1: Analyze the intensity variation of light due to interference, diffraction and polarization.

CO2: Familiarize with the basics of crystals and their structures.

CO3: Summarize various types of polarization of dielectrics and classify the magnetic materials.

CO4: Explain the basic concepts of Quantum Mechanics, free electron theory.

CO5: Apply the band theory of solids and Hall Effect to study the semiconductors.

UNIT–I: Wave Optics

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

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

UNIT–II: Crystallography and X-ray diffraction

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

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

UNIT–III: Dielectric and Magnetic Materials

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

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

loss

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

UNIT–IV: Quantum Mechanics and Free electron Theory

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

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

UNIT–V: Semiconductors

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

Text Books:

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

Reference Books:

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

Web Resources:

1. `https://www.loc.gov/rr/scitech/selected-internet/physics.html`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST02	Linear Algebra & Calculus (Common to All Branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives: To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

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

CO1: Demonstrate the understanding of rank of a matrix. Analyze the solutions of the system of linear equations.

CO2: Find the Eigen values and Eigen vectors of a matrix, apply Cayley-Hamilton theorem to determine inverse and power of a matrix and identify the nature of quadratic form.

CO3: Utilize mean value theorems to real life problems.

CO4: Familiarize with functions of several variables which are useful in optimization.

CO5: Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

UNIT–I: Matrices

Rank of a matrix by echelon form, normal form. Cauchy–Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT–II: Eigenvalues, Eigenvectors and Orthogonal Transformation

Eigenvalues, Eigenvectors and their properties, 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: Calculus

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

UNIT–IV: Partial differentiation and Applications (Multi variable calculus)

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT–V: Multiple Integrals (Multi variable Calculus)

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas by double integrals and volumes by double integrals and triple integrals.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44^{th} Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10^{th} Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14^{th} Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha ScienceInternational Ltd., 2021 5^{th} Edition (9^{th} reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5^{th} Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9^{th} edition.
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021)

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST03	Basic Electrical & Electronics Engineering (Common to All branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

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

CO1: Describe fundamental laws, operating principles of motors/generators, MC/MI instruments (L2)

CO2: Demonstrate the working of electrical machines, measuring instruments and power generation stations. (L2)

CO3: Apply mathematical tools and fundamental concepts to derive various equations related to electrical circuits and machines. (L3)

CO4: Calculate electrical load and electricity bill of residential and commercial buildings. (L4)

PART A: BASIC ELECTRICAL ENGINEERING

UNIT–I: DC & AC Circuits

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

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

UNIT–II: Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, Applications.

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

UNIT–III: Energy Resources, Electricity Bill & Safety Measures

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

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical

energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

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

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, Fourth Edition
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.

Web Resources:

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

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

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

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

CO1: Compare the operation and characteristics of various semiconductor devices and their utilization.

CO2: Implement various power supply circuits using diodes and amplifier circuits using BJT.

CO3: Categorize various types of Logic gates and implement simple combinational logic circuits.

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 of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator.

Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT–III: DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders.

Text Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4^{th} 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, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

Semester end examination pattern:

1. Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.
2. In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1 mark.
3. 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.
4. The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST04	Engineering Graphics (Common to All branches of Engineering)	1	0	4	3

Internal Marks: 30 External Marks: 70

Course Objectives:

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

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

CO1: Understand the principles of engineering drawing, including polygons, engineering curves, scales.

CO2: Draw and interpret orthographic projections of points, lines, planes.

CO3: Understand and draw projection of solids in various positions in first quadrant.

CO4: Explain principles behind sections of solids and development of surfaces.

CO5: Convert the isometric view into orthographic view and vice versa.

UNIT–I:

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

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

Scales: Plain scales, diagonal scales and vernier scales.

UNIT–II:

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

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

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

UNIT–III:

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

UNIT–IV:

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

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

UNIT–V: Semiconductors

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

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

Text Books:

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, Tata McGraw Hill, 2017.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST02	Introduction To Programming (Common to All branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. To introduce students to the fundamentals of computer programming.
2. To provide hands-on experience with coding and debugging.
3. To foster logical thinking and problem-solving skills using programming.
4. To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
5. To encourage collaborative learning and teamwork in coding projects.

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

CO1: Understand basics of computers, the concept of algorithm, flowcharts and algorithmic thinking.

CO2: Analyse a problem and develop programs involving decision structures and loops.

CO3: Implement different operations on arrays and solve problems using Strings.

CO4: Design the programs by applying the features of pointers, structures and unions.

CO5: Develop problem-solving skills and the ability to debug and optimize the code by using functions and files.

UNIT–I: Introduction to Programming and Problem Solving

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms

UNIT–II: Control Structures

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do- while) Break and Continue.

UNIT–III: Arrays and Strings

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

UNIT–IV: Pointers & User Defined Data types

Pointers, dereferencing (Pointer to Pointer) and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

UNIT–V: Functions & File Handling

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

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

Text Books:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice- Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2^{nd} edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL04	IT Workshop (Common to All branches of Engineering)	0	0	2	1

Internal Marks: 30 External Marks: 70

Course Objectives:

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

Course Outcomes:

CO1: Understand the fundamental principles of computer hardware components and their interconnections.

CO2: Analyze the historical development of the Internet and its impact on global communication.

CO3: Analyze the underlying principles and structure of LaTeX and Word documents.

CO4: Implement essential toolbars and ribbons for common spreadsheet tasks.

CO5: Understand the principles of effective content organization in presentations.

CO6: Implement AI tools like ChatGPT into their professional workflows for content creation and translation.

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. A video 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 access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

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

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

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

LaTeX and WORD

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

Task 2: Using LaTeX 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 LaTeX 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 help them 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 – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the 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 beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

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

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

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

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3^{rd} edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2^{nd} 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 Ken Quamme. – CISCO Press, Pearson Education, 3^{rd} edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3^{rd} edition

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BSL02	Engineering Physics Lab (Common to All Branches of Engineering)	0	0	2	1

Internal Marks: 30 External Marks: 70

Course Objectives:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

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

CO1: Apply the concepts of wave optics to get wavelength of light.

CO2: Apply the concept of resonance in sonometer and melde's experiments for getting frequency.

CO3: Study the earth's gravity and rigidity modulus of material.

CO4: Study electrostatics and magnetism to determine its dependent properties.

CO5: Determine the properties of semiconductors and Planks constant.

List of Experiments:

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

12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non- uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

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

References:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

Web Resources:

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL03	Electrical & Electronics Engineering Workshop (Common to All branches of Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:

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

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

CO1: Measure voltage, current and power in an electrical circuit. (L3)

CO2: **CO2:** Measure of Resistance using Wheat stone bridge (L4)

CO3: Discover critical field resistance and critical speed of DC shunt generators. (L4)

CO4: Investigate the effect of reactive power and power factor in electrical loads. (L5)

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 and fundamentals of electron devices & its applications.

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

CO1: Identify & testing of various electronic components.

CO2: Understand the usage of electronic measuring instruments.

CO3: Plot and discuss the characteristics of various electron devices.

CO4: Explain the operation of a digital circuit.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers

4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

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

References:

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

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL02	Computer Programming Lab (Common to All branches of Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:

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

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

CO1: Understand and trace the execution of programs written in C language.

CO2: Analyze the right control structure for solving the problem.

CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers and structures

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 writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

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

WEEK 2

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

Suggested Experiments/Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab2: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

1. Sum and average of 3 numbers
2. Conversion of Fahrenheit to Celsius and vice versa
3. 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:
Lab3: Simple computational problems using arithmetic expressions.

1. Finding the square root of a given number
2. Finding compound interest
3. Area of a triangle using heron's formulae
4. 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

1. 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)
2. Find the maximum of three numbers using conditional operator
3. Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

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

Suggested Experiments/Activities:
Tutorial 5: Branching and logical expressions:
Lab5: Problems involving if-then-else structures.

1. Write a C program to find the max and min of four numbers using if-else.

2. Write a C program to generate electricity bill.
3. TFind the roots of the quadratic equation.
4. Write a C program to simulate a calculator using switch case.
5. 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
Lab6: Iterative problems e.g., the sum of series

1. Find the factorial of given number using any loop.
2. Find the given number is a prime or not.
3. Compute sine and cos series
4. Checking a number palindrome
5. 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.
Lab7: 1D Array manipulation, linear search

1. Find the min and max of a 1-D integer array.
2. Perform linear search on1D array.
3. The reverse of a 1D integer array
4. Find 2's complement of the given binary number.
5. 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

1. Addition of two matrices
2. Multiplication two matrices
3. Sort array elements using bubble sort
4. Concatenate two strings without built-in functions
5. 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.

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

WEEK 10

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

Suggested Experiments/Activities:
Tutorial 10: Bitfields, Self-Referential Structures, Linked lists
Lab10 : Bitfields, linked lists
Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

1. Create and display a singly linked list using self-referential structure.
2. Demonstrate the differences between structures and unions using a C program.
3. Write a C program to shift/rotate using bitfields.
4. Write a C program to copy one structure variable to another structure of the same type.

UNIT V
WEEK 11

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

Suggested Experiments/Activities:
Tutorial 11: Functions, call by value, scope and extent,
Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

1. Write a C function to calculate NCR value.
2. Write a C function to find the length of a string.
3. Write a C function to transpose of a matrix.
4. 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

1. Write a recursive function to generate Fibonacci series.
2. Write a recursive function to find the lcm of two numbers.
3. Write a recursive function to find the factorial of a number.
4. Write a C Program to implement Ackermann function using recursion.
5. 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.

1. Write a C program to swap two numbers using call by reference.
2. Demonstrate Dangling pointer problem using a C program.
3. Write a C program to copy one string into another using pointer.
4. Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK 14

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

Suggested Experiments/Activities:
Tutorial 12: Recursion, the structure of recursive calls
Lab 14: File operations

1. Write a C program to write and read text into a file.
2. Write a C program to write and read text into a binary file using fread() and fwrite()
3. Copy the contents of one file to another file.
4. Write a C program to merge two files into the third file using command-line arguments.
5. Find no. of lines, words and characters in a file
6. Write a C program to print last n characters of a given file.

Text Books:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum & 39; 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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BSL06	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, teamwork, social consciousness among the students and engaging them in selfless service.

Course Outcomes: At the end of the course, the student 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:

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

UNIT–II: Nature & Care :

Activities:

1. Best out of waste competition.
2. Poster and signs making competition to spread environmental awareness.
3. Recycling and environmental pollution article writing competition.
4. Organising Zero-waste day.
5. Digital Environmental awareness activity via various social media platforms.
6. Virtual demonstration of different eco-friendly approaches for sustainable living.

7. Write a summary on any book related to environmental issues.

UNIT–III: Community Service
Activities:

1. 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.
2. Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
3. Conducting consumer Awareness. Explaining various legal provisions etc.
4. Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
5. 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:

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST01	Communicative English (Common to All Branches of Engineering)	2	0	0	2

Internal Marks: 30 External Marks: 70

Course Objectives: The main objective of introducing this course, Communicative English, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

Course Outcomes:

CO1: Understand the context, topic, and pieces of specific information from social or Transactional dialogues.

CO2: Apply grammatical structures to formulate sentences and correct word forms.

CO3: Analyze discourse markers to speak clearly on a specific topic in informal discussions.

CO4: Evaluate reading / listening texts and to write summaries based on global comprehension of these texts.

CO5: Create a coherent paragraph, essay, and resume

UNIT I

Lesson: HUMAN VALUES: Gift of Magi **(Short Story)**

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

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

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

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

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

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

UNIT II

Lesson: NATURE: The Brook by Alfred Tennyson (Poem)

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

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

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

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

UNIT III

Lesson: BIOGRAPHY: Elon Musk

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: Readinga text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations
Vocabulary: Compound words, Collocations

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.
Writing: Letter Writing: Official Letters, Resumes
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice
Vocabulary: Words often confused, Jargons

UNIT V

Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)
Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts
Reading: Reading comprehension.
Writing: Writing 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, 1^{st} Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

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:

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

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST06	Chemistry (Common to EEE, ECE, CSE, IT & allied branches)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives: At the end of the course the student can be able

1. To predict the Fundamentals of Quantum mechanics, energy level diagrams in homo, hetero nuclear molecules.
2. To Illustrate the commonly used industrial materials.
3. To train the students on the principles and applications of electrochemistry.
4. To train the students on the principles and applications of polymers.
5. To introduce instrumental methods, molecular machines and switches.

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

CO1: Explain the Fundamentals of Quantum mechanics, energy level diagrams in homo, hetero nuclear molecules.
CO2: Explain the. commonly used industrial materials.
CO3: Explain the principles and applications of electrochemistry.
CO4: Explain the principles and applications of polymers.
CO5: Explain the instrumental methods and applications.

UNIT–I: Structure and Bonding Models

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of ψ and $\psi 2$, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2, N_2 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.

Supercapacitors: 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-oxygenfuel 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.

Text Books:

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, 5^{th} Edition, Wiley Publications, Feb.2008
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3^{rd} Edition

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST03	Differential Equations and Vector Calculus (Common to All Branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. To enlighten the learners in the concept of differential equations and multivariable calculus.
2. 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

CO1: Solve the differential equations related to various engineering fields.

CO2: Find the complete solution to the higher order linear differential equations and apply these methods to find the current in complex electrical circuits.

CO3: Identify solution methods for partial differential equations that model physical processes.

CO3: Interpret the physical meaning of different operators such as gradient, curl and divergence.

CO4: Estimate the work done against a field, circulation and flux using vector calculus.

UNIT–I: Differential equations of first order and first degree

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

UNIT–II: Linear differential equations of higher order (Constant Coefficients)

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

UNIT–III: Partial Differential Equations

Introduction, Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method and non-linear(standard types) equations, Second order PDE: solution of linear PDE with constant coefficients- RHS term of the type $e^{ax+by}, sin(ax+by), cos(ax+by), x^m y^n$

UNIT–IV: Vector differentiation

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions-Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, Scalar potential functions, Vector identities.

UNIT–V: Vector integration

LWithoutegral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44^{th} Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10^{th} Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14^{th} Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha ScienceInternational Ltd., 2021 5^{th} Edition(9^{th} reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5^{th} Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9^{th} edition
5. Higher Engineering Mathematics, B. V. Ramana, McGraw Hill Education, 2017

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST01	Basic Civil and Mechanical Engineering (Common to All branches of Engineering)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

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

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

CO1: Summarize various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

CO2: Identity 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.

UNIT–I:

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

UNIT–II:

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

UNIT–III: Polymers and Fuel Chemistry

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

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

Text Books:

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. 38^{th} Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10^{th} Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

PART B: BASIC MECHANICAL ENGINEERING

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

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

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

CO1: Understand the role of mechnical engineering and different engineering materials.

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

CO3: Describe the working of different mechanical power transmission systems,power plants, basics of robotics and its applications.

UNIT–I:

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

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

UNIT–II:

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

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

UNIT–III:

Power plants – Working principle of Steam, Diesel, Hydro, Nuclear power plants.

Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

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

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

Text Books:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt.
2. A text 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.

Reference Books:

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EET02	Network Analysis (ECE & allied branches)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

1. To introduce basic laws, mesh & nodal analysis techniques for solving electrical circuits
2. To impart knowledge on applying appropriate theorem for electrical circuit analysis
3. To explain transient behavior of circuits in time and frequency domains
4. To teach concepts of resonance
5. To introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship.

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

CO1: Understand basic electrical circuits with nodal and mesh analysis.
CO2: Analyse the circuit using network simplification theorems.
CO3: Find Transient response and Steady state response of a network.
CO4: Analyse electrical networks in the Laplace domain.
CO5: Compute the parameters of a two-port network.

UNIT–I:

Types of circuit components, Types of Sources and Source Transformations, Mesh analysis and Nodal analysis, problem solving with resistances only including dependent sources also. Principal of Duality with examples.

Network Theorems: Thevenin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Max Power Transfer, Tellegens - problem solving using dependent sources also.

UNIT–II:

Transients: First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem-solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots.

Laplace transform: introduction, Laplace transformation, basic theorems, problem solving using Laplace transform, partial fraction expansion, Heaviside's expansions, problem solving using Laplace transform.

UNIT–III:

Steady State Analysis of A.C Circuits: Impedance concept, phase angle, series R-L, R-C, R-L- C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving using Laplace transforms also.

UNIT–IV:

Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, general case-resistance present in both branches, anti-resonance at all frequencies.

Coupled Circuits: Coupled Circuits: Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.

UNIT–V:

Two-port Networks: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h- parameters, Relationships Between parameter Sets, Parallel & series connection of two port networks, cascading of two port networks, problem solving using dependent sources also.

Text Books:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3^{rd} Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9^{th} Edition 2020.
3. Network lines and Fields by John. D. Ryder 2^{nd} Edition, PHI

Reference Books:

1. D. Roy Choudhury, Networks and Systems, New Age International Publications, 2013.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series, 7^{th} Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017
3. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill Education.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BSL01	Communicative English Lab (Common to All Branches of Engineering)	0	0	2	1

Internal Marks: 30 External Marks: 70

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

Course Outcomes:

CO1: Understand the different aspects of the English language proficiency with emphasis on LSRW skills.

CO2: Apply communication skills through various language learning activities.

CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

CO4: Evaluate and exhibit professionalism in participating in debates and group discussions.

CO5: Create effective Course Objectives

List of Topics:

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

Suggested Software:

1. Walden Infotech
2. Young India Films

Reference Books:

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

Web Resources:

Spoken English:

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

Voice & Accent:

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BSL04	Chemistry Lab (Common to EEE, ECE, CSE, IT & allied branches)	3	0	0	3

Internal Marks: 30 External Marks: 70

Course Objectives:

- To verify the fundamental concepts with experiments

Course Outcomes: At the end of the course, the student 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

References:

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL01	Engineering Workshop (Common to All branches of Engineering)	0	0	3	1.5

Internal Marks: 30 External Marks: 70

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting, electrical house wiring skills, and basic repairs of two-wheeler vehicle.

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

CO1: Identify workshop tools and their operational capabilities.

CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry, welding and plumbing.

CO3: Apply sheet metal working operations in various applications and basic repairs of two weeler vehicle.

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:** Familiarity with 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.
9. **Basic repairs of Two-wheeler vehicle** – Demonstration of working of two-wheeler vehicle and its repairs.

Text Books:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019.
2. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5^{th} Edn. 2015.
3. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EEL02	Network Analysis and Simulation Laboratory (ECE & allied branches)	0	0	3	1.5

Internal Marks: 15 External Marks: 35

Course Objectives:

1. To gain hands on experience in verifying Kirchoff's laws and network theorems
2. To analyze transient behavior of circuits
3. To study resonance characteristics
4. To determine 2-port network parameters

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

CO1: Verify Kirchoff's laws and network theorems.
CO2: Measure time constants of RL & RC circuits.
CO3: Analyze behavior of RLC circuit for different cases.
CO4: Design resonant circuit for given specifications.
CO5: Characterize and model the network in terms of all network parameters.

The following experiments need to be performed using both Hardware and simulation Software.
The experiments need to be simulated using software and the same need to be verified using the hardware.

List of Experiments:

1. Study of components of a circuit and Verification of KCL and KVL.
2. Verification of mesh and nodal analysis for AC circuits
3. Verification of Superposition, Thevenin's & Norton theorems for AC circuits
4. Verification of maximum power transfer theorem for AC circuits
5. Verification of Tellegen's theorem for two networks of the same topology.
6. Study of DC transients in RL, RC and RLC circuits
7. To study frequency response of various 1^{st} order RL & RC networks
8. To study the transient and steady state response of a 2^{nd} order circuit by varying its various parameters and studying their effects on responses
9. Find the Q Factor and Bandwidth of a Series and Parallel Resonance circuit.

10. Determination of open circuit (Z) and short circuit (Y) parameters
11. Determination of hybrid (H) and transmission (ABCD) parameters
12. To measure two port parameters of a twin-T network and study its frequency response.

Hardware Requirements:
Regulated Power supplies, Analog/Digital Function Generators, Digital Multimeters, Decade Resistance Boxes/Rheostats, Decade Capacitance Boxes, Ammeters (Analog or Digital), Voltmeters (Analog or Digital), Active & Passive Electronic Components

Software requirements:
Multisim/ Pspice/Equivalent simulation software tool, Computer Systems with required specifications

References:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3^{rd} Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9^{th} Edition 2020.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BSL05	Health and Wellness, Yoga and Sports (Common to All branches of Engineering)	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: At the end 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:

1. Organizing health awareness programmes in community
2. Preparation of health profile
3. 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:

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

   Practicing general and specific warm up, aerobics
2. Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14^{th} 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 Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. – 3^{rd} ed. Human Kinetics, Inc.2014

General Guidelines:

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

Evaluation Guidelines:

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST11	Complex Variables and Random Processes	3	0	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

1. To familiarize the complex variables.
2. This gives basic understanding of random variables and operations that can be performed on them.
3. To know the Spectral and temporal characteristics of Random Process.

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

CO1: Apply Cauchy-Riemann equations to complex functions to determine analyticity. (L3)

CO2: Calculate Taylor and Laurent expansions, identify singularities and apply residue theorem. (L3)

CO3: Apply discrete and continuous probability distributions. (L3)

CO4: Perform operations on single and multiple Random variables. (L3)

CO5: Analyze stochastic processes and determine signal characteristics. (L3)

UNIT–I: Functions of a Complex Variable and Complex Integration (10 Lectures)

Continuity, Differentiability, Analyticity, Cauchy-Riemann equations (Cartesian and polar), Harmonic and conjugate harmonic functions, Milne–Thompson method.

Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, Generalized integral formula (without proofs).

UNIT–II: Series Expansions and Residue Theorem (8 Lectures)

Radius of convergence, Taylor's, Maclaurin's and Laurent's series.

Types of Singularities: Isolated, Essential, Pole of order m, Residues, Residue theorem (without proof), Real integrals:

$$\int_{-\infty}^{\infty} f(x)\,dx, \quad \int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)\,d\theta$$

UNIT–III: Probability & Random Variables (10 Lectures)

Sets, Sample Spaces, Events, Axioms, Joint and Conditional Probability, Bayes' Theorem, Independent Events.

Random Variables: Functions, expectation, mixed variables, Binomial, Poisson, Uniform, Gaussian distributions.

UNIT–IV: Operations on Random Variables (10 Lectures)

Moments: Origin, Central moments, Variance, Skew, Chebyshev's inequality, MGF, Characteristic function.

Multiple RVs: Joint, Marginal and Conditional Distributions, Independence.

UNIT–V: Stochastic Processes and Spectral Characteristics (8 Lectures)
Power Spectrum and properties, Autocorrelation, Cross-Power Spectrum, Cross-Correlation.
System Response: Power density spectrum, Cross power spectral density of input/output.

Text Books:

1. B. S. Grewal, *Higher Engineering Mathematics*, 44th Edition, Khanna Publishers.
2. Peyton Z. Peebles, *Probability, Random Variables & Random Signal Principles*, 4th Ed., TMH, 2001.
3. Taub and Schilling, *Principles of Communication Systems*, TMH, 2008.

Reference Books:

1. Bruce Hajck, *Random Processes for Engineers*, Cambridge Press, 2015.
2. A. Papoulis and S. U. Pillai, *Probability, Random Variables and Stochastic Process*, 4th Ed., PHI, 2002.
3. B. P. Lathi, *Signals, Systems & Communications*, B.S. Publications, 2003.
4. S. P. Eugene Xavier, *Statistical Theory of Communication*, New Age, 2003.

Web Resources:

1. `http://tutorial.math.lamar.edu/Classes/DE/DE.aspx`
2. `http://mathworld.wolfram.com/topics`
3. `http://www.nptel.ac.in/course.php`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST12	Universal Human Values – Understanding Harmony and Ethical Human Conduct (Common to All branches of Engineering)	2	1	0	3

Internal Marks: 30 **External Marks: 70**

Course Objectives:

1. 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.
2. 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.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

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

CO1: Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
CO2: Identify one's self, and one's surroundings (family, society, nature) (L1, L2)
CO3: Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
CO4: Relate human values with human relationship and human society. (L4)
CO5: Justify the need for universal human values and harmonious existence (L5)
CO6: Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions. The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

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

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: Self-exploration as the Process for Value Education

Lecture 4: 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)

Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

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

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV: Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)

Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

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

Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body

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

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:
Textbook and Teachers Manual
a. The Textbook
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/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST08	Signals and Systems	3	0	0	3

Course Objectives:

- To study about signals and systems.
- To analyze the spectral characteristics of signal using Fourier series and Fourier transforms.
- To understand the characteristics of systems.
- To introduce the concept of sampling process.
- To know various transform techniques to analyze the signals and systems.

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

CO1: Differentiate the various classifications of signals and systems.

CO2: Analyze the frequency domain representation of signals using Fourier concepts.

CO3: Classify the systems based on their properties and determine the response of LTI Systems.

CO4: Know the sampling process and various types of sampling techniques.

CO5: Apply Laplace and Z-transforms to analyze signals and Systems (continuous & discrete).

UNIT-I: INTRODUCTION

Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function, signum function and ramp function.

UNIT-II: FOURIER SERIES AND FOURIER TRANSFORM

Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum. 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, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform, Related problems.

UNIT-III: ANALYSIS OF LINEAR SYSTEMS

Introduction, Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system, Related problems. Filter characteristics of linear systems.

UNIT-IV: CORRELATION

Auto-correlation and cross-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between Convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

SAMPLING THEOREM:

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.

UNIT-V: LAPLACE TRANSFORMS

Introduction, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of Laplace transforms, Inverse Laplace transform, Relation between Laplace transforms and Fourier transforms of a signal. Laplace transform of certain signals using waveform synthesis.

Z–TRANSFORMS:

Concept of Z-Transform of a discrete sequence. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms. Distinction between Laplace, Fourier and Z-transforms.

TEXTBOOKS:

1. Signals, Systems & Communications - B.P. Lathi, B S Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn, 1997.
3. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition, 2007.

REFERENCE BOOKS:

1. Principles of Linear Systems and Signals – B.P. Lathi, Oxford University Press, 2015.
2. Signals and Systems – T.K. Rawat, Oxford University Press, 2011.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECT02	Switching Theory and Logic Design	3	0	0	3

II Year - I Semester

Course Objectives:

- To solve a typical number base conversion and analyze new error coding techniques.
- Understand theorems and functions of Boolean algebra and behavior of logic gates.
- To optimize logic gates for digital circuits using various techniques.
- Boolean function simplification using Karnaugh maps and Quine-McCluskey methods.
- To understand concepts of combinational circuits.
- To develop advanced sequential circuits.

Course Outcomes:

CO1: Classify different number systems and apply them to generate various codes.
CO2: Use the concept of Boolean algebra in minimization of switching functions.
CO3: Design different types of combinational logic circuits.
CO4: Apply knowledge of flip-flops in the design of registers and counters.
CO5: Understand the operation and design methodology for synchronous sequential circuits and algorithmic state machines.
CO6: Produce innovative designs by modifying traditional design techniques.

UNIT–I: Review of Number Systems & Codes
Representation of numbers of different radix, conversion from one radix to another, $(r-1)$'s and r's complements of signed numbers. Gray code, 4-bit codes: BCD, Excess-3, 2421, 84-2-1 code etc.
Error detection & correction codes: parity checking, even parity, odd parity, Hamming code.
Boolean Theorems and Logic Operations: Boolean theorems, principle of complementation & duality, De Morgan's theorems. Logic operations: Basic operations – NOT, OR, AND; Universal operations, EX-OR, EX-NOR operations. Standard SOP and POS forms, NAND–NAND and NOR–NOR realizations, realization of three-level logic circuits.

UNIT–II: Minimization Techniques
Minimization and realization of switching functions using Boolean theorems, K-Map (up to 4 variables).
Combinational Logic Circuits Design: Design of Half adder, Full adder, Half

subtractor, Full subtractor; applications of full adders; 4-bit adder-subtractor, BCD adder, Excess-3 adder, Carry Look-ahead adder.

UNIT–III: Combinational Logic Circuits using MSI & LSI

Design of encoder, decoder, multiplexer, and demultiplexer. Implementation of higher-order circuits using lower-order circuits. Design of priority encoder, 4-bit digital comparator.

Introduction to PLDs: PROM, PAL, PLA – basic structures, realization of Boolean functions, programming table.

UNIT–IV: Sequential Circuits I

Classification of sequential circuits (synchronous and asynchronous), operation of NAND & NOR latches and flip-flops. Truth tables and excitation tables of RS, JK, T, and D flip-flops with reset and clear terminals. Conversion between flip-flops. Design of ripple counters, synchronous counters, Johnson counter, ring counter. Design of registers: buffer, control buffer, shift register, bi-directional shift register, universal shift register.

UNIT–V: Sequential Circuits II

Finite state machines: state diagrams, state tables, reduction of state tables. Analysis of clocked sequential circuits. Mealy to Moore conversion and vice versa. Realization of sequence generators. Design of clocked sequential circuits to detect specific sequences (with or without overlapping).

Text Books:

1. Switching and Finite Automata Theory – Zvi Kohavi, Niraj K. Jha, 3rd Edition, Cambridge University Press, 2009.
2. Digital Design – M. Morris Mano, Michael D. Ciletti, 4th Edition, PHI, 2008.
3. Switching Theory and Logic Design – Hill and Peterson, McGraw-Hill TMH, 2012.

References:

1. Fundamentals of Logic Design – Charles H. Roth Jr., Jaico Publishers, 2006.
2. Digital Electronics – R. S. Sedha, S. Chand & Co. Ltd., 2010.
3. Switching Theory and Logic Design – A. Anand Kumar, PHI Learning Pvt. Ltd., 2016.
4. Digital Logic Applications and Design – John M. Yarbrough, Cengage Learning, 2006.
5. TTL 74-Series Databook.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECT01	Electronic Devices and Circuits	3	0	0	3

Course Objectives:

- To learn and understand the basic concepts of semiconductor physics.
- Study the physical phenomena such as conduction, transport mechanism and electrical characteristics of different diodes.
- To learn and understand the application of diodes as rectifiers with their operation and characteristics with and without filters are discussed.
- Acquire knowledge about the principle of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics.
- To learn and understand the purpose of transistor biasing and its significance.
- Small signal equivalent circuit analysis of BJT and FET transistor amplifiers and compare different configurations.

Course Outcomes:

CO1: Apply the basic concepts of semiconductor physics.

CO2: Understand the formation of p-n junction and how it can be used as a p-n junction diode in different modes of operation.

CO3: Analyze the construction, working principle of Semiconductor Devices and Diode Circuits.

CO4: Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions.

CO5: Apply small signal low frequency transistor amplifier circuits using BJT and FET in different configurations.

UNIT-I: Review of Semiconductor Physics

Mobility and Conductivity, Intrinsic and extrinsic semiconductors, Hall effect, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors.

Junction Diode Characteristics: energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.

UNIT-II:

Special Semiconductor Devices: Varactor Diode, LED, Photodiode, Tunnel Diode, UJT, SCR, Construction, operation and V-I characteristics.

Diode Circuits: The Diode as a circuit element, The Load-Line concept, The Piecewise Linear Diode model, Clipping (limiting) circuits, Clipping at Two Independent Levels, Peak Detector, Clamping circuits, Comparators, Sampling Gate.

UNIT-III:

Transistor Characteristics: Junction transistor, transistor equation in CB configuration, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, punch through/ reach through.

Transistor Biasing and Thermal Stabilization: Need for biasing, operating point, load line analysis, BJT biasing - methods, basic stability, fixed bias, collector to base bias, self bias,

Stabilization against variations in V_{BE}, I_c, and β, Stability factors (S, S', S''), Bias compensation, Thermal runaway, Thermal stability.

UNIT-IV: Small Signal Low Frequency Transistor Amplifier Models

BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h- parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.

UNIT-V:

FET: FET types, JFET operation, characteristics, small signal model of JFET.

MOSFET: MOSFET Structure, Operation of MOSFET: operation in triode region, operation in saturation region, MOSFET as a variable resistor, MOS device models: MOS small signal model, PMOS Transistor, CMOS Technology, Comparison of Bipolar and MOS devices.

Text Books:

1. Millman's Electronic Devices and Circuits - J. Millman, C. C. Halkias and Satyabrata Jit, Mc-Graw Hill Education, 4th edition, 2015.
2. Millman's Integrated Electronics - J. Millman, C. Halkias, and Ch. D. Parikh, Mc-Graw Hill Education, 2nd Edition, 2009.
3. Fundamentals of Microelectronics - Behzad Razavi, Wiley, 3rd edition, 2021.

Reference Books:

1. Basic Electronics - Principles and Applications, Chinmoy Saha, Arindam Halder, Debarati Ganguly, Cambridge University Press.
2. Electronics devices & circuit theory - Robert L. Boylestad and Louis Nashelsky, Pearson, 11th edition, 2015.
3. Electronic Devices and Circuits - David A. Bell, Oxford University Press, 5th edition, 2008.
4. Electronic Devices and Circuits - S. Salivahanan, N. Suresh Kumar, Mc-Graw Hill, 5th edition, 2022.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECL01	Electronic Devices and Circuits Lab	0	0	3	1.5

Note: The students are required to perform the experiment to obtain the V-I characteristics and to determine the relevant parameters from the obtained graphs.

List of Experiments:

(Minimum of Ten Experiments must be performed)

1. Clipper circuit using diode
2. Clamping circuit using diode
3. Rectifiers (without and with C-filter)
   Part A: Half-wave Rectifier
   Part B: Full-wave Rectifier
4. BJT Characteristics (CE Configuration)
   Part A: Input Characteristics
   Part B: Output Characteristics
5. FET Characteristics (CS Configuration)
   Part A: Drain Characteristics
   Part B: Transfer Characteristics
6. SCR Characteristics
7. UJT Characteristics
8. Transistor Biasing
9. CRO Operation and its Measurements
10. BJT-CE Amplifier
11. Emitter Follower - CC Amplifier
12. FET - CS Amplifier

Equipment Required:

- Regulated Power Supplies
- Analog/Digital Storage Oscilloscopes
- Analog/Digital Function Generators
- Digital Multimeters
- Decade Resistance Boxes / Rheostats

- Decade Capacitance Boxes
- Ammeters (Analog or Digital)
- Voltmeters (Analog or Digital)
- Active and Passive Electronic Components

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECL02	Switching Theory and Logic Design Lab	0	0	3	1.5

List of Experiments:

1. Verification of truth tables of the following Logic gates:
   Two input: (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive-OR (vi) Exclusive-NOR
2. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.
3. Verification of functional table of 3 to 8-line Decoder / De-multiplexer
4. 4-variable logic function verification using 8 to 1 multiplexer
5. Design full adder circuit and verify its functional table
6. Verification of functional tables of:
   (i) JK Edge Triggered Flip–Flop
   (ii) JK Master-Slave Flip–Flop
   (iii) D Flip–Flop
7. Design a four-bit ring counter using D Flip–Flops / JK Flip-Flop and verify output
8. Design a four-bit Johnson's counter using D Flip–Flops / JK Flip-Flops and verify output
9. Verify the operation of 4-bit Universal Shift Register for different modes of operation
10. Draw the circuit diagram of MOD-8 ripple counter and construct the circuit using T Flip-Flops. Test it with a low-frequency clock and sketch the output waveforms
11. Design MOD–8 synchronous counter using T Flip-Flop, verify the result, and sketch the output waveforms
12. (a) Draw the circuit diagram of a single bit comparator and test the output
    (b) Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it

Additional Experiments:

1. Design BCD Adder Circuit and test the same using relevant IC
2. Design Excess-3 to 9-Complement convertor using only four Full Adders and test the circuit

3. Design an experimental model to demonstrate the operation of 74154 De-Multiplexer using LEDs for outputs
4. Design of any combinational circuit using Hardware Description Language (HDL)
5. Design of any sequential circuit using Hardware Description Language (HDL)

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECS01	Data Structures Using Python	0	0	3	1.5

List of Experiments:

1. Write a Python program for a class `Flower` that has three instance variables of type `str`, `int`, and `float` that respectively represent the name of the flower, its number of petals, and its price. Include a constructor to initialize variables and methods to set and retrieve each variable.
2. Develop an inheritance hierarchy based upon a `Polygon` class having abstract methods `area()` and `perimeter()`. Implement classes `Triangle`, `Quadrilateral`, and `Pentagon` that extend this base class. Write a program to allow users to create polygons, input dimensions, and output area and perimeter.
3. Write a Python program to implement Method Overloading and Method Overriding.
4. Write a Python program to illustrate:
   - List Comprehensions
   - Dictionary Comprehensions
   - Set Comprehensions
   - Generator Comprehensions
5. Write a Python program to generate the combinations of n distinct objects taken from the elements of a given list. Example: Original list: [1, 2, 3, 4, 5, 6, 7, 8, 9]; Combinations of 2 distinct objects: [1, 2], [1, 3], ..., [8, 9].
6. Write a program for Linear Search and Binary Search.
7. Write a program to implement Bubble Sort and Selection Sort.
8. Write a program to implement Merge Sort and Quick Sort.
9. Write a program to implement Stacks and Queues.
10. Write a program to implement a Singly Linked List.
11. Write a program to implement a Doubly Linked List.
12. Write a program to implement a Binary Search Tree.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ACT01	Environmental Science	0	1	2	2

Course Objectives:

- To make the students aware of the environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution caused due to day-to-day human activities.
- To save Earth from the inventions by the engineers.

Course Outcomes:

CO1: Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.

CO2: Understand flow and bio-geo-chemical cycles and ecological pyramids.

CO3: Identify causes of pollution and solid waste management and related preventive measures.

CO4: Understand rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation.

CO5: Illustrate causes of population explosion, value education and welfare programmes.

UNIT-I: Multidisciplinary Nature of Environmental Studies

Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable resources – Problems – Forest resources – Use and over-exploitation, deforestation, case studies – Timber extraction – Mining, dams and 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, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources.

UNIT-II: Ecosystems and Biodiversity

Concept of ecosystem – Structure and function – Producers, consumers and decomposers – Energy flow – Ecological succession – Food chains, food webs, ecological pyramids – Forest, Grassland, Desert and Aquatic ecosystems (ponds, lakes, rivers, oceans, estuaries).

Biodiversity: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity – Threats: habitat loss, poaching, man-wildlife conflicts – Endangered and endemic species – Conservation: In-situ and Ex-situ conservation of biodiversity.

UNIT-III: Environmental Pollution

Definition, Cause, effects and control measures of Air, Water, Soil, Marine, Noise, Thermal and Nuclear pollution.

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

UNIT-IV: Social Issues and the Environment

Sustainable development – Urban energy problems – Water conservation, rainwater harvesting, watershed management – Resettlement and rehabilitation problems – Environmental ethics – Climate change, global warming, acid rain, ozone depletion, nuclear hazards – Wasteland reclamation – Environment Protection Acts and Legislation – Public awareness.

UNIT-V: Human Population and Environment

Population growth and variation – Population explosion – Family welfare programmes – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of IT in Environment and Health – Case studies.

Text Books:

1. Erach Bharucha, *Textbook of Environmental Studies for Undergraduate Courses*, Universities Press, 2019.
2. Palaniswamy, *Environmental Studies*, Pearson Education, 2014.
3. S. Azeem Unnisa, *Environmental Studies*, Academic Publishing Company, 2021.
4. K. Raghavan Nambiar, *Textbook of Environmental Studies for Undergraduate Courses*, SciTech Publications, 2010.

Reference Books:

1. Deeksha Dave and E. Sai Baba Reddy, *Textbook of Environmental Studies*, Cengage, 2012.
2. M. Anji Reddy, *Environmental Sciences and Technology*, BS Publication, 2014.
3. J.P. Sharma, *Comprehensive Environmental Studies*, Laxmi Publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, *Environmental Sciences and Engineering*, Prentice Hall of India, 1988.
5. G.R. Chatwal, *A Text Book of Environmental Studies*, Himalaya Publishing, 2018.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23MBT01	Managerial Economics and Financial Analysis	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:

CO1: Define the concepts related to Managerial Economics, financial accounting and management (L2)

CO2: Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)

CO3: Apply the concept of Production cost and revenues for effective Business decision (L3)

CO4: Analyze how to invest their capital and maximize returns (L4)

CO5: Evaluate the capital budgeting techniques (L5)

CO6: Develop the accounting statements and evaluate the financial performance of business entity (L5)

UNIT - I: Managerial Economics

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

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

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

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 of Return (IRR) Method (sample problems).

UNIT - V: Financial Accounting and Analysis

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, 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 H.L: 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:

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

Course Code	Course Name	Course Structure			
		L	T	P	C
P23EST12	Linear Control Systems	3	0	0	3

Course Objectives:

- To introduce the concepts of open loop and closed loop systems, mathematical models of mechanical and electrical systems, and concepts of feedback.
- To study the characteristics of the given system in terms of the transfer function and introducing various approaches to reduce the overall system for necessary analysis.
- To develop acquaintance in analyzing the system response in time-domain and frequency-domain in terms of various performance indices.
- To analyze the system in terms of absolute stability and relative stability by different approaches.
- To design different control systems for different applications as per given specifications.
- To introduce the concepts of state variable analysis, design and also the concepts of controllability and observability.

Course Outcomes:

- This course introduces the concepts of feedback and its advantages to various control systems.
- The performance metrics to design the control system in time-domain and frequency domain are introduced.
- Control systems for various applications can be designed using time-domain and frequency domain analysis.
- In addition to the conventional approach, the state space approach for the analysis of control systems is also introduced.

UNIT I - INTRODUCTION

Concepts of System, Control Systems: Open Loop and closed loop control systems and their differences. Different examples of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models, Differential equations, Impulse Response and transfer functions. Translational and Rotational mechanical systems.

UNIT II – TRANSFER FUNCTION REPRESENTATION

Transfer Function of DC Servo motor - AC Servo motor- Synchro-transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples – Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula. TIME RESPONSE ANALYSIS Standard test

signals – Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems – Time domain specifications – Steady state response - Steady state errors and error constants.

UNIT III – STABILITY ANALYSIS IN S-DOMAIN

The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability. Root Locus Technique: The root locus concept - construction of root loci - effects of adding poles and zeros to G(s) H(s) on the root loci.

UNIT IV

Frequency response analysis: Introduction, Correlation between time and frequency response, Polar Plots, Bode Plots, Nyquist Stability Criterion.

UNIT V – CLASSICAL CONTROL DESIGN TECHNIQUES

Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers. State Space Analysis of Continuous Systems Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization - Solving the Time invariant state Equations - State Transition Matrix and its Properties – Concepts of Controllability and Observability.

Text Books:

1. Automatic Control Systems, 8th edition – by B.C. Kuo, John Wiley and Sons, 2003.
2. Control Systems Engineering – by I.J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 2nd edition, 2007.
3. Modern Control Engineering – by Katsuhiko Ogata, Pearson Publications, 5th edition, 2015.

Reference Books:

1. Control Systems by A. Nagoorkani, RB Publications, 3rd edition, 2017.
2. Control Systems by A. Anandkumar, PHI, 2nd Edition, 2014.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECT03	Electromagnetic Waves and Transmission Lines	3	0	0	3

Course Objectives: The main objectives of this course are to:

- Understand the fundamentals of electric fields, Coulomb's law and Gauss law.
- Familiar with Biot-Savart Law, Ampere's Circuital Law and Maxwell equations.
- Aware of electromagnetic wave propagation in dielectric and conducting media.
- Study the equivalent circuit of transmission lines and parameters of the transmission lines.
- Learn the working of Smith chart and its usage in the calculation of transmission line parameters.

Course Outcomes:

- Determine electric field intensity using Coulomb's law and Gauss law.
- Determine magnetic field intensity using Biot-Savart Law and Ampere's Circuital Law.
- Analyze the electromagnetic wave propagation in dielectric and conducting media.
- Examine the primary and secondary constants of different types of transmission lines.
- Derive the expressions for input impedance, reflection coefficient, and VSWR of transmission lines and calculate these parameters using Smith chart.

UNIT I: Electrostatics

Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.

UNIT II: Magnetostatics

Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Inductances and Magnetic Energy, Illustrative Problems. Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements, Conditions at a Boundary Surface, Illustrative Problems.

UNIT III: EM Wave Characteristics

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types, Illustrative Problems.

UNIT IV: Transmission Lines - I

Types, Parameters, T & π Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Illustrative Problems.

UNIT V: Transmission Lines – II

Input Impedance Relations, Reflection Coefficient, VSWR, Average Power, Shorted Lines, Open Circuited Lines, and Matched Lines, Low loss radio frequency and UHF Transmission lines, UHF Lines as Circuit Elements, Smith Chart – Construction and Applications, Quarter wave transformer, Single Stub Matching, Illustrative Problems.

Text Books:

1. Elements of Electromagnetics – Matthew N. O. Sadiku, Oxford University Press, 7th edition, 2018.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2008.

Reference Books:

1. Engineering Electromagnetics – William H. Hayt, John A. Buck, Jaleel M. Akhtar, TMH, 9th edition, 2020.
2. Electromagnetic Field Theory and Transmission Lines – G. S. N. Raju, Pearson Education, 2006.
3. Electromagnetic Field Theory and Transmission Lines – G. Sasi Bhushana Rao, Wiley India, 2013.
4. Networks, Lines and Fields – John D. Ryder, Second Edition, Pearson Education, 2015.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECT04	Electronic Circuit Analysis	3	0	0	3

Course Objectives:

- To learn hybrid-π parameters at high frequency and compare with low frequency parameters.
- Understand the purpose of cascading single stage amplifiers and derive overall voltage gain.
- Analyze effects of negative feedback on amplifier characteristics and derive characteristics.
- Understand principles of oscillator circuits and analyze different oscillator circuits.
- Compare and analyze different power amplifiers like Class A, B, C, AB, and others.
- Analyze different types of tuned amplifier circuits.

Course Outcomes:

CO1: Design and analyze small signal high frequency transistor amplifiers using BJT and FET.

CO2: Design and analyze multistage and differential amplifiers using BJT and FET.

CO3: Derive expressions for frequency and conditions of oscillation for RC and LC oscillators; understand amplitude and frequency stability.

CO4: Classify and analyze power and tuned amplifiers and compare their performance.

UNIT-I: Small Signal High Frequency Transistor Amplifier models

BJT: High frequency transistor, Hybrid-π common emitter model, hybrid conductance and capacitances, validity of model, relation to low-frequency parameters, cut-off frequencies, frequency response, gain bandwidth product.

FET: Analysis of common source and common drain amplifier circuits at high frequencies.

UNIT-II: Multistage Amplifiers

Classification, methods of coupling, cascaded transistor amplifiers, analysis of two-stage RC coupled amplifier, high input resistance circuits such as Darlington pair, Cascode amplifier, Bootstrap emitter follower, Differential amplifier using BJT.

UNIT-III: Feedback Amplifiers

Feedback principle and concept, types of feedback, classification of amplifiers, feedback topologies, Characteristics of negative feedback amplifiers, Generalized

analysis of feedback amplifiers, Performance comparison of feedback amplifiers, Method of analysis of feedback amplifiers.

UNIT-IV: Oscillators

Oscillator principle, condition for oscillations, types of oscillators, RC- phaseshift and Wien bridge oscillators with BJT and FET and their analysis, Generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators using BJT, Frequency and amplitude stability of oscillators.

UNIT-V: Power Amplifiers and Tuned Amplifiers

Classification of amplifiers(A to H), Class A power Amplifiers, Class B Push-pull amplifiers, Complementary symmetry push pull amplifier, Class AB power amplifier, Class-C power amplifier, Thermal stability and Heat sinks.

Tuned Amplifiers: Introduction, Q-Factor, small signal tuned amplifier, capacitance single tuned amplifier, double tuned amplifiers, , staggered tuned amplifiers.

Text Books:

1. J. Millman and C.C. Halkias, *Integrated Electronics*, Tata McGraw-Hill, 1972.
2. Robert L. Boylestad and Louis Nashelsky, *Electronic Devices and Circuits Theory*, Pearson, 10th Edition, 2009.
3. B.P. Singh, Rekha, *Electronic Devices and Integrated Circuits*, Pearson, 2006.

Reference Books:

1. Donald A. Neaman, *Electronic Circuit Analysis and Design*, McGraw Hill, 2010.
2. Sedra A.S. and K.C. Smith, *Microelectronic Circuits*, Oxford University Press, 6th Edition, 2011.
3. B.V. Rao, K.R. Rajeswari, P.C.R. Pantulu, K.B.R. Murthy, *Electronic Circuit Analysis*, Pearson Publications.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECT05	Analog Communications	3	0	0	3

Course Outcomes:

- Describe modulation and demodulation techniques of standard AM.
- Compare different AM modulation and demodulation methods.
- Analyze generation and detection of angle modulated signals.
- Outline the different sections of radio receivers.
- Interpret radio transmitters fully.
- Illustrate noise performance in analog modulation and concepts of pulse analog modulation and demodulation.

UNIT-I: Amplitude Modulation

Introduction to Fourier transform, communication systems, need for modulation, FDM, amplitude modulation - time and frequency domain descriptions, single tone modulation, power relations, AM wave generation (square law, switching modulators), AM wave detection (square law, envelope detectors), related problems.

UNIT-II: DSB & SSB Modulation

DSBSC modulator: time & frequency domain, generation by balanced & ring modulators, coherent detection, COSTAS and squaring loops.
SSBSC modulator: time & frequency domain, generation by frequency and phase discrimination, coherent demodulation.
Vestigial sideband modulation: time & frequency domain, generation, envelope detection, comparison and applications.

UNIT-III: Angle Modulation

Basic concepts of phase and frequency modulation, spectrum analysis of sinusoidal FM, narrowband and wideband FM, power, bandwidth, generation (direct & indirect), detection methods (balanced frequency discriminator, zero crossing, PLL), comparison of FM & AM.

UNIT-IV: Radio Transmitters and Receivers

Classification of transmitters, AM and FM transmitters, feedback effects, frequency stability.
Receivers: Tuned RF, super heterodyne receiver, RF sections, frequency changing/tracking, IF, AGC, AM & FM receivers, communication receivers, extensions.

UNIT-V: Noise and Pulse Analog Modulation

Noise sources, noise figure, noise in DSB, SSB, AM, and angle modulation systems, threshold effects, pre-emphasis & de-emphasis.
Pulse modulation types: PAM, PWM, PPM, their generation and detection, time division multiplexing.

Text Books:

1. Simon Haykin, Michael Moher, *Communication Systems*, Wiley, 5th Edition, 2009.
2. H. Taub, D.L. Schilling, Gautam Sahe, *Principles of Communication Systems*, TMH, 4th Edition, 2017.
3. B.P. Lathi, Zhi Ding, Hari Mohan Gupta, *Modern Digital and Analog Communication Systems*, Oxford, 4th Edition, 2017.

Reference Books:

1. George Kennedy, Bernard Davis, S.R.M. Prasanna, *Electronics & Communication Systems*, TMH, 6th Edition, 2017.
2. R.P. Singh, S.D. Sapre, *Communication Systems*, TMH, 3rd Edition, 2017.
3. Dr. Sanjay Sharma, *Communication Systems (Analog and Digital)*, Katson Books, 7th Reprint, 2018.

Web Links:

- http://nptel.ac.in/courses/117102059/ Prof. Surendra Prasad.
- https://ict.iitk.ac.in/wp-content/uploads/EE320A-Principles-Of-Communication-CommunicationSystems-4ed-Haykin.pdf
- https://www.scribd.com/document/266137872/sanjay-sharma-pdf
- http://bayanbox.ir/view/9144090835198890 86/Book-Modern-Digital-And-AnalogCommunication-Systems-4th-edition-by-Lathi.pdf
- https://soaneemrana.org/onewebmedia/ELECTRONICS%20COMMUNICATION%20SYSTEM%20BY%20GEORGE%20KENNEDY.pdf

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECL04	Electronic Circuit Analysis Lab	0	0	3	1.5

Course Objectives:

- To design and simulate electronic circuits using Multisim or equivalent licensed simulation software.
- To verify simulation results through hands-on experiments using hardware equipment.
- To develop practical skills in electronic circuit analysis and hardware testing.

List of Experiments: (Minimum of Ten experiments to be performed)

1. Determination of Ft of a given transistor.
2. Voltage-Series Feedback Amplifier.
3. Current-Shunt Feedback Amplifier.
4. RC Phase Shift / Wien Bridge Oscillator.
5. Hartley / Colpitt's Oscillator.
6. Two Stage RC Coupled Amplifier.
7. Darlington Pair Amplifier.
8. Bootstrapped Emitter Follower.
9. Class A Series-fed Power Amplifier.
10. Transformer-coupled Class A Power Amplifier.
11. Class B Push-Pull Power Amplifier.
12. Complementary Symmetry Class B Push-Pull Power Amplifier.
13. Single Tuned Voltage Amplifier.
14. Double Tuned Voltage Amplifier.

Equipment Required:

Software:

- Multisim or equivalent industrial standard licensed simulation software.
- Computer systems with required specifications.

Hardware:

- Regulated power supplies.
- Analog/Digital storage oscilloscopes.
- Analog/Digital function generators.
- Digital multimeters.
- Decade resistance boxes / rheostats.
- Decade capacitance boxes.
- Ammeters (analog or digital).
- Voltmeters (analog or digital).
- Active and passive electronic components.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECL03	Signals and Systems Lab	0	0	3	1.5

Lab Experiments:

1. Generation of Basic Signals (Analog and Discrete): Unit step, Unit impulse, Unit ramp, Sinusoidal, Signum.
2. Operations on signals: Addition & subtraction, multiplication & division, maximum & minimum.
3. Energy and power of signals; even and odd signals.
4. Transformation of independent variable: shifting (delay & advance), reversing, scaling.
5. Convolution & deconvolution.
6. Correlation.
7. Fourier series representation.
8. Fourier transform and spectrum analysis.
9. Laplace transforms.
10. Z-transforms.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECS02	Soft Skills	2	0	0	2

Course Objectives:

- To prepare students to face global competition for employment and excellence in profession.
- To help students understand and build interpersonal and intrapersonal skills to lead a meaningful professional life.

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

CO1: Assimilate and understand the meaning and importance of soft skills and learn how to develop them. (L1)

CO2: Understand the significance of soft skills in the working environment for professional excellence. (L2)

CO3: Prepare to undergo the placement process with confidence and clarity. (L3)

CO4: Be ready to face any situation in life and equip themselves to handle them effectively. (L6)

CO5: Understand and learn the importance of etiquette in both professional and personal life. (L2)

UNIT–I: INTRODUCTION

Emergence of life skills – Definition and Meaning – Importance and Need – Reasons for Skill Gap – Soft Skills vs Hard Skills – Linkage between Industry and Soft Skills – Challenges – Personality Development – Soft Skills vs English – Techniques for Improvement.

UNIT–II: INTRA-PERSONAL SKILLS

Definition – Meaning – Importance – SWOT Analysis – Johari Window – Goal Setting – Quotient Skills – Emotional Intelligence – Attitudinal Skills – Right Thinking – Problem Solving – Time Management – Stress Management.

UNIT–III: INTER-PERSONAL SKILLS

Definition – Meaning – Importance – Communication Skills – Team Work – Managerial Skills – Negotiation Skills – Leadership Skills – Corporate Etiquettes.

UNIT–IV: VERBAL SKILLS

Definition and Meaning – Listening Skills – Need – Types – Advantages – Importance – Improving Tips – Speaking – Need – Types – Advantages – Improving Tips – Reading – Writing – Report – Resume – Statement of Purpose – Tips for Improvement.

UNIT–V: NON-VERBAL SKILLS & INTERVIEW SKILLS

Definition and Meaning – Importance – Facial Expressions – Eye Contact – Proxemics – Haptics – Posture – Cross-Cultural Body Language – Body Language in

Interview Room – Appearance and Dress Code – Kinetics – Para Language – Tone, Pitch, Pause, Accent Neutralization – Use of Appropriate Language – Interview Skills – Interview Methods and Questions.

TEXTBOOKS:

1. Sherfield, M. Robert et al., *Cornerstone: Developing Soft Skills*, 4/e, Pearson Publication, New Delhi, 2014.
2. Alka Wadkar, *Life Skills for Success*, 1/e, Sage Publications India Pvt. Ltd., 2016.

REFERENCE BOOKS:

1. Sambaiah M., *Technical English*, Wiley India, New Delhi, 2014.
2. Gangadhar Joshi, *From Campus to Corporate*, SAGE Text.
3. Alex K., *Soft Skills*, 3rd ed., S. Chand Publication, New Delhi, 2014.
4. Meenakshi Raman and Sangita Sharma, *Technical Communication: Principles and Practice*, Oxford University Press, 2009.
5. Shalini Varma, *Body Language for Your Success Mantra*, 4/e, S. Chand Publication, New Delhi, 2014.
6. Stephen Covey, *The 7 Habits of Highly Effective People*, JMD Book, 2013.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc20_hs60/preview
- http://www.youtube.com/@softskillsdevelopment6210
- https://youtube.com/playlist?list=PLLy_2iUCG87CQhELCytvXh0E_ybOO1_q&si=Fs05Xh8ZrOPsR8F4
- https://www.coursera.org/learn/people-soft-skills-assessment?language=English
- https://www.edx.org/learn/soft-skills

Course Code	Course Name	Course Structure			
		L	T	P	C
P23BST17	Design Thinking & Innovation	1	0	2	2

Course Objectives:

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert them into demand.
- Introduce product planning and product development process.

Course Outcomes:

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

CO1: Apply Cauchy-Riemann equations to complex functions to determine analyticity. (L3)

CO2: Calculate Taylor and Laurent expansions, identify singularities and apply residue theorem. (L3)

CO3: Apply discrete and continuous probability distributions. (L3)

CO4: Perform operations on single and multiple Random variables. (L3)

CO5: Analyze stochastic processes and determine signal characteristics. (L3)

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, customer 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 modeling, 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*, 1/e, Harper Bollins, 2009.
2. Idris Mootee, *Design Thinking for Strategic Innovation*, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, *Design Thinking in the Classroom*, Ulysses Press, 2018.
2. Shrrutin N Shetty, *Design the Future*, 1/e, Norton Press, 2018.
3. William Lidwell, Kristin Holden, & Jill Butter, *Universal Principles of Design*, 2/e, Rockport Publishers, 2010.
4. Chesbrough H., *The Era of Open Innovation*, 2003.

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
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECT06	Analog and Digital IC Applications	3	0	0	3

Course Outcomes:

CO1: Understand the operational principles and characteristics of operational amplifiers (op-amps) used in analog circuit design such as amplifiers and active filters.

CO2: Apply op-amp-based configurations to design waveform generators and comparator circuits for signal processing applications.

CO3: Analyze the functionality of combinational and sequential logic circuits using digital ICs, and troubleshoot faults in logic circuit implementations.

CO4: Evaluate different data conversion techniques (DAC and ADC) and implement optimal conversion circuits for real-time digital-to-analog and analog-to-digital applications.

CO5: Analyze the design and interfacing of digital systems using programmable logic devices like PLDs and FPGAs for specific application requirements.

UNIT-I: Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, features of 741 Op-Amp, Modes of Operation-Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT-II: Op-Amp, IC-555 and IC-565 Applications: Introduction to Active Filters, Characteristics of Bandpass, Band reject and All Pass Filters, Analysis of 1^{st} order LPF and HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer-Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL-Block Schematic, principle and Applications.

UNIT-III: Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs – Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT-IV: Combinational Logic ICs: Specifications and Applications of TTL-74XX and CMOS 40XX Series ICs - Code Converters, Decoders, LED and LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT-V: Sequential Logic ICs and Memories: Familiarity with commonly available 74XX and CMOS40XX Series ICs - All Types of Flip-flops, Synchronous

Counters, Decade Counters, Shift Registers. Memories - ROM Architecture, Types of ROMS and Applications, RAM Architecture, Static and Dynamic RAMs.

Text Books:

1. Ramakanth A. Gayakwad, *Op-Amps and Linear ICs*, PHI, 2003.
2. Floyd and Jain, *Digital Fundamentals*, Pearson Education, 8th Ed., 2005.

Reference Books:

1. D. Roy Chowdhury, *Linear Integrated Circuits*, New Age International (P) Ltd., 2nd Ed., 2003.
2. John F. Wakerly, *Digital Design Principles and Practices*, 3rd Ed., Pearson, 2009.
3. Salivahana, *Linear Integrated Circuits and Applications*, TMH, 2008.
4. William D. Stanley, *Operational Amplifiers with Linear Integrated Circuits*, Pearson Education India, 4th Ed., 2009.

Web References:

- `https://www.allaboutcircuits.com/video-tutorials/analog-and-digital-electronics/`
- `https://www.ee.iitm.ac.in/~ani/2013/ee5390/lectures.html`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECT07	Digital Communications	3	0	0	3

Course Outcomes:

CO1: Understand the basic components and functional architecture of digital communication systems.

CO2: Apply digital modulation techniques to generate and represent signals effectively in communication systems.

CO3: Analyze the performance of digital modulation schemes and design optimum receivers for minimizing error probabilities.

CO4: Understand the principles of information theory and apply different source coding techniques for efficient data representation.

CO5: Evaluate and analyze error control coding schemes including block codes, cyclic codes, convolutional codes, and Turbo codes.

UNIT-I: Pulse Digital Modulation

Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization and Coding, Quantization error, Companding in PCM systems. Differential PCM systems (DPCM). Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems, noise in PCM and DM systems, Time division multiplexing, Frequency division multiplexing.

UNIT-II: Digital Modulation Techniques

Introduction, ASK, FSK, PSK, DPSK, DEPSK, QPSK, M-ary PSK, ASK, FSK, similarity of BFSK and BPSK.

UNIT-III: Data Transmission

Base band signal receiver, probability of error, the optimum filter, matched filter, probability of error using matched filter, coherent reception, non-coherent detection of FSK, calculation of error probability of ASK, BPSK, BFSK, QPSK.

UNIT-IV: Information Theory and Source Coding

Discrete messages, concept of amount of information and itsproperties. Average information, Entropy and its properties, Information rate, Mutualinformation and its properties.

Source Coding: Introductions,Advantages,Shannon'stheorem,Shanon-Fanocoding,Huffman coding, efficiency calculations, channel capacity of discrete and analogChannels, capacity of a Gaussian channel, bandwidth–S/N trade off.

UNIT-V: Linear Block Codes & Convolution Codes:

Linear Block Codes: Introduction, Matrix description of Linear Block codes, Error detection and error correction capabilities of Linear block codes, Hamming codes, Binary cyclic codes, Algebraic structure, encoding, syndrome calculation, BCH

codes

Convolution Codes: Introduction, encoding of convolution codes, time domain approach, transform domain approach. Graphical approach: state, tree and trellis diagram decoding using Viterbi algorithm, Turbo Codes.

Text Books:

1. Simon Haykin, *Digital Communications*, John Wiley, 2005.
2. H. Taub and D. Schilling, *Principles of Communication Systems*, TMH, 2003.
3. J. Das, S. K. Mullick, P. K. Chatterjee, *Digital Communications*, Wiley, 1986.

Reference Books:

1. Sam Shanmugam, *Digital and Analog Communication Systems*, Wiley, 2005.
2. John Proakis, *Digital Communications*, TMH, 1983.
3. Singh and Sapre, *Communication Systems Analog and Digital*, TMH, 2004.
4. B. P. Lathi, *Modern Analog and Digital Communication*, Oxford University Press, 2004.

Web Reference:

1. https://www.tutorialspoint.com/digital_communication/index.htm#:~:text=This%20tutorial%20on%20Digital%20Communication%20is%20designed%20to,communicated%2C%20and%20why%20digitalization%20is%20needed%20in%20communication.
2. https://complextoreal.com/tutorials/

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECT08	Antennas and Wave Propagation	3	0	0	3

Course Outcomes:

CO1: Understand the basic parameters, characteristics, and functions of different types of antennas.

CO2: Apply electromagnetic field concepts to compute and interpret radiation from various antennas.

CO3: Analyze the design and performance of antenna arrays used in communication systems.

CO4: Analyze the structure and behavior of wire, loop, reflector, lens, horn, and microstrip antennas.

CO5: Evaluate antenna measurement data to determine and optimize antenna performance.

UNIT-I: Antenna Fundamentals

Introduction, Radiation Mechanism – Single Wire, 2-Wire, dipoles, Current Distribution on a thin wire antenna. Antenna Parameters - Radiation Patterns, Patterns in Principal Planes, Field Regions, Main Lobe and Side Lobes, Beamwidth, Radiation Intensity, Directivity, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance, Beam Area and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height, illustrated Problems.

UNIT-II: Thin Linear Wire Antennas

Retarded Potentials, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Evaluation of Field Components, Power Radiated, Radiation Resistance, Radiation Efficiency, Beamwidth, Directivity, Effective Area and Effective Height. Antenna Theorems – Applicability and Proofs for equivalence of directional characteristics, Loop Antennas: Small Loops - Field Components, Comparison of far fields of small loop and short dipole, Concept of short magnetic dipole, D and Rr relations for small loops.

UNIT-III:

Non-Resonant Radiators: Introduction, Traveling wave radiators – basic concepts, long wire antennas – field strength calculations and patterns. Performance comparison with resonant radiators,

Antenna Arrays: 2 element arrays – different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End-fire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison, Effects of Uniform and Non-uniform Amplitude Distributions, Design Relations,

Arrays with Parasitic Elements: Yagi-Uda Arrays, Folded Dipoles and their characteristics

UNIT-IV:

Broadband Antennas: Log periodic antenna, Basic principle, Helical Antennas – Significance, Geometry, basic properties; Design considerations for monofilar helical antennas in Axial Mode and Normal Modes (Qualitative Treatment).

UHF And Microwave Antennas:

Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns;

Paraboloidal Reflectors: – Geometry, characteristics, types of feeds, F/D Ratio, Spill Over, Back Lobes, Aperture Blocking, Off-set Feeds, Case grain Feeds.

Microstrip Antennas-Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas –Geometry and Parameters, Impact of different parameters on characteristics, illustrated Problems.

UNIT-V: Measurements and Propagation

Antenna Measurements: FRIIS Transmission Equation, Patterns Required, Set Up, Distance Criterion, Directivity and Gain Measurements (Comparison, Absolute and 3-Antenna Methods).

Wave Propagation: types of propagations. Sky Wave Propagation – Formation of Ionospheric Layers and their Characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF and Skip Distance; Space Wave Propagation – Mechanism, LOS and Radio Horizon, Field strength equation, illustrated Problems.

Text Books:

1. C. A. Balanis, *Antenna Theory: Analysis and Design*, 3rd Ed., Wiley, 2003.
2. J. D. Kraus and R. J. Marhefka, *Antennas for All Applications*, 3rd Ed., TMH, 2003.
3. E. C. Jordan and K. G. Balmain, *Electromagnetic Waves and Radiating Systems*, PHI, 2nd Ed., 2000.

Reference Books:

1. G. S. N. Raju, *Antennas and Wave Propagation*, Pearson, 2006.
2. E. V. D. Glazier and H. R. L. Lamont, *Transmission and Propagation*, Standard Publishers.
3. J. D. Kraus, *Antennas*, 2nd Ed., McGraw-Hill, 1988.

Web Reference:

1. https://www.rfwireless-world.com/tutorials/antenna-tutorial-functions-types-principles-applications#:~:text=This%20tutorial%20provides%20a%20comprehensive%20overview%20of%20antenna,far%20field%2C%20radiation%20pattern%2C%20applications%2C%20advantages%20and%20disadvantages.
2. https://www.iare.ac.in/sites/default/files/IARE_AWP-ECE-CD.pdf

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECL06	Analog and Digital IC Applications Lab	0	0	3	1.5

PART-A: (Minimum **SIX** Experiments to be conducted):

1. OP AMP Applications – Adder, Subtractor, Comparator Circuits.
2. Integrator and Differentiator Circuits using IC 741.
3. Active Filter Applications – LPF, HPF (first order)
4. Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.
5. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.
6. Function Generator using OP AMPs.
7. IC 555 Timer – Astable and Mono-stable Operation Circuit.
8. Schmitt Trigger Circuits – using IC 741 and IC 555.
9. IC 565 – PLL Applications.
10. IC 566 – VCO Applications.
11. 4 bit DAC using OP AMP.

Equipment required for Laboratories:

1. RPS
2. CRO
3. Function Generator
4. Multi Meters
5. IC Trainer Kits (Optional)
6. Bread Boards
7. Components:- IC741, IC555, IC565, IC1496, IC723, 7805, 7809, 7912 etc.
8. Analog IC Tester

PART-B: (Minimum **SIX** Experiments to be conducted):
The students are required to design and draw the internal structure of the following Digital Integrated Circuits and to develop HDL(VHDL, Verilog HDL) source code, perform simulation using relevant simulator and analyze the obtained simulation results using appropriate synthesizer. Further, it is required to verify the logic with necessary hardware.

List of Experiments:

1. Realization of Logic Gates
2. 3 to 8 Decoder- 74138
3. 8*1 Multiplexer-74151 and 2*1 De-multiplexer-74155
4. 4-Bit Comparator-7485.
5. D Flip-Flop- 7474
6. Decade Counter- 7490

7. Universal shift register-74194/195
8. RAM (16*4)-74189 (read and write operations)

Equipment Required:

1. Xilinix Vivado/Equivalent Standard IDE
2. Personal computer with necessary peripherals
3. Hardware kits- Various FPGA families.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECL05	Analog and Digital Communications Lab	0	0	3	1.5

List of Experiments:

(Fourteen experiments to be done-**The students have to calculate the relevant parameters**)– (a. Hardware, b. MATLAB Simulink c. MATLAB Communication toolbox)

Part-A

1. Amplitude Modulation-Modulation and Demodulation
2. AM-DSBSC-Modulation and Demodulation
3. Diode Detector
4. Pre-emphasis and De-emphasis
5. Frequency Modulation-Modulation and Demodulation
6. Verification of Sampling Theorem
7. Pulse Amplitude Modulation and Demodulation
8. PWM, PPM–Modulation and Demodulation

Part-B

1. Time division multiplexing.
2. Frequency Division Multiplexing
3. Pulse code modulation.
4. Differential pulse code modulation.
5. Delta modulation.
6. Frequency shift keying.
7. Phase shift keying.
8. Differential phase shift keying.
9. Companding
10. Source Encoder and Decoder
11. Linear Block Code-Encoder and Decoder and Binary Cyclic Code–Encoder and Decoder
12. Convolution Code–Encoder and Decoder

Note: All the above experiments are to be executed/completed using hardware boards and also to be simulated on Mat lab.

Equipment and Software required: Software:

i) Computer Systems with latestspecifications

ii) Connected in LAN(Optional)

iii) Operating system (Windows/Linux software)

iv) Simulations software (Simulink and MATLAB)

Equipment:

1. RPS - 0 –30V
2. CRO - 0–20MHz.
3. Function Generators -0–1MHz
4. Components and Breadboards

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECS03	Applications of LabVIEW for Instrumentation and Communications	0	1	2	2

Course Outcomes:

CO1: Develop loops, case structures, arrays, and clusters using LabVIEW for virtual instrumentation applications.

CO2: Analyze and interface real-time applications using NI DAQ hardware for data acquisition and control.

CO3: Implement coding techniques and modular programming using LabVIEW for various engineering problems.

CO4: Design and evaluate automation and process control applications using LabVIEW-based systems.

CO5: Apply LabVIEW tools for data processing and visualization in real-time environments.

Unit I:Introduction to LabVIEW and Virtual Instrumentation

Overview of LabVIEW: Graphical programming paradigm, LabVIEW Environment: Front panel, block diagram, data flow programming, creating simple Virtual Instruments (VIs), Debugging and troubleshooting techniques, Implementing loops, case structures, arrays, and clusters.

Unit II:Data Acquisition and Signal Processing

Interfacing sensors (temperature, pressure, light, etc.) with LabVIEW, Real-time data acquisition using NI DAQ hardware, Signal generation: Sine, Square, Triangular waves, Fourier Transform (FFT) for frequency analysis, Filtering techniques: Low-pass, High-pass, Band-pass filters.

Unit III:Communication System Implementation

AM and FM Modulation/Demodulation using LabVIEW, Simulation of Digital Modulation Schemes (ASK, PSK, FSK), Eye diagrams and constellation plots for digital signals, Error detection and correction: Parity, CRC, Hamming Code.

Unit IV: Instrumentation and Automation Applications:

Real-time data logging and file handling (Excel/CSV), PID Controller Design for automation and process control, Motor speed control using LabVIEW and DAQ, Signal visualization and user interface design.

Unit V: Advanced Applications:

Image Processing using LabVIEW, Wireless communication using Bluetooth and Wi-Fi in LabVIEW, IoT Integration-Cloud-based monitoring and remote data access, Project-based learning.

Textbooks and References

1. R. W. Larsen, *LabVIEW for Engineers*, Prentice Hall, 1st edition, 2011.
2. G. W. Johnson and R. Jennings, *LabVIEW Graphical Programming*, McGraw-Hill, 4th edition, 2017.
3. J. Jerome, *LabVIEW Tutorials and Documentation*, National Instruments, Available: `https://www.ni.com`, Virtual Instrumentation Using LabVIEW, 1st ed., PHI Learning Pvt.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESL07	Design of PCB & Antennas Lab	0	0	2	1

Merits of PCB Machine

1. CNC based for better accuracy and results.
2. Etching, engraving, and drilling can be done with the same machine.
3. Maintenance-free machine compared to chemical method.
4. Compatible with multiple software: Gerber / G-code.
5. Reduction of time and inventory.
6. Height mapping for bed level and depth sensing.
7. Surface mapping of bed.
8. Power-optimized system with the ability to run on UPS systems, unlike other machines.
9. High-precision lead screw.
10. 5 μm resolution, 0.001 repeatability, 2-layer with FR4.
11. Scalability from a single prototype to a batch of 10–50 PCBs.

Scope of Learning

1. In-house PCB prototype manufacturing process.
2. How to convert simulation results into real-time electronic boards/projects.
3. Designing according to project requirements.
4. Along with PCB, other multi-materials support such as:
    - Carbon fiber sheets.
    - Drone frames.
    - Acrylic sheets.
    - Engraving on aluminium.
5. Latest multi-domain project extensions: 3D printing and additive manufacturing.
6. Exposure to designing prototype products.

Antennas Lab

List of Experiments: (Any ten experiments using any simulation software)

1. Generation of EM-wave.
2. Impedance matching using Smith chart.
3. Calculation of phase and group velocity.
4. Plot of radiation pattern of dipole antenna.
5. Plot of radiation pattern of monopole antenna.
6. Plot of radiation pattern of uniform linear array.
7. Measurement of radiation pattern of all wired and aperture antennas.
8. Measurement of radiation pattern of planar antennas.
9. Measurement of radiation pattern of reflector antennas.
10. Measurement of radiation pattern of array antennas.
11. Analysis of co-polarization and cross-polarization.
12. Performance analysis of Yagi-Uda antenna.
13. Performance analysis of helix antenna.
14. Radio wave propagation path loss calculations.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECT09	Digital Signal Processing	3	0	0	3

Course Outcomes:

CO1: Explain the fundamental concepts and characteristics of discrete-time signals and systems.

CO2: Compute the Z-Transform, Discrete-Time Fourier Transform (DTFT), and Discrete Fourier Transform (DFT) of discrete signals.

CO3: Analyze and apply efficient algorithms (e.g., FFT) for computing DFT coefficients of signals.

CO4: Design Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) digital filters for signal processing applications.

CO5: Recall the architecture, addressing modes, and instruction sets of various Digital Signal Processors (DSPs).

UNIT-1:Introduction:

Signals, Systems, and Signal Processing, Classification of Signals, The Concept of Frequency in Continuous Time and Discrete Time Signals Discrete Time Signals and Systems: Discrete Time Signals, Discrete Time Systems, Analysis of Discrete Time Linear Time Invariant Systems, Discrete Time Systems Described by Difference Equations, Implementation of Discrete Time Systems, Correlation of Discrete Time Signals. Frequency Analysis of Signals: Frequency Analysis of Continuous Time Signals, Frequency Analysis of Discrete Time Signals, Frequency Domain and Time Domain Signal Properties, Properties of the Fourier Transform for Discrete Time Signals. Frequency Domain Analysis of LTI Systems: Frequency domain characteristics of LTI systems, Frequency response of LTI systems.

UNIT-2:The *z*-Transform and Its Applications to the Analysis of LTI Systems:

The z-Transform, Properties, Rational z Transforms, Inversion of the z-Transform, Analysis of Linear Time Invariant Systems in the z-Domain, The One sided z-Transform. (Review only for entire z – Transform topic). The Discrete Fourier Transform: Its Properties and Applications: Frequency Domain Sampling: The Discrete Fourier Transform, Properties of the DFT, Linear Filtering Methods Based on the DFT, Frequency Analysis of Signals Using DFT.

UNIT-3:Efficient Computation of the DFT:

Fast Fourier Transform Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms. Implementation of Discrete Time Systems: Structures for the Realization of Discrete Time Systems, Structures for FIR Systems: Direct Form Structure, Cascade Form Structures, Frequency Sampling Structures. Structures for IIR Systems: Discrete Form Structures, Signal Flow Graphs and Transposed Structures, Cascade Form Structures, Parallel Form Structures.

UNIT-4:Design of Digital Filters:

General Considerations: Causality and Its Implications, Characteristics of Practical Frequency Selective Filters. Design of FIR Filters: Symmetric and Antisymmetric FIR Filters, Design of Linear Phase FIR Filters Using Windows, Design of Linear Phase FIR Filters by the Frequency Sampling Method. Design of IIR Filters From Analog Filters: IIR Filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation. Frequency Transformations: Frequency Transformations in the Analog Domain, Frequency Transformations in the Digital Domain.

UNIT-5:Introduction to programmable DSPs:

Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs, Multiple Access Memory, Multipored memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals. Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Auxiliary Register Compare Register, Block Move Address Register, Block Repeat Registers, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals. TMS320C5X Assembly Language Instructions.

Text Books:

1. John G. Proakis, Dimitris G.Manolakis, *Digital Signal Processing, Principles, Algorithms, and Applications*, Pearson Education, 4th Edition, 2007.
2. B.Venkataramani, M.Bhaskar, *Digital Signal Processors – Architecture, Programming and Applications*, TATA McGraw Hill, 2002.

Reference Books:

1. A.V.Oppenheim and R.W.Schaffer, *Discrete Time Signal Processing*, Pearson, 3rd Edition 2014.
2. P. Ramesh Babu, *Digital Signal Processing*, SCITECH Publishers 5th Edition.

Web Reference:

1. https://signalprocessingsociety.org/newsletter/2016/09/mit-online-course-6341x-discrete-time-signal-processing-now-free-online#:~:text=This%20free%20online%20self-paced%20course%20is%20based%20on,exams%20from%20the%20live%20residential%20MIT%20course%206.341.
2. https://www.tutorialspoint.com/digital_signal_processing/index.htm

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECT10	Microprocessor and Microcontrollers	3	0	0	3

Course Outcomes:

CO1: Explain the architecture and operation of the 8086 microprocessors.

CO2: Develop assembly language programs for various applications using the 8086 microprocessors.

CO3: Apply 8086 processor concepts to interface with peripherals such as I/O devices and memory.

CO4: Describe the architecture of the 8051 microcontroller and its interfacing techniques with external peripherals.

CO5: Recall the basic features and introductory concepts of advanced processors such as ARM processors.

Unit -I:

Introduction: Basic Microprocessor architecture, Harvard and Von Neumann architectures with examples, Microprocessor Unit versus Microcontroller Unit, History and classifications of Microprocessor and Microcontroller.

8086 Architecture: register organization, internal architecture of 8086, pin description of 8086, minimum mode and maximum mode of 8086 operation and timing diagrams.

Unit -II:

8086 Programming: instruction set, addressing modes, assembler directives, programming with an assembler, writing simple programs with an assembler, stack and stack structure, interrupts and interrupt service routines 8086 system.

Unit -III:

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

Unit -IV: Intel 8051 MICROCONTROLLER and Interfacing:

Architecture, Hardware concepts, Input/output ports and circuits, external memory, counters/timers, serial data input/output, interrupts. Assembly language programming: Instructions, addressing modes, simple programs. Interfacing to 8051: A/D and D/A Convertors, Stepper motor interface, keyboard, LCD Interfacing, Traffic light control.

Unit -V:ARM Architectures and Processors:

Introduction to CISC and RISC architectures, ARM Architecture, ARM Processors Families, ARM Cortex-M Series Family, ARM Cortex-M3 Processor Functional

Description, Instruction set summary, System address map, write buffer, bit-banding. Programmers Model – Modes of operation and execution, stack pointer, exceptions and interrupt handling.
ARM Cortext-M3 programming – Software delay, Programming techniques, Loops, Stack and Stack pointer, subroutines and parameter passing, parallel I/O, Nested Vectored Interrupt Controller– functional description and NVIC programmers 'model.

Text Books:

1. Bhurchandi, K. M., *Advanced Microprocessors & Peripherals*, McGraw-Hill Publishing Company, 2013.
2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.McKinlay, *The 8051 Microcontrollers and Embedded systems Using Assembly and C*, Pearson 2-Edition, 2011.
3. Joseph Yiu, *The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors*, Newnes Third edition, 2013.

Reference Books:

1. Dr. Alexander G. Dean, *Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English*, Arm Education Media, 2017.
2. Cortex-M3 Technical Reference Manual.

Web Reference:

1. https://books.google.co.in/books/about/Introduction_to_Microcontrollers.html?id=Gew2E-svUcgC&redir_esc=y#:~:text=Introduction%20to%20Microcontrollers%20is%20a%20comprehensive%2C%20introductory%20text%2Freference,assembly%20language%2C%20as%20well%20as%20C%20and%20C%2B%2B.
2. https://www.geeksforgeeks.org/electronics-engineering/whats-difference-between-microcontoller-%c2%b5c-and-microprocessor-%c2%b5p/

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECT11	VLSI Design	3	0	0	3

Course Outcomes:

CO1: Explain the CMOS fabrication process and the impact of technology scaling on device performance.

CO2: Design MOSFET-based logic circuits for digital applications.

CO3: Design basic building blocks used in analog integrated circuit (IC) design.

CO4: Develop combinational logic circuits using various CMOS logic styles.

CO5: Analyze the performance and behavior of static and dynamic CMOS logic circuits.

UNIT-I:INTRODUCTION AND BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS:

VLSI Design Flow, Introduction to IC technology, Fabrication process: nMOS, pMOS and CMOS. I_{ds} versus V_{ds} Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. nMOS Inverter, Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. Alternative forms of pull-up, The CMOS Inverter, Latch-up in CMOS circuits, Bi-CMOS Inverter, Comparison between CMOS and BiCMOS technology, MOS Layers, Stick Diagrams, Design Rules and Layout, Layout Diagrams for MOS circuits.

UNIT-II:BASIC CIRCUIT CONCEPTS:

Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, some area Capacitance Calculations, The Delay Unit, Inverter Delays, driving large capacitive loads, Propagation Delays, Wiring Capacitances, Choice of layers.

SCALING OF MOS CIRCUITS: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling, Limits due to sub threshold currents, Limits on logic levels and supply voltage due to noise and current density.

UNIT-III:BASIC BUILDING BLOCKS OF ANALOG IC DESIGN:

Regions of operation of MOSFET, Modelling of transistor, body bias effect, biasing styles, single stage amplifier with resistive load, single stage amplifier with diode connected load, Common Source amplifier, Common Drain amplifier, Common Gate amplifier, current sources and sinks.

UNIT-IV:CMOS COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUIT DESIGN:

Static CMOS Design: Complementary CMOS, Rationed Logic, Pass-Transistor Logic, design of Half adder, full adder, multiplexer, decoder.

Dynamic CMOS Design: Dynamic Logic-Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates,

Design examples of sequential circuits: Cross coupled NAND and NOR flipflops, D flipflop, SR JK flip flop, SR Master Slave flip flop.

UNIT-V: FPGA DESIGN:
FPGA design flow, Basic FPGA architecture, FPGA Technologies, Introduction to FPGA Families.
INTRODUCTION TO ADVANCED TECHNOLOGIES: Giga-scale dilemma, Short channel effects, High–k, Metal Gate Technology, FinFET, TFET.

Text Books:

1. Kamran Eshraghian, Douglas and A. Pucknell And Sholeh Eshraghian, *Prentice Essentials of VLSI Circuits and Systems*, Hall of India Private Limited, 2005 Edition.
2. Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, McGraw Hill, 2003.
3. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, *Digital Integrated Circuits*, PHI, 2nd edition, 2016.

Reference Books:

1. John P. Uyemura, *Introduction to VLSI Circuits and Systems*, John Wiley and Sons, reprint 2009.
2. Vinod Kumar Khanna, *Integrated Nanoelectronics: Nanoscale CMOS, Post-CMOS and Allied Nanotechnologies*, Springer India, 1st edition, 2016.
3. Colinge JP, *FinFETs and other multi-gate transistors*, Editor New York, Springer, 2008.

Web Reference:

1. `https://www.tutorialspoint.com/vlsi_design/index.htm`
2. `https://onlinecourses.nptel.ac.in/noc23_ee137/preview`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECL07	VLSI Design LAB	0	0	3	1.5

Laboratory Objective

The objective of this laboratory course is to enable students to design, simulate, and implement CMOS-based digital and analog circuits using industry-standard Electronic Design Automation (EDA) tools. Students are expected to develop a comprehensive understanding of schematic capture, layout design, and verification methodologies as per current CMOS technology standards.

List of Experiments:

Students shall design the schematic diagrams using CMOS logic, generate corresponding layout diagrams, and perform simulation and analysis using the latest CMOS process technology with the aid of professional-grade EDA tools (Cadence/Synopsys/Mentor Graphics/Tanner/Microwind or any Industry Standard EDA Tools).

The following experiments shall be carried out:

1. Design and implementation of an inverter
2. Design and implementation of universal gates
3. Design and implementation of full adder
4. Design and implementation of full Subtractor
5. Design and implementation of RS-latch
6. Design and implementation of D-latch
7. Design and implementation asynchronous counter
8. Design and Implementation of static RAM cell
9. Design and Implementation of differential amplifier
10. Design and Implementation of ring oscillator

Equipment Required:

1. Cadence/Synopsys/Mentor Graphics/Tanner/Microwind or any Industry Standard EDA Tools
2. Personal computer with necessary peripherals.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECL08	Microprocessor and Microcontrollers Lab	0	0	3	1.5

List of Experiments:

PART- A: (Minimum of 5 Experiments has to be performed) 8086 Assembly Language Programming and Interfacing

1. Programs for 16 -bit arithmetic operations (using Various Addressing Modes).
    a. Addition and subtraction of n-BCD numbers.
    b. Multiplication and Division operations.
    c. Addition of an array of numbers with overflow detection.
2. Program for sorting an array.
3. Program for Factorial of given n-numbers.
4. Interfacing ADC to 8086
5. Interfacing DAC to 8086.
6. Interfacing stepper motor to 8086.
7. Interfacing Seven-Segment display to 8086
8. Keyboard interface with 8086

PART-B: (Minimum of 5 Experiments has to be performed) 8051 Assembly Language Programming and Interfacing

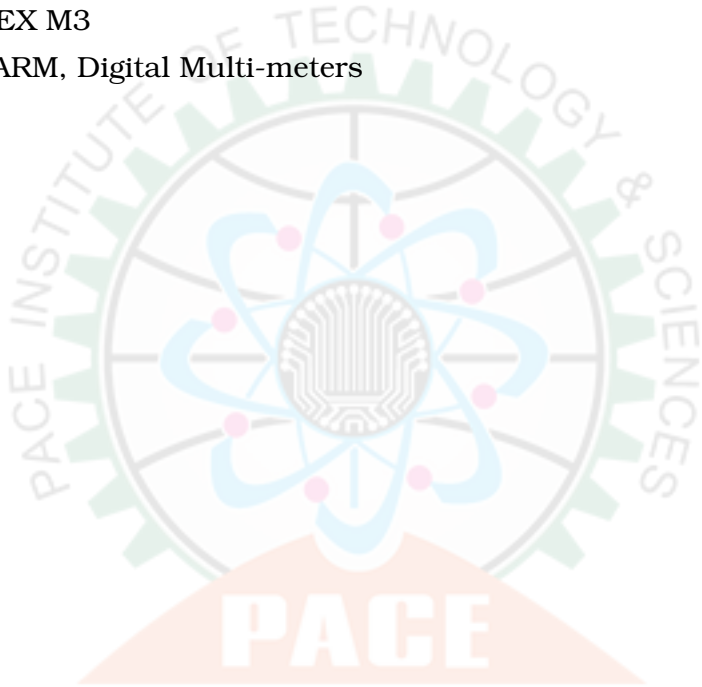
1. Finding number of 1's and number of 0's in a given 8-bit number
2. Average of n-numbers.
3. Program and verify Timer/ Counter in 8051.
4. Interfacing Traffic Light Controller to 8051.
5. UART operation in 8051
6. Interfacing LCD to 8051.
7. Interfacing temperature sensor (LM 35) with 8051
8. Stepper motor control with 8051

PART-C (Minimum of 2 Experiments has to be performed) Conduct the following experiments using ARM CORTEX M3 PROCESSOR USING KEIL MDK ARM

1. Write an assembly program to multiply of 2 16-bit binary numbers.
2. Write an assembly program to find the sum of first 10 integers numbers.
3. Write a program to toggle LED every second using timer interrupt.
4. PWM signal generation
5. Analog signal measurement (ADC)
6. Interfacing with serial communication (UART)

Equipment Required:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. 8086 Microprocessor kits
4. 8051 microcontroller kits
5. ADC module, DAC module
6. Stepper motor module
7. Key board module
8. LED, 7-Segemt Units, LCD display modules
9. Temperature sensor module
10. Digital Multimeters
11. ROM/RAM Interface module
12. Bread Board etc.
13. ARM CORTEX M3
14. KEIL MDK ARM, Digital Multi-meters



Course Code	Course Name	Course Structure			
		L	T	P	C
P23ESC04	Machine Learning Lab	0	1	2	2

Course Outcomes:

CO1: Understand the need for simulation in verifying mathematical functions.
CO2: Describe the features of the SCILAB programming environment.
CO3: Implement basic mathematical functions using SCILAB.
CO4: Visualize mathematical operations using SCILAB plotting tools.
CO5: Analyze program correctness and interpret results through simulation and graphing in SCILAB.

Module-1:
The Fundamentals of Machine Learning, Learning from experience, Machine learning tasks, Training data and test data, Performance measures, bias, and variance, An introduction to scikit-learn ,Installing scikit-learn ,Installing scikit-learn on Windows, Installing scikit-learn on Linux ,Installing scikit-learn on OS X, Verifying the installation, Installing pandas and matplotlib Linear Regression: Simple linear regression, Evaluating the fitness of a model with a cost function ,Solving ordinary least squares for simple linear regression, Evaluating the model, Multiple linear regression, Polynomial regression, Regularization, Applying linear regression, Exploring the data, Fitting and evaluating the model, Fitting models with gradient descent

Module-2:
Extracting features from categorical variables, extracting features from text, the bag-of-words representation, Stop-word filtering, Stemming and lemmatization, extending bag-of-words with TF-IDF weights, Space-efficient feature vectorizing with the hashing trick, extracting features from images, extracting features from pixel intensities, extracting points of interest as features, SIFT and SURF, Data standardization Binary classification with logistic regression, Spam filtering, Binary classification performance metrics, Accuracy, Precision and recall ,Calculating the F1 measure, ROC AUC, Tuning models with grid search, Multi-class classification, Multi-class classification performance metrics, Multi-label classification and problem transformation, Multi-label classification performance metrics

Module-3:
Decision trees, Training decision trees, Selecting the questions, Information gain, Gini impurity, Decision trees with scikit-learn, Tree ensembles, The advantages and disadvantages of decision trees Clustering with the K-Means algorithm, Local optima, the elbow method, evaluating clusters, Image quantization, Clustering to learn features

Module-4:
An overview of PCA ,Performing Principal Component Analysis, Variance, Covari-

ance, and Covariance Matrices, Eigenvectors and eigen values, Dimensionality reduction with Principal Component Analysis ,Using PCA to visualize high-dimensional data, Face recognition with PCA

Module-5:

Kernels and the kernel trick, Maximum margin classification and support vectors, Classifying characters in scikit-learn, Classifying handwritten digits, Classifying characters in natural images Nonlinear decision boundaries, Feed forward and feedback artificial neural networks, multi-layer perceptron, Minimizing the cost function, Forward propagation, Back propagation, Approximating XOR with Multilayer perceptron, Classifying handwritten digits.

Text Books:

1. Gavin Hackeling, *Mastering Machine Learning with scikit-learn*, Packt Publishing.

Reference Books:

1. Aurélien Géron, *Hands-On Machine Learning with Scikit-Learn and TensorFlow*.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23XXXXX	Research Methodology and IPR	2	0	0	0

Course Outcomes:

CO1: Understand the process of research problem formulation.

CO2: Analyze research information and apply ethical principles in research.

CO3: Recognize the importance of ideas, creativity, and innovation in the modern world.

CO4: Understand the significance of Intellectual Property Rights (IPR) in personal and national development.

CO5: Apply knowledge of IPR to promote innovation and protect research outcomes.

Unit 1 :

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentation.

Unit 2:

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 3:

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 4:

Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications.

Unit 5:

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Books:

1. Stuart Melville and Wayne Goddard, *Research methodology: an introduction for science and engineering students*, juta, 2004.

2. Wayne Goddard and Stuart Melville, *Research Methodology: An Introduction*, juta, 2004.

Reference Books:

1. Ranjit Kumar, *Research Methodology: A Step-by-Step Guide for beginners* 2nd Edition, 2010.
2. Halbert, *Resisting Intellectual Property*, Taylor and Francis Ltd, 2007.
3. Mayall, *Industrial Design*, McGraw Hill, 1992.

Web Reference:

1. `https://online.vtu.ac.in/course-details/research-methodologies-and-ipr`
2. `https://onlinecourses.nptel.ac.in/noc23_ge36/preview`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECE01	Digital System Design through HDL (Professional Electives-I)	3	0	0	3

Course Outcomes:

CO1: Understand the syntax, language constructs, and programming principles of Verilog Hardware Description Language (HDL).

CO2: Apply suitable levels of abstraction—behavioural, dataflow, and structural—for modelling digital circuits using Verilog HDL.

CO3: Analyze the design of combinational and sequential circuits implemented in different modelling styles.

CO4: Apply logic synthesis techniques to implement combinational and sequential digital systems using Verilog HDL.

CO5: Evaluate the functionality and performance of digital circuits by creating and executing test benches.

UNIT-I: Introduction to Verilog HDL and Gate Level Modelling

Verilog as HDL, Levels of Design Description Basics of Concepts of Verilog, Data Types, System Task, Compiler directives, modules and ports. AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tri-State Gates, Array of Instances of Primitives, Additional Examples, Design of Flipflops with Gate Primitives, Delay.

UNIT-II: Behavioural Modelling

Introduction, structured processors, procedural assignments, timing controls, conditional statements, multi-way branching, loops, sequential and parallel blocks, generate blocks, Design of Decoders, Multiplexers, Flip-flops, Registers and Counters in Behavioural model.

UNIT-III: Modelling at Data flow Level

Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators, Design of Decoders, Multiplexers, Flip-flops, Registers and Counters in dataflow model, Switch Level Modelling: Introduction, Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitive delays.

UNIT-IV: FSM Design

Functions, Tasks, User-defined, Primitives: Introduction, Function, Tasks, User-Defined Primitives (UDP), FSM Design (Moore and Mealy Machines), Encoding Style: From Binary to One Hot. Introduction to Synthesis, Synthesis of combinational logic, Synthesis of sequential logic with latches and flip-flops, Synthesis of Explicit and Implicit State Machines.

UNIT-V: Components Test and Verification

Test Bench – Combinational Circuits Testing, Sequential Circuits Testing, Test Bench Techniques, Design Verification, Assertion Verification.

Text Books:

1. Samir Palnitkar, *Verilog HDL A Guide to Digital and Synthesis*, Pearson Education, 2nd Edition, 2006.
2. Michael, D. Ciletti, *Advanced digital design with the Verilog HDL*, Pearson Education India, 2005.

Reference Books:

1. Padmanabhan, Tripura Sundari, *Design through Verilog HDL*, Wiley, 2016.
2. S. Brown, Zvonko Vranesic, *Fundamentals of Digital Logic with Verilog Design*, TMH, 3rd Edition, 2014.
3. J. Bhasker, *A Verilog HDL Primer*, BS Publications, 2nd edition, 2001.

Web Reference:

1. https://www.coursera.org/learn/design-of-digital-circuits-with-vhdl-programming#:~:text=This%20course%20is%20designed%20to%20provide%20a%20comprehensive,for%20digital%20circuits%2C%20including%20combinational%20and%20sequential%20circuits.?msockid=0d05f389449b6a130b37e62e45b26b1a
2. http://esd.cs.ucr.edu/labs/tutorial/

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECE02	Optical Communications (Professional Electives-I)	3	0	0	3

Course Outcomes:

CO1: Understand the components and principles involved in modern optical communication systems.

CO2: Apply electromagnetic theory to design and perform optical Fiber experiments, including mode calculation, dispersion, and loss estimation.

CO3: Analyze the behaviour of optical Fiber systems using photodetectors and optical test equipment.

CO4: Evaluate different types of optical cables to identify the most suitable options for minimizing communication losses.

CO5: Apply optical communication concepts by constructing and demonstrating laboratory-based optical Fiber systems.

UNIT-I: Optical Fiber Communication Systems

Overview of optical fiber communication - Historical development, The general system, advantages of optical fiber communications. Optical fiber waveguides-Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays, Cylindrical fibers- Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers-Cutoff wave length, Mode Field Diameter, Effective Refractive Index, Related problems.

UNIT-II: Fiber Materials and Signal Distortion

Fiber materials:- Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers-Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Information capacity determination, Group delay, Types of Dispersion:- Material dispersion, Wave-guide dispersion, Polarization-Mode dispersion, Intermodal dispersion, Pulse broadening in Graded index fiber, Related problems.

UNIT-III: Optical Fiber Connections

Optical fiber Connectors-Connector types, Single mode fiber connectors, Connector return loss, Fiber Splicing-Splicing techniques, Splicing single mode fibers, Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints.

UNIT-IV: Optical Sources and Detectors

Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies, Reliability of LED and ILD, Optical detectors- Physical principles of PIN and APD, Detector response time, Comparison of Photo detectors, Related problems.

UNIT-V: Optical System Design and Transmission

Source to fiber power launching - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantum limit, Analog receivers. Optical system design - Point-to- point links- Component choice and considerations, Link power budget, Risetime budget with examples, Line coding in Optical links, WDM, Necessity, Principles, Measurement of Attenuation and Dispersion, Eye pattern.

Text Books:

1. Gerd Keiser, *Optical Fiber Communications*, McGraw Hill International edition, 3rd Edition, 2000.
2. Joseph C. Palais, *Fiber Optic Communications*, 4th Edition, Pearson Education, 2004.

Reference Books:

1. D. K. Mynbaev, S. C. Gupta and Lowell L. Scheiner, *Fiber Optic Communications*, Pearson Education, 2005.
2. S. C. Gupta, *Text Book on Optical Fiber Communication and its Applications*, PHI, 2005.
3. Govind P. Agarwal, *Fiber Optic Communication Systems*, John Wiley, 3rd Edition, 2004.

Web Reference:

1. `https://www.sciencedirect.com/topics/computer-science/optical-fiber-communication`
2. `https://www.sciencedirect.com/topics/engineering/optical-fiber-transmission`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECE03	Electronic Measurements and Instrumentation (Professional Electives-I)	3	0	0	3

Course Outcomes:

CO1: Explain the principles and operation of various analog and digital measuring instruments.

CO2: Describe the working and applications of different types of oscilloscopes.

CO3: Perform measurements using various electrical bridges accurately.

CO4: Analyze the characteristics and functionalities of signal generators and function generators.

CO5: Examine and interpret the working principles of various transducers and intelligent sensors.

UNIT-I: Measuring Instruments

Measuring Instruments: Introduction, Errors in Measurement, Accuracy, Precision, Resolution and Significant figures. Basic PMMC Meter- construction and working, DC and AC Voltmeters- Multirange, Range extension, DC Ammeter, Multimeter for Voltage, Current and resistance measurements.

Digital Instruments: Digital Voltmeters – Introduction, DVM's based on V–T, V–F and Successive approximation principles, Resolution and sensitivity, General specifications, Digital Multimeters, Digital frequency meters, Digital measurement of time.

UNIT-II: Oscilloscopes

Introduction, Block diagram of CRO, Basic principle of CRT, CRT Construction and features, vertical amplifiers, horizontal deflection system- sweep, trigger pulse, delay line, sync selector circuits. Dual beam and dual trace CROs, Sampling and Digital storage oscilloscopes.

UNIT-III: Bridges

DC Bridges for Measurement of resistance - Wheat stone bridge, Kelvin's Bridge, AC Bridges for Measurement of inductance- Maxwell's bridge, Hay's Bridge, Anderson bridge, Measurement of capacitance - Schearing Bridge, Wien Bridge, Errors and precautions in using bridges.

UNIT-IV: Signal Generators

Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator.

UNIT-V: Transducers and Intelligent Sensors

Transducers: Introduction, Types of Transducers, Electrical transducers, Selecting a transducer, Resistive transducer, Strain gauges, Piezoelectric transducer,

Photoelectric transducer, Photovoltaic transducer, Temperature transducers-RTD, LVDT.
Intelligent Sensors: definition of intelligent instrumentation, types of instruments, Classification, Smart sensors, Cogent Sensors, Soft or Virtual sensors, Self-Adaptive Sensors, Self-Validating Sensors, Temperature Compensating Intelligent Sensors, Pressure Sensor, Indirect Sensing.

Text Books:

1. H. S. Kalsi, *Electronic Instrumentation*, Tata McGraw Hill, 3rd edition, 2010.
2. A. D. Helfrick and W. D. Cooper, *Modern Electronic Instrumentation and Measurement Techniques*, PHI, 6th Edition, 2010.
3. Manabendra Bhuyan, *Intelligent Instrumentation: Principles and Applications*, CRC Press, 2011.

Reference Books:

1. A. K. Sawhney, *A course in Electrical and Electronic Measurements and Instrumentation*, Dhanpat Rai and Co., 9th Edition, 2010.
2. David A. Bell, *Electronic Instrumentation and Measurements*, PHI, 2nd Edition, 2006.

Web Reference:

1. `https://www.udemy.com/course/electronic-measurements-and-instrumentation/?couponCode=25BBPMXNVD35TRT`
2. `https://onlinecourses.nptel.ac.in/noc21_ee107/preview`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECE04	Computer Architecture and Organization (Professional Electives-I)	3	0	0	3

Course Outcomes:

CO1: Explain data representation, register transfer language (RTL), and micro-operations in computer systems.

CO2: Describe the organization and design of a basic computer, including programming and designing the microprogrammed control unit.

CO3: Analyze the architecture of the central processing unit (CPU) and algorithms for computer arithmetic operations.

CO4: Interface peripheral devices and perform various data transfer operations in computer systems.

CO5: Explain the memory hierarchy and different types of computer memory.

UNIT-I: Introduction and Data Representation

Introduction: Digital Computers, Von Neumann computers, Basic organization of a computer.

Data Representation: Data types, Complements, Fixed-point representation, Conversion of fractions, Floating-point representation.

Register Transfer and Microoperations: Register transfer language, Register transfer, Bus and Memory transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

UNIT-II: Basic Computer Organization and Programming

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.

Programming the Basic Computer: Introduction, Machine Language, Assembly language, The Assembler, Program Loops, Programming Arithmetic and Logic Operations.

Microprogrammed Control: Control Memory, Address Sequencing, Microprogram Example, Design of Control Unit.

UNIT-III: Central Processing Unit and Computer Arithmetic

Central Processing Unit: Introduction, General Register Organization, Stack organization, Instruction Formats, Addressing Modes, Data transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

Computer Arithmetic: Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating-Point Arithmetic Operations, Decimal Arithmetic Unit, Decimal Arithmetic Operations.

UNIT-IV: Input-Output Organization

Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor (IOP), Serial Communication.

UNIT-V: Memory Organization

Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Text Books:

1. M. Morris Mano, *Computer System Architecture*, Pearson Publishers, Revised 3rd Edition.

Reference Books:

1. John P Hayes, *Computer Architecture and Organization*, Mc-Graw Hill Publishers, 3rd Edition.
2. Carl Hamacher, *Computer Organization*, Tata Mc-Graw Hill Publishers, 5th Edition.

Web Reference:

1. `https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECE05	Analog IC Design (Professional Electives-II)	3	0	0	3

Course Outcomes:

CO1: Explain the operating principles and modelling of MOS devices used in analog circuit design.

CO2: Design and implement analog circuits for real-time applications using MOS technology.

CO3: Analyze the performance of analog circuits and extend their design to solve real-world engineering problems.

CO4: Describe the operation and characteristics of open-loop comparators and different types of oscillators.

CO5: Analyze the principles and applications of oscillators and phase-locked loops (PLLs).

UNIT -I:MOS Devices and Modelling:

The MOS Transistor, Passive Components- Capacitor and Resistor, Integrated circuit Layout, CMOS Device Modelling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT -II:Analog CMOS Sub-Circuits:

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT -III:CMOS Amplifiers:

Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures. CMOS Operational Amplifiers: Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT -IV:Comparators:

Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

UNIT -V:Oscillators and Phase-Locked Loops:

General Considerations, Ring Oscillators, LC Oscillators, Voltage Controlled Oscillators. Simple PLL, Charge Pump PLLs, Non-Ideal Effects in PLLs, Delay Locked Loops, Applications.

Text Books:

1. Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, TMH Edition, Second Edition, 2017.
2. Philip E. Allen and Douglas R. Holberg, *CMOS Analog Circuit Design*, Oxford University Press, International Second Edition/Indian Edition, 2010.

Reference Books:

1. Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, *Analysis and Design of Analog Integrated Circuits*, Wiley India, Fifth Edition, 2010.
2. David A.Johns, Ken Martin, *Analog Integrated Circuit Design*, Wiley Student Edn, 2013.

Web Reference:

1. https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/
2. https://wiki.analog.com/university/courses/tutorials/index#:~:text=These%20tutorial%20pages%20centered%20around%20analog%20electronics%20comprise,amplifiers%2C%20analog%20multipliers%2C%20analog%20switches%20and%20voltage%20references.

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECE06	Satellite Communication (Professional Electives-II)	3	0	0	3

Course Outcomes:

CO1: Explain the concepts, applications, and key subsystems of satellite communication systems.

CO2: Derive the G/T ratio expression and solve analytical problems related to satellite link design.

CO3: Describe various multiple access techniques and the architecture of earth station design.

CO4: Understand the basic concepts and architecture of the Global Positioning System (GPS).

UNIT I: INTRODUCTION:

Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

ORBITAL MECHANICS AND LAUNCHERS: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.

UNIT II: SATELLITE SUBSYSTEMS:

Attitude and orbit control system, telemetry, tracking, Command and monitoring system, power systems, communication subsystems, Satellite antennas, Equipment reliability and Space qualification.

UNIT III: SATELLITE LINK DESIGN:

Basic transmission theory, link equation, C/N ratio, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example.

UNIT IV: MULTIPLE ACCESS:

Frequency division multiple access (FDMA): Intermodulation, Calculation of C/N. Time division Multiple Access (TDMA); Frame structure, Examples. Code Division Multiple access (CDMA): Spread spectrum transmission and reception.

EARTH STATION TECHNOLOGY: Introduction, basic architecture, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power test methods.

UNIT V: LOW EARTH ORBIT AND GEO-STATIONARY SATELLITE SYSTEMS:

Orbit consideration, coverage and frequency considerations, Delay and Throughput considerations, System considerations, Operational NGSO constellation Designs.

GLOBAL NAVIGATION SATELLITE SYSTEM(GNSS): Introduction, various GNSS: GPS, GLONASS, GALILEO, BeiDou, QZSS, IRNSS. GPS-location principle, GPS navigation message, GPS receiver operation, differential GPS; IRNSS-introduction, IRNSS satellites, IRNSS constellation, IRNSS configuration, IRNSS services, navigation data, applications of IRNSS; multi GNSS.

Text Books:

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, *Satellite Communications*, Wiley Publications, 3rd Edition, 2020.
2. Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, *Satellite Communications Engineering*, 2nd Edition, Pearson Publications, 2003.

Reference Books:

1. M. Richharia, *Satellite Communications: Design Principles*, BS Publications, 2nd Edition, 2003.
2. D.C Agarwal, *Satellite Communication*, Khanna Publications, 5th Edition, 2019.
3. K.N. Raja Rao, *Fundamentals of Satellite Communications*, PHI, 2004.
4. Dennis Roddy, *Satellite Communications*, McGraw Hill, 2nd Edition, 1996.

Web Reference:

1. https://www.rfwireless-world.com/tutorials/satellite-communication-tutorial#:~:text=This%20guide%20provides%20an%20in-depth%20look%20at%20satellite,orbits%2C%20applications%20and%20more.%20What%20is%20a%20Satellite%3F
2. https://www.tutorialspoint.com/satellite_communication/index.htm

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECE07	Smart and Wireless Instrumentation (Professional Electives-II)	3	0	0	3

Course Outcomes:

CO1: Analyze smart and wireless instrumentation based on various performance parameters.

CO2: Design and develop applications using Wireless Sensor Networks (WSNs).

CO3: Demonstrate knowledge of various node architectures in wireless sensor networks.

CO4: Explain the fundamentals of wireless digital communication systems.

CO5: Analyze power sources and design power management strategies according to system requirements.

UNIT – 1: Introduction:

Smart Instrumentation(Materials, automation systems, ensign and Sensors, Sensor Classifications, Wireless Sensor Networks, History of Wireless Sensor networks (WSN), Communication in a WSN, important design constraints of a WSN like Energy, Self Management, Wireless Networking, Decentralized Management, Design Constraints, Security etc.

UNIT – 2: Node architecture:

The sensing subsystem, Analog to Digital converter, the processor subsystem, architectural overview, microcontroller, digital signal processor, application specific integrated circuit, field programmable gate array (FPGA), comparison, communication interfaces, serial peripheral interface, inter integrated circuit, the IMote node architecture, The XYZ node architecture, the Hog throb node architecture.

UNIT – 3: Fundamentals of Wireless Digital Communication:

Basic components, source encoding, the efficiency of a source encoder, pulse code modulation and delta modulation, channel encoding, types of channels, information transmission over a channel, error recognition and correction, modulation, modulation types, quadratic amplitude modulation, signal propagation.

UNIT – 4: Frequency of Wireless Communication:

Development of Wireless Sensor Network based on Microcontroller and communication device-Zigbee Communication device. Power sources- Energy Harvesting Solar and Lead acid batteries-RF Energy /Harvesting-Energy Harvesting from vibration Thermal Energy Harvesting-Energy Management Techniques Calculation for Battery Selection.

UNIT – 5: Applications:

Structural health monitoring - sensing seismic events, single damage detection using natural frequencies, multiple damage detection using natural frequencies,

multiple damage detection using mode shapes, coherence, piezoelectric effect, traffic control, health care - available sensors, pipeline monitoring, precision agriculture, active volcano, underground mining.

Text Books:

1. Waltenegus Dargie, Christian Poellabauer, *Fundamentals of wireless sensor networks : theory and practice*, A John Wiley and Sons, Ltd., Publication, 2010.
2. Subhas Chandra Mukhopadhyay, Springer Heidelberg, *Smart Sensors, Measurement and Instrumentation*, New York, Dordrecht London, 2013.
3. Halit Eren, *Wireless Sensors and Instruments: Networks, Design and Applications*, CRC Press, Taylor and Francis Group, 2006.

Reference Books:

1. Uvais Qidwai, *Smart Instrumentation: A data flow approach to Interfacing*, Chapman and Hall; 1st edition, December 2013.
2. Callaway, Jr., E. H., *Wireless Sensor Networks: Architectures and Protocols* Taylor & Francis, 2003.

Web Reference:

1. `https://www.geeksforgeeks.org/computer-networks/wireless-sensor-network-wsn/`
2. `https://ieeexplore.ieee.org/document/4796311`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECE08	Machine Learning (Professional Electives-II)	3	0	0	3

Course Outcomes:

CO1: Define machine learning, its different types, and their applications.

CO2: Explain various data pre-processing techniques used for data analysis.

CO3: Apply supervised learning algorithms such as decision trees and k-nearest neighbors (k-NN) to solve problems.

CO4: Implement unsupervised learning techniques, including K-means clustering.

CO5: Understand and evaluate performance metrics used in machine learning applications.

UNIT-I: Introduction to Machine Learning:

What is Machine Learning?, Traditional programming approach vs Machine learning approach, History and Evolution of Machine Learning, Learning by Rote vs Learning by Induction, Paradigms for ML - Supervised ML, Unsupervised ML, Reinforcement ML, Datatypes in ML - Quantitative data (Continuous, Discrete), Qualitative data (Structured, Semi structured, Unstructured), Nominal data, Ordinal data, Interval data, Ratio data, Stages involved in Machine Learning, Main challenges of ML, Applications of Machine Learning, IDE's for ML Programming - Jupyter Notebook, Spyder, PyCharm, Google Colab, R Studio, VS Code, Basic packages to deal with ML - Numpy, Scipy, Pandas, Scikit-learn, Matplotlib, Seaborn, Programming Languages for Machine Learning - Python, Java, R, JavaScript, C++

UNIT - II: Explorative Data Analysis (EDA):

What is EDA? Why EDA is important?, Types of EDA - Univariate Analysis, Bivariate Analysis, Multivariate Analysis, Data Cleaning - Data Acquisition,Analyzing the data Dealing with duplicate data, Dealing with missing values, Dealing with outliers Scaling and Transformations - Feature Scaling and Transformation, Univariate nonlinear Transformations, Dimensionality Reduction - Principal Component Analysis (PCA), Feature Engineering - Handling Categorical attributes (One-Hot-Encoding), Feature Expansion - Interactions and Polynomials, Automatic Feature Selection - Univariate Statistics, Model-Based Feature Selection, Iterative Feature Selection

UNIT-III: Supervised Machine Learning:

What is Supervised Machine Learning?, General architecture of Supervised ML, Types of Supervised ML - Classification and Regression, Different Classification Algorithms - K-Nearest Neighbor (KNN) Classifier, Linear Models, Logistic Regression, Naive Bayes Classifiers, Decision Tree Classifier, Ensemble learning and Decision Trees - Voting, Bagging and pasting, Random Forests, AdaBoost, Gradient

Boosting, Stacking, Support Vector Classifier (SVC), Neural Networks, Different Regression Algorithms - K-Neighbors Regressor, Linear Regression, Ridge Regression, Lasso Regression, Polynomial Regression, Support Vector Regressor (SVR), Decision Tree Regressor, Random Forest Regressor

UNIT-IV: Unsupervised Machine Learning
What is Unsupervised Machine Learning?, General architecture of Unsupervised Machine Learning, Challenges in Unsupervised ML, Clustering - Introduction to Clustering, Soft clustering vs Hard Clustering, K-Means Clustering algorithm, Centroid-based clustering algorithm, Divisive Clustering and Agglomerative Clustering, DBSCAN

UNIT V: Model Evaluation metrics, Fine tuning the model and Visualizations
Evaluation Metrics for Classification - Confusion Matrices, Accuracy, Precision, Recall, F1-Score, Precision-recall curves, ROC (Receiver Operating Characteristics) curves, Confusion Matrix, Evaluation Metrics for Regression - R^2, Mean Squared Error (MSE), Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), Evaluation Metrics for clustering - Adjusted Random Index (ARI), Normalized Mutual Information (NMI), Cross Validation - Cross-Validation in scikit-learn, benefits of cross-validation, stratified k-fold cross validation, Grid Search- Simple Grid search, Grid search with cross validation, Randomized search, Visualization - Univariate Analysis (Bar plot, Box plot, Count plot, Density plot, Histogram, Pieplot), Bivariate Analysis (Pair plot, Scatter plot, Bar plot, Stacked barplot, Multivariate Analysis (Heat Maps)

Text Books:

1. Andreas C.Muller and Sarah Guido, *Introduction to Machine Learning with Python*, O'Reilly Publications, 2016.
2. Aurelien Geron, *Hands-on Machine Learning with Scikit-Learn, Keras and TensorFlow*, O'Reilly Publications, 2019.
3. M N Murthy, V S Ananthanarayana, *Machine Learning Theory and Practice*, Universities Press (India), 2024.

Reference Books:

1. Tom M. Mitchell, *Machine Learning*, McGraw-Hill Publication, 2017.
2. Peter Harrington, *Machine Learning in Action*, DreamTech.
3. Pang-Ning Tan, Michel Stenbach, Vipin Kumar, *Introduction to Data Mining*, Pearson Education, 7th Edition, 2019.

Web Reference:

1. Free `https://www.classcentral.com/course/edx-principles-of-machine-learning-6511#:~:text=In%20this%20data%20science%20course%2C%20you%20will%20be,experience%20building%2C%20validating%2C%20and%20deploying%20machine%20learning%20models.`

2. https://www.coursera.org/specializations/deep-learning?utm_medium=sem&utm_source=bg&utm_campaign=b2c_india_deep-learning_deeplearning-ai_ftcof_specializations_cx_dr_bau_bg_sem_pr_in_all_m_x_25-05_x&campaignid=663465691&adgroupid=1244648511648114&device=c&keyword=andrew%20ng%20deep%20learning%20course&matchtype=b&network=o&devicemodel=&adposition=&creativeid=7779066486 5582&adgroup=Andrew%20Ng%20Deep%20Learning&querystring=ast.ai%20%E2%80%93%20Practical%20Deep%20Learning%20for%20Coders%20Hands-on%20deep%20learning%20course%20emphasizing%20code-first%20approach.%20fast.ai%20Course&targetid=kwd-77790912861013:loc-90&bidmatchtype=bb&extensionid=&msclkid=83c169fbbce71ed814e801c6c3a48d23&utm_term=andrew%20ng%20deep%20learning%20course&utm_content=Andrew%20Ng%20Deep%20Learning

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECE09	Bio-Medical Instrumentation (Professional Electives-III)	3	0	0	3

Course Outcomes:

CO1: Demonstrate foundational understanding of human anatomy and physiology.

CO2: Apply various techniques to measure physiological parameters.

CO3: Explain modern imaging techniques and identify therapeutic equipment used in biomedical applications.

CO4: Apply bio-telemetry principles for transmission of bioelectrical signals.

CO5: Analyze patient safety measures and evaluate recent advancements in medical technology.

UNIT – 1: Introduction:

Factors to be considered in the design of medical instrumentation systems, Basic objectives of medical instrumentation system, Physiological systems of human body, Sources of Bioelectric potentials: Resisting and Action Potentials, Propagation of Action Potentials, The Bioelectric Potentials. Electrodes: Electrode theory, Bio Potential Electrodes, Biochemical Transducers, Introduction to bio-medical signals.

UNIT – 2: The Cardiovascular System:

The Heart and Cardiovascular System, The Heart, Blood Pressure, Characteristics of Blood Flow, Heart Sounds, Cardio Vascular Measurements, Electrocardiography, Measurement of Blood Pressure, Measurement of Blood Flow and Cardiac output, Plethysmography, Measurement of Heart Sounds, Event detection, PQRS and T-Waves in ECG, the first and second Heart beats, ECG rhythm analysis, the di-crotic notch in the carotid pulse detection of events and waves, analysis of exercise ECG, analysis of event related potentials, correlation analysis of EEG channels, correlation of muscular contraction.

UNIT – 3: Patient Care and Monitory and Measurements in Respiratory System:

The elements of Intensive Care Monitory, Diagnosis, Calibration and reparability of Patient Monitoring equipment, other instrumentation for monitoring patients, pace makers, defibrillators, the physiology of respiratory system, tests and instrumentation for mechanics of breathing, respiratory theory equipment, analysis of respiration.

UNIT – 4: Bio telemetry and Instrumentation for the Clinical Laboratory,

Introduction to bio telemetry, Physiological parameters adaptable to bio telemetry, the components of bio telemetry system, implantable units, applications of telemetry in patient care – The blood, tests on blood cells, chemical test, automation of chemical tests.

UNIT – 5: X-ray and radioisotope instrumentation and electrical safety of medical equipment:

Generation of Ionizing radiation, instrumentation for diagnostic X-rays, special techniques, instrumentation for the medical use of radioisotopes, radiation therapy - Physiological effects of electrical current, shock Hazards from electrical equipment, Methods of accident prevention, Modern Imaging Systems: Tomography, Magnetic Resonance Imaging System, Ultrasonic Imaging System, Medical Thermography.

Text Books:

1. C.Cromwell,F.J.Weibell,E.A.Pfeiffer, *Biomedical Instrumentation and Measurements* Pearson education, 2011.
2. Rangaraj, M. Rangayya, *Biomedical Signal Analysis* Wiley Inter Science, John Willey and Sons Inc, 2015.

Reference Books:

1. R.S. Khandpur, *Hand Book of Bio-Medical Instrumentation*, TMH.
2. Domach, *Introduction to Bio-Medical Engineering*, Pearson, 2004.
3. Cart, *Introduction to Bio-Medical Equipment Technology*, Pearson.

Web Reference:

1. https://www.sciencedirect.com/topics/engineering/biomedical-device
2. https://en.wikipedia.org/wiki/International_Federation_of_Medical_and_Biological_Engineering
3. https://www.x-mol.net/paper/article/1374085945233981440

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECE10	Microwave Engineering (Professional Electives-III)	3	0	0	3

Course Outcomes:

CO1: Design various propagation modes in waveguide structures for microwave applications.

CO2: Calculate scattering (S-) matrices for waveguide components and analyze power division in desired directions.

CO3: Distinguish between microwave tubes and solid-state devices and compute their efficiencies.

CO4: Measure key microwave parameters using a microwave test bench setup.

UNIT-I: MICROWAVE TRANSMISSION LINES:

Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations; Power Transmission and Power Losses in Rectangular Guide. Related Problems.
MICROSTRIP LINES– Introduction, Z_0 Relations, Effective Dielectric Constant, Losses, Q factor.

UNIT II: MICROWAVE TUBES:

Limitations and Losses of conventional tubes at microwave frequencies. Microwave tubes – O type and M type classifications. O-type tubes : 2 Cavity Klystrons – Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for o/p Power and Efficiency. Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Mathematical Theory of Bunching, Power Output, Efficiency, Electronic Admittance; Oscillating Modes and o/p Characteristics, Electronic and Mechanical Tuning. Applications.

UNIT-III: HELIX TWTS:

Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Nature of the four Propagation Constants, Gain Considerations(qualitative treatment).M-type Tubes Introduction, Cross-field effects, Magnetrons – Different Types, 8-Cavity Cylindrical Travelling Wave Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, o/p characteristics.

UNIT-IV: WAVEGUIDE COMPONENTS AND APPLICATIONS:

Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities

– Waveguide irises, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Resistive Card, Rotary Vane types; Waveguide Phase Shifters – Dielectric, Rotary Vane types, Scattering Matrix– Significance, Formulation and Properties, S-Matrix Calculations for – 2,3,4 port Junctions: E-plane and H-plane Tees, Magic Tee, Hybrid Ring; Directional Couplers – 2Hole, Bethe Hole types-Matrix Calculations Ferrite Components– Faraday Rotation, Gyrator, Isolator, Circulator, Related Problems.

UNIT-V: MICROWAVE SOLID STATE DEVICES:
Introduction, Classification, Applications. TEDs – Introduction, Gunn Diode – Principle, RWH Theory, Characteristics, Basic Modes of Operation, Oscillation Modes.
MICROWAVE MEASUREMENTS: Description of Microwave Bench – Different Blocks and their Features, Precautions; Microwave Power Measurement – Bolometer Method. Measurement of Attenuation, Frequency, Q- factor, Phase shift, VSWR, Impedance Measurement.

Text Books:

1. R.E. Collin, *Foundations for Microwave Engineering*, IEEE Press, John Wiley, 2nd Edition, 2002.
2. Annapurna Das and Sisir K.Das, *Microwave Engineering, Mc Graw Hill Education*, 3rd Edition.

Reference Books:

1. Samuel Y. Liao, *Microwave Devices and Circuits*, PHI, 3rd Edition, 1994.
2. G S N Raju, *Microwave Engineering*, I K International, 2013.
3. M.Kulkarni, *Microwave and Radar Engineering*, Umesh Publications, 3rd Edition.

Web Reference:

1. https://www.microwaves101.com/encyclopedias/transmission-lines
2. https://www.tutorialspoint.com/microwave_engineering/microwave_engineering_waveguides.htm

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECE11	Embedded Systems (Professional Electives-III)	3	0	0	3

Course Outcomes:

CO1: Recall the basics of embedded systems, including classifications, memory types, communication interfaces, firmware, and system components.

CO2: Distinguish between different communication and peripheral devices used in embedded systems.

CO3: Differentiate between standard C and embedded C, and between compiler and cross-compiler concepts.

CO4: Choose appropriate operating systems and real-time operating systems (RTOS) for embedded applications.

Unit-I:Introduction:

Embedded System-Definition, History, Classification, application areas and purpose of embedded systems, The typical embedded system-Core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, PCB and passive components. Characteristics, Quality attributes of an Embedded systems, Application-specific and Domain-Specific examples of an embedded system, Main processing elements of embedded system, hardware and software partitions.

Unit-II:Embedded Hardware Design:

Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

Unit-III:Embedded Firmware Design:

Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

Unit-IV:Real Time Operating System:

Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Threads, Processes and Scheduling, Task Scheduling, Communication, Synchronization, Device Drivers, how to choose an RTOS. Electronics and Communication Engineering.

Hardware Software Co-Design: Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hard ware and Firm ware, ICE.

Unit-V:Embedded System Development:

The integrated development environment, Types of files generated on cross-compilation, Deassembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools.

Embedded System Implementation and Testing: The main software utility tool, CAD and the hardware, Translation Tools-Pre-processors, Interpreters, Compilers and Linkers, debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools. Test and evolution of an embedded systems (Build in self-test etc). Case study-typical embedded system design flow with an example.

Text Books:

1. Tammy Noergaard, *Embedded Systems Architecture*, Elsevier Publications, 2005.
2. Frank Vahid, Tony Givargis, *Embedded System Design*, John Wiley Publications.

Reference Books:

1. Labrosse, *Embedding system building blocks*, CMP publishers.

Web Reference:

1. `https://deepbluembedded.com/`
2. `https://embeddedcraft.org/`

Course Code	Course Name	Course Structure			
		L	T	P	C
P23ECE12	Artificial Intelligence (Professional Electives-III)	3	0	0	3

Course Outcomes:

CO1: Explain the fundamental concepts of computational intelligence and machine learning.

CO2: Apply machine learning techniques to solve real-time problems across various domains.

CO3: Describe neural networks and their role in machine learning applications.

CO4: Apply appropriate algorithms and evaluate the performance of models derived from data.

CO5: Implement machine learning algorithms to address real-world problems effectively.

UNIT-1: What is AI (Artificial Intelligence)?:

The AI Problems, The Underlying Assumption, what are AI Techniques, The Level of The Model, Criteria for Success, Some General References, One Final Word Problems, State Space Search and Heuristic Search Techniques: Defining the Problems as A State Space Search, Production Systems, Production Characteristics, Production System, Characteristics and Issues in The Design of Search Programs, Additional Problems. Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

UNIT-2: Knowledge Representation Issues:

Representations And Mappings, Approaches to Knowledge Representation. Using Predicate Logic: Representation Simple Facts in Logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

UNIT-3: Symbolic Reasoning Under Uncertainty:

Introduction to No monotonic Reasoning, Logics for Non-monotonic Reasoning. Statistical Reasoning: Probability And Bays' Theorem, Factors And Rule-Base Systems, Bayesian Networks, Dempster Shafer Theory.

UNIT-4:Fuzzy Logic. Weak Slot-and-Filler Structures:

Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC.

UNIT-5: Game Playing:

Overview, And Example Domain: Overview, Mini Max, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical

Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI

Text Books:

1. Elaine Rich and Kevin Knight, *Artificial Intelligence*, 2nd Edition, Tata McGraw-Hill, 2005.
2. Stuart Russel and Peter Norvig, *Artificial Intelligence A Modern Approach*, Prentice Hall, 3rd Edition 2009.

Web Reference:

1. https://www.coursera.org/specializations/deep-learning?utm_medium=sem&utm_source=bg&utm_campaign=b2c_india_deep-learning_deplearning-ai_ftcof_specializations_cx_dr_bau_bg_pmax_pr_india_all_m_x_25-05_x&campaignid=663465606&adgroupid=1253444604204330&device=c&keyword=www.coursera.org&matchtype=b&network=o&devicemodel=&adposition=&creativeid=783404207208 58&adgroup=b2c_india_deep-learning_deeplearning-ai_cx_bau_bg_in_x_x_npl-sr-thm_x_hyb_x_x_specializations_x&querystring=MIT%20OpenCourseWare%20Offers%20free%20access%20to%20course%20materials%20from%20MIT%27s%20AI%20courses,%20including%20lecture%20notes,%20assignments,%20and%20exams.%20It%27s%20an%20excellent%20resource%20for%20those%20seeking%20academically%20rigorous%20AI%20education.&targetid=kwd-2330140017797320:loc-90&bidmatchtype=bb&extensionid=&msclkid=14fc92821d801071b29efabc94509da7&utm_term=www.coursera.org&utm_content=b2c_india_deep-learning_deeplearning-ai_cx_bau_bg_in_x_x_npl-sr-thm_x_hyb_x_x_specializations_x
2. https://dsssolutions.com/2025/02/03/towards-data-science-is-launching-as-an-independent-publication/#:~:text=Since%20founding%20Towards%20Data%20Science%20in%202016%2C%20we%E2%80%99ve,focused%20on%20data%20science%2C%20machine%20learning%2C%20and%20AI.