NARASARAOPETA
ENGINEERING COLLEGE
(AUTONOMOUS)

ACADEMIC REGULATIONS

R23 – B. TECH

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1. Award of the Degree:

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

A student will be declared eligible for the award of the B.Tech. with Honors ifhe/she fulfils the following:

(I) Student secures additional 15 credits fulfilling all the requisites of aB.Tech. program i.e., 160 credits.
(II) Registering for Honors is optional.
(III) Honors is to be completed simultaneously with B.Tech. programme.

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

3. Admissions:

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

any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

4. Program related terms:

Credit: A unit by which the course work is measured. It determines the number of hoursof 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.

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Credit definition:

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

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

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

5. Semester/Credits:

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

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

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

6. 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)	Percentageof total credits	AICTE Recommendation(%)
1.	Humanities and Social Science including Management (HM)	13	8 %	8 – 9%
2.	Basic Sciences (BS)	20	13 %	12 - 16%
3.	Engineering Sciences (ES)	23.5	14%	10 – 18%
4.	Professional Core (PC)	54.5	34 %	30 – 36%
5.	Electives – Professional (PE) &Open (OE); Domain Specific Skill Enhancement Courses(SEC)	33	21 %	19 - 23%
6.	Internships & Project work (PR)	16	10 %	8 – 11%
7.	Mandatory Courses (MC)	Non-credit	Non-credit	-

7. Course Classification:

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

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S.No.	Broad Course Classification	Course Category	Description
1.	Foundation Core Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses
2.	Core Courses	Professional Courses (PC)	Includes subjects related to the 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 whichare relevant to the industry
4.	Project & Internships	Project	B.Tech. Project or Major Project
		Internships	Summer Internships – Community based and Industry Internships; Industry oriented Full Semester Internship
5.	Audit Courses	Mandatory credit courses	Covering subjects of developing desired attitude among the learners

8. Programme Pattern:

i. Total duration of the of B.Tech (Regular) Programme is four academic years.
ii. Each academic year of study is divided into two semesters.
iii. Minimum number of instruction days in each semester is 90 days.
iv. There shall be mandatory student induction program for freshers, 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.
v. Health/wellness/yoga/sports and NCC /NSS /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduatestudents.
vi. Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
vii. Design Thinking for Innovation & Tinkering Labs are made mandatory as creditcourses for all the undergraduate students.

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

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

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

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

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

xiii. Students shall undergo mandatory summer internships, for a minimum of eightweeks duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.

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

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

xvi. College will plan to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

xvii. College will assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.

xviii. Preferably 25% of course work for the theory courses in every semester shallbe conducted in the blended mode of learning.

9. Evaluation Process:

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

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

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 70marks for the End-Examination.
ii) For practical subject, the distribution shall be 30 marks for Internal Evaluation and70 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 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 weightageof 10 marks. Any fraction shall be rounded off to the next higher mark.
- The objective paper shall be conducted either online or offline by the respectivedepartment on the day of subjective paper test.
- If conducted offline, the midterm examination shall be conducted first by distribution of the Objective paper, simultaneously marking the attendance, after 20 minutes the answered objective paper shall be collected back. The student is not allowed to leave the examination hall.

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- Then the descriptive question paper and the answer booklet shall be distributed. After 90 minutes the answered booklets are collected back.
- Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered.
- Assignment Test if conducted like slip tests, the following procedure may be followed: Two assignment tests may be conducted before first and second mid examinations for 5 marks. First assignment test may be conducted after the 1st Unit of syllabus. 5 or 6 questions may be announced in advance. On the day of test, 2 questions will be given to each student randomly. The test may be conducted in the first hour for 30 minutes. Second assignment test may be conducted in the similar way after the completion of 3rd Unit of syllabus.

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) 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

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a total of20 marks such that each question carries 2 marks.

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

iv) 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.

v) The questions from 2 to 6 shall be set by covering one unit of the syllabus for eachquestion.

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 35marks each.

ii) In each part, question 1 shall contain 5 compulsory short answer questions for a totalof 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 markseach. 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 eachquestion.

PRACTICAL COURSES:

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

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

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

c) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and External examiner from the other reputed Institutions.
- Procedure: 20 marks
- Experimental work & Results: 30 marks
- Viva voce: 20 marks.

In a practical subject consisting of two parts (Eg: Basic Electrical &Electronics Engineering Lab), the end examination shall be conducted for 70 marks as a singlelaboratory 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

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Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination.

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

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

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

10. 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. Skill oriented Courses

i) There shall be five skill-oriented courses offered during III to VII semesters.
ii) Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.
iii) The 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.
iv) 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

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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.

v) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalentmarks/grades.

vi) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the concerted department's HOD at the beginning of the semester.

vii) 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.

11. Massive Open Online Courses (MOOCs):

A Student has to pursue and complete one course compulsorily through MOOCs approved by the HOD. 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 studentneeds to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.

Students who have qualified in the proctored examinations conducted through MOOCsplatform can apply for credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent credit course only)conducted by the College.
Necessary amendments in rules and regulations regarding adoption of MOOC courseswould be proposed from time to time.

12. Credit Transfer Policy:

Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the College 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.

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i) The College shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learningcourses.
ii) Student registration for the MOOCs shall be only through the respective department, it is mandatory for the student to share necessary information with the department.
iii) Credit transfer policy will be applicable to the Professional & Open Elective courses only.
iv) The concerned department shall identify the courses permitted for credit transfer.
v) The concerned department shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.
vi) The department's HOD will designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.
vii) The College will ensure no overlap of MOOC exams with that of the End Semester examination schedule.
viii) Student pursuing courses under MOOCs shall acquire the required credits onlyafter successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.
ix) The Department shall submit the following to the examination section:
    a) List of students who have passed MOOC courses in the current semester along with the certificate of completion.
    b) Undertaking form filled by the students for credit transfer.
x) The College 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 respective Department from time to time.

Academic Bank of Credits (ABC):

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

i. provide option of mobility for learners across the universities of their choice
ii. provide option to gain the credits through MOOCs from approved digitalplatforms.
iii. facilitate award of certificate/diploma/degree in line with the accumulatedcredits in ABC
iv. execute Multiple Entry and Exit system with credit count, credit transfer andcredit acceptance from student's account.

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13. 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 shallbe 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 becompleted 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 facultymember 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 College.

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 is 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 showcasedat the department for the benefit of all students and staff and the same is to be evaluatedby 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-VoceExamination conducted in the presence of internal examiner and

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external examiner appointed by the Principal and is evaluated for 140 marks.

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

14. Guidelines for offering a Minor:

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

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

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

15. 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 andresearch.

i) Honors is introduced in the curriculum of all B.Tech. programs offering a major degree and is applicable to all B.Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
ii) A student shall earn additional 15 credits (4 theory courses of 3 credits each **And** One MOOC course of 3 credits) for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).
iii) A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum one subject per semester pertaining to the Honors from IV Semester onwards.
iv) The college will arrange separate class work and timetable of the courses offered under Honors program.
v) Courses that are used to fulfil the student's primary major may not be

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double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.

vi) Students can complete the MOOC course in online platforms like SWAYAM with a minimum duration of 12 weeks for 3-credits satisfying the criteria for credit mobility. Student can register for online MOOC course in any semester starting from the 4th Semester. Should submit the MOOC certificate before the commencement of 7th Semester End Examinations. For the 4 theory courses offered by the college, the teaching and evaluation procedure shall be similar to regular B.Tech courses.

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

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

ix) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme. Honors courses should be completed in a single attempt otherwise the registration for honors stands cancelled.

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

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

xii) Student who registered for Honors should pass all subsequent regular semester courses in a single attempt with a minimum of 7 SGPA.

Enrolment into Honors:

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

ii) The enrolment of student into Honors is based on the SGPA obtained in each semester in the major degree program. 7 SGPA shall be maintained in all semesters up to III semester in case of regularentry students and only III semester in case of lateral entry students. Students having 7 SGPA(in all semesters) without any backlog subjects will be permitted to register for Honors.

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

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

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

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Registration for Honors:

i) The eligible and interested students shall apply through the HOD of his/her parent department. Selected students shall be permitted to register the courses under Honors.
ii) The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.
iii) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of studentsto monitor the progress.
iv) There is no fee for registration of subjects for Honors program offered in offlinemode.

16. Attendance Requirements:

i) A student shall be eligible to appear for the University external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. b) Condonation of shortage of

attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.
ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.
iii) A stipulated fee shall be payable towards condonation of shortage of attendanceto the College.
iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.
vi) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
vii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.
viii) For induction programme attendance shall be maintained as per AICTE norms.

17. Promotion Rules:

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

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

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subjects that have been studied up to III semester.

iii) 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.

iv) When a student is detained due to lack of credits/shortage of attendance he/she maybe 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.

18. Grading:

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

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

Structure of Grading of Academic Performance:

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

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

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

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

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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.,

$$SGPA = \Sigma (Ci \times Gi)/\Sigma Ci$$

where, Ci is the number of credits of the ith subject and Gi is the grade point scored by the student in the ith course.

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

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

where "Si" is the SGPA of the ith semester and Ci 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.

Semester Grade Point Average(SGPA) for a semster will be computed only for those students, who have successfully passed all the courses of that semester. Similarly Cumulative Grade Point Average(CGPA) will be computed for the current semester only for those candidates who successfully completed all the courses starting from the 1st Semester to the Current Semester.

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 ,E 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 oneof the following four classes:

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

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

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

19. With–holding of Results:

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

20. Multiple Entry / Exit Option:

a. Exit Policy:

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

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.

21. 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

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to pursue full-time entrepreneurship programme/to establish startups. This period may be extended to two years at the mostand these two years would not be counted for the time for the maximum time for graduation. The HOD of the respective 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

22. 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 havebeen 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 orequivalent 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 arereadmitted.

23. Minimum Instruction Days for a Semester:

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

24. 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.

25. Student Transfers:

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

26. General Instructions:

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

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on rolls with effect from the dates notified by the Universities.

f. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decisionof the Vice-Chancellor / Head of the institution is final.

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ACADEMIC REGULATIONS (R23) FOR B.TECH. (LATERAL ENTRY SCHEME)

*(Effective for the students getting admitted into II year through Lateral Entry Schemefrom the Academic Year **2024-2025** 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

A student will be declared eligible for the award of the B.Tech. with Honors if he/she fulfils the following:

(i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 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**

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

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

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

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4. Course Pattern

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

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

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

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

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MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

- The Principal shall refer the cases of Malpractices in Internal Assessment Test and Semester end examinations to a malpractice prevention committee constituted by him for the purpose. Such committee shall follow the approved levels of punishment. The Principal shall take necessary action against the students based on the recommendations of the committee.
- Any action by the candidate trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained here under

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

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3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and to be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent /any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the Police and a police case is registered against them.

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	person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in- charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all college examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.

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

OTHER MATTERS:

1. Physically challenged candidates who have availed additional examination time and a scribe during their intermediate / EAPCET examinations will be given similar concessions on production of relevant proof / documents.
2. The Principal shall deal in an appropriate manner with any academic problem whichis not covered under these rules and regulations, in consultation with the Controller of Examinations and Heads of the departments and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of regulation, approved in the meetings of the Heads of the departments shall be reported to the Academic Council for ratification.

GENERAL:

1. The academic council may, from time to time, revise, amend or change the regulations, schemes of examinations and / or syllabi.
2. Where ever the words “he”, “him”, “his” occur in the regulations, they include “she”, “her”, “hers”.

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3. The academic regulation should be read as a whole for the purpose of any interpretation.
4. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.
5. Malpractice cases will be indicated in the grade card with letters 'MP'.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA-533003, 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 & Humiliation	6 Months	+	Rs. 1,000/-
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Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
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ANNEXURE-I

COMMUNITY SERVICE PROJECT

Experiential learning through community engagement

As per the decision of the concerned department BOS

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability.
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.
- Implementation of Community Service Project.
- Every student should put in a minimum of **180 hours** for the Community Service

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Project during the summer vacation.

- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc.

- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.

- The log book has to be countersigned by the concerned mentor/faculty incharge.

- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.

- The final evaluation to be reflected in the grade memo of the student.

- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.

- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.

- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.

- The Community Service Project is a twofold one –

- First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
- Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –

    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture

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- Fisheries
- Sericulture
- Revenue and Survey
- Natural Disaster Management
- Irrigation
- Law & Order
- Excise and Prohibition
- Mines and Geology
- Energy
- Internet
- Free Electricity
- Drinking Water

- Irrigation
- Law & Order
- Excise and Prohibition
- Mines and Geology
- Energy
- Internet
- Free Electricity
- Drinking Water

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EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college.
- Improved graduation rates

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BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following is the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating,

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facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries

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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

I B.Tech. I SEMESTER

S.No	Subject	Course Code	Cat.Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	Linear Algebra & Calculus	R23CC1101	BS&H	30	70	100	3	0	0	3
2	Introduction To Programming	R23CC1102	ES	30	70	100	3	0	0	3
3	Engineering Physics	R23CC1106	BS&H	30	70	100	3	0	0	3
4	Basic Electrical & Electronics Engineering	R23CC1107	ES	30	70	100	3	0	0	3
5	Engineering Graphics	R23CC1108	ES	30	70	100	1	0	4	3
6	Computer Programming Lab	R23CC11L1	ES	30	70	100	0	0	3	1.5
7	It Workshop	R23CC11L5	ES	30	70	100	0	0	2	1
8	Engineering Physics Lab	R23CC11L6	BS&H	30	70	100	0	0	2	1
9	Eee Workshop	R23CC11L7	ES	30	70	100	0	0	3	1.5
10	Nss/Ncc/Scouts&Guides/Community Service	R23CC11MC2	BS&H	100	-	100	-	-	1	0.5
TOTAL										**20.5**

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I B. TECH I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23CC1101	**LINEAR ALGEBRA & CALCULUS**						

COURSE OBJECTIVES:

1. Grasping fundamental principles in linear algebra, including linear transformations, solving systems of linear equations, and applying matrix calculus.
2. To become proficiency in solving computational problems of linear algebra.
3. To acquire knowledge on mean value theorems in calculus.
4. Familiarization about the techniques in calculus and multivariate analysis.

COURSE OUTCOMES:

After completion of the course, the students should be able to

CO 1: Solve the system of linear equations and transformations. **[K3]**

CO 2: Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors. **[K4]**

CO 3: Utilize mean value theorems to real life problems.**[K3]**

CO 4: Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering. **[K3]**

CO 5: Identify the area and volume by interlinking them to appropriate double and triple integrals. [[**K3]**

UNIT-I: Matrices

Introduction to Linear Transformation-Rank of a matrix by Echelon form and 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 - Gauss elimination method, Jacobi and Gauss-Seidel iteration methods.

Applications: L-C-R Circuits

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 form and nature of a quadratic form - Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT-III: Calculus

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

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

Functions of several variables: Continuity and Differentiability - Partial derivatives – Homogeneous function-Euler's Theorem on homogeneous functions-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's 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).

Textbooks:

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

Reference Books:

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

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I B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R23CC1102	**INTRODUCTION TO PROGRAMMING**						

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

After completion of the course, student will be able to:

CO1: Infer the basic concepts of computers, algorithms and Flowcharts **[K3].**
CO2: Develop programs using appropriate control structures **[K3].**
CO3: Write programs using arrays and strings **[K3].**
CO4: Develop programs using structures and pointers. **[K3].**
CO5: Make use of functions and file Operations in C programming for a given application **[K3].**

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, Operators, 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.

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UNIT III : Arrays and Strings

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Strings: Introduction – Reading Strings – Writing Strings – String Manipulation functions -Array of Strings.

UNIT IV : Pointers & User Defined Data types

Pointers, dereferencing 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. Scopeand Lifetime of Variables, Basics of File Handling

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

TEXTBOOKS:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 2005.
2. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad,CENGAGE, 3rd edition.
3. How to Solve it by Computer, R G Dromey, Pearson Education.

REFERENCE BOOKS:

1. Computing Fundamentals and C Programming, Balagurusamy, E., McGraw-HillEducation, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education,1998.

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I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23CC1103	**ENGINEERING PHYSICS**						

Course Objectives:

- To bridge the gap between the Physics at 10+2 level and UG level engineering courses
- Identifying the importance of Lasers and optical fibers,
- Enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics,
- Introduce novel concepts of magnetic materials and superconductors, physics of semiconductors and smart materials.

Course Outcomes:

After completion of the course, student will be able to

CO 1 : Analyze the intensity variation of Laser light and it's propagation in optical fibers. **[K4]**

CO 2 : Familiarize with the basics of crystals and their structures. **[K3]**

CO 3 : Summarize various types of Magnetic materials and Super conductors.**[K2]**

CO 4 : Explain the basic concepts of Quantum Mechanics and the band theory of solids. **[K2]**

CO 5 : Identify the type of semiconductor and smart materials. **[K3]**

UNIT I: Lasers and Optical Fibers

Lasers: Introduction – Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Population inversion - Einstein's coefficients and relation between them - Ruby laser – Helium Neon laser- Semiconductor laser-Applications.

Optical Fibers: Introduction- Basic Structure and Principle of optical fiber - Acceptance angle – Acceptance cone - Numerical Aperture - Step Index and Graded index fibers - Applications.

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.

X-ray diffraction: Miller indices – separation between successive (hkl) planes. Bragg's law - crystal structure determination by Laue's and powder methods.

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UNIT III: Magnetic Materials and Superconductivity

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility, permeability and relation between them - Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Hysteresis - soft and hard magnetic materials.

Superconductivity: Introduction- Properties, Meissner effect - Type-I and Type-II super conductors- BCS Theory- AC and DC Josephson effect-Applications.

UNITT IV: Quantum Mechanics and Free electron theory

Quantum Mechanics: de-Broglie's matter Waves – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent wave equation – Particle in a one-dimensional infinite potential well.

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

UNIT V: Semiconductors and Smart materials

Semiconductors: Formation of energy bands – classification of solids – Types of semiconductors - Drift and diffusion currents – Einstein's equation - Hall Effectand its applications.

Smart materials: Introduction – properties- types of smart materials- shape memory alloys – piezoelectric materials- magnetostrictive materials – Thermoelectric materials- magneto rheological fluids- electro rheological fluids- Chromic materials – Engineering applications of smart materials.

Textbooks:

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

Reference Books:

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

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I B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23CC1104	**BASIC ELECTRICAL & ELECTRONICS ENGINEERING**						

PART A: BASIC ELECTRICAL ENGINEERING

Course Objectives

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

Course Outcomes:

After the completion of the course students will be able to

CO1: Explore the fundamental laws and concept of DC and AC circuits. **(K3)**
CO2: Demonstrate the working and operating principles of electrical machines, measuring instruments. **(K3)**
CO3: Demonstrate the working and operating principles of different power generation stations. **(K3)**
CO4: Calculate electrical load, electricity bill of residential and commercial buildings and safety measures. **(K3)**

UNIT I : DC & AC Circuits

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

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

UNIT II: Machines and Measuring Instruments

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

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

UNIT III : Energy Resources, Electricity Bill & Safety Measures

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

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

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

Textbooks:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 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.

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Course Outcomes:

After the completion of the course students will be able to

CO1: Describe the working of diode and explore the operation of BJT and its applications. **(K2)**

CO2: Describe the working of Rectifiers and amplifiers in electronic circuits. **(K2)**

CO3: Manipulate numeric information in different forms, various codes such as ASCII, Gray, and BCD, simple Boolean expressions and Boolean Theorems **(K3)**

CO4: Design and analyse combinational circuits, sequential circuits, flip flops Registers and Counters. **(K4)**

UNIT I: SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT II : BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

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

UNIT III : DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops(S-R, J-K, D and T Flip flops), Registers(4-bit Shift Register - serial input and output) and counters (Ripple Counters, Binary Ripple Counter, Ring Counter) (Elementary Treatment only)

Textbooks:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.

2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

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Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.

2. Salivahanan, N. Suresh Kumar, A. Vallavaraj, "Electronic Devices and Circuits" Tata McGraw-Hill, Second Edition, 2008.

3. Jacob Millman, C. Halkies, C.D. Parikh, Satyabrata Jit, "Integrated Electronics", Tata McGraw-Hill, Second Edition, 2011.

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I B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	1	0	4	30	70	100	3
SUB CODE: R23CC1105	**ENGINEERING GRAPHICS**						

Course Objectives:

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

Course Outcomes:

After the completion of the course students will be able to

CO1: Construct the principles of engineering drawing, including engineering curves, scales, Orthographic and isometric projections**.(K3)**
CO2: Construct orthographic projections of points, lines, planes and solids in front,top and Side views**.(K3)**
CO3: Analyze and draw projection of solids in various positions in first Quadrant.(**K4**)
CO4: Develop the sections of Solids & Development of Surfaces**.(K3)**
CO5: Compare & Draw isometric Views & Orthographic Views**.(K2)**

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

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

UNIT IV

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

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

UNIT V

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

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

Textbook:

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

Reference Books:

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

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I B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	30	70	100	1.5
SUB CODE: R23CC11L1	**COMPUTER PROGRAMMING LAB**						

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

After completion of the course, student will be able to**:**

CO1: Analyze and trace the execution of programs written in C language **[K4].**
CO2: Implement programs with appropriate control structures for solving the problems **[K3].**
CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers **[K3].**
CO4: Code, Debug and Execute programs to demonstrate the applications of arrays, functions, files and various other concepts in C **[K3].**

UNIT 1

WEEK 1

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

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Basic commands of Linux (sudo, pwd, cd, ls, cat, cp, mv, mkdir, rmdir, rm, touch, locate, find, grep, df, du, head, tail, diff, tar, chmod, chown, kill, ping)
iii) Exposure to Turbo C, gcc
iv) Writing simple programs using printf(), scanf()

WEEK 2

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

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Suggested Experiments /Activities:

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

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

WEEK 3

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

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

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

UNIT II

WEEK 4

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

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:
Lab4: Simple computational problems using the operator' precedence and associativity

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

WEEK 5

Objective: Explore the full scope of different variants of "if construct" namely if-else,

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null- else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures.

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

WEEK 6

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

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

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

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

UNIT III

WEEK 7:

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

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7:1D Array manipulation, linear search

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i) Find the min and max of a 1-D integer array.
ii) Perform linear search on1D array.
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number.
v) Eliminate duplicate elements in an array.

WEEK 8:

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

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort
i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

UNIT IV

WEEK :9

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

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation
Lab 9: Pointers and structures, memory dereference.
i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details alongwith the total.

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v) Write a C program to implement realloc()

WEEK 10:

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

Suggested Experiments/Activities:

Tutorial 10: Bitfields, Self-Referential Structures, Linked lists
Lab10 : Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the samewithout using bit- fields

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

UNIT V

WEEK 11:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing someexperiments 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 Eulerstheorem.

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

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.

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Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

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

WEEK 13:

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

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

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

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

WEEK14:

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

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

i) Write a C program to write and read text into a file.
ii) Write a C program to write and read text into a binary file using fread() andfwrite()
iii) Copy the contents of one file to another file.
iv) Write a C program to merge two files into the third file using command-linearguments.

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v) Find no. of lines, words and characters in a file
vi) Write a C program to print last n characters of a given file.

WEEK 15: Virtual Labs:

https://ps-iiith.vlabs.ac.in/List%20of%20experiments.html

TEXTBOOKS:

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

REFERENCE BOOKS:

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

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I B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	XTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	2	30	70	100	1
SUB CODE: R23CC11L2	**IT WORKSHOP**						

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

After completion of the course, student will be able to:

CO1: Identify Hardware components and inter dependencies **[K3].**
CO2: Utilize Antivirus s/w to Safeguard computer systems while using Internet **[K3].**
CO3: Develop a Document or Presentation. **[K6]**
CO4: Make use of spreadsheets to perform calculations **[K3].**
CO5: Utilize the AI Tool Chat GPT **[K3].**

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 throughthe 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 bothWindows 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 configuredas dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva.

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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. Finallystudents 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 WWWon 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 howto 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 customizetheir 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 La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent(FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Usinghelp and resources, rulers, format painter in word.

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

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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 – Chat GPT

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: Whatis the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a storyor a description of a scene, and let the model generate the rest of the content. This can be a funway 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 tosee how accurate and fluent the translations are.

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

REFERENCE BOOKS:

2. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
3. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech,2013, 3rd edition

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4. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
5. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
6. LaTeX Companion, Leslie Lamport, PHI/Pearson.
7. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition

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I B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	30	70	100	1.5
SUB CODE: R23CC11L3	**ENGINEERING PHYSICS LAB**						

Course Objectives:

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

Course Outcomes:

After completion of the course students will be able to

CO:1 Operate optical instruments like travelling microscope and spectrometer**.[K3]**

CO:2 Estimate the wavelengths of different colors using diffraction grating. **[K2]**

CO:3 Plot the intensity of the magnetic field of circular coil carrying current with distance.**[K3]**

CO:4 Calculate the band gap of a given semiconductor. **[K3]**

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'sMethod.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor usingHall effect.
12. Determination of temperature coefficients of a thermistor.
13 Determination of acceleration due to gravity and radius of Gyration by using acompound pendulum.
14 Determination of magnetic susptibility by Kundt's tube method.
15 Determination of rigidity modulus of the material of the given wire using Torsional

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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'sexperiment.

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

References: A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. ChandPublishers, 2017.

URL: *www.vlab.co.in*

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I B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	2	30	70	100	1
SUB CODE: R23CC11L4	**EEE WORKSHOP**						

PART A: ELECTRICAL ENGINEERING LAB

Course Objectives:

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

Course Outcomes:

After completion of this course, the student will be able to

CO1: Measure voltage, current and power in an electrical circuit. **(K3)**

CO2: Measure of Resistance using Wheatstone bridge **(K4)**

CO3: Discover critical field resistance and critical speed of DC shunt generators. **(K4)**

CO4: Investigate the effect of reactive power and power factor in electrical loads. **(K5)**

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

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List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheatstone 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
8. Determination of open circuit and short circuit parameters of a 1-phase transformer(Content Beyond syllabus)

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:

After competition of this course, the student will be able to

CO1: Analyze the characteristics of various electronic components. **(K4)**

CO2: Implement Rectifiers circuits. **(K3)**

CO3: Design Amplifiers circuit. **(K6)**

CO4: Examine the operation of Logic gates. **(K4)**

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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.
9. Design a Full Adder Circuit and verify the truth table. (Content beyond syllabus)

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

References:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.

2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

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

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I B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	1	100	-	100	0.5
SUB CODE: R23CC11MC1	**NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE**						

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:

After completion of the course the students will be able to
CO1: Understand the importance of discipline, character and service motto. **[K3]**
CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques. **[K6]**
CO3: Explore human relationships by analyzing social problems. **[K4]**
CO4: Determine to extend their help for the fellow beings and downtrodden people. **[K5]**
CO5: Develop leadership skills and civic responsibilities. **[K6]**

UNIT I Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.
Activities:
i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II Nature & Care Activities:

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

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UNIT III Community Service Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities experts-etc.

ii) Conducting awareness programs on Health-related issues such as General Health,Mental health, Spiritual Health, HIV/AIDS.

iii) Conducting consumer Awareness. Explaining various legal provisions etc.

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

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

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)

2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi

3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering",McGraw Hill, New York 4/e 2008

4. Masters G. M., Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007

5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.

2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

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, totaling to 90 marks.

3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

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I B.Tech. II SEMESTER

S.No	Subject	Course Code	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	Differential Equations& Vector Calculus	R23CC1201	BS&H	30	70	100	3	0	0	3
3	Communicative English	R23CC1206	BS&H	30	70	100	2	0	0	2
4	Chemistry	R23CC1207	BS&H	30	70	100	3	0	0	3
5	Network Analysis	R23EC1211	ES	30	70	100	3	0	0	3
2	Basic Civil& Mechanical Engineering	R23CC1212	ES	30	70	100	3	0	0	3
8	Na & Simulation Lab	R23EC12L6	ES	30	70	100	0	0	3	1.5
6	Engineering Workshop	R23CC12L9	ES	30	70	100	0	0	3	1.5
9	Chemistry Lab	R23CC12L10	BS&H	30	70	100	0	0	2	1
7	Communicative English Lab	R23CC12L12	BS&H	30	70	100	0	0	2	1
10	Health And Wellness, Yoga And Sports	R23CC12MC1	BS&H	100	-	100	-	-	1	0.5
Total										**19.5**

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I B. TECH II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23CC1201	**DIFFERENTIAL EQUATIONS & VECTOR CALCULUS**						

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

After completion of the course, the students should be able to

CO 1: First order ordinary differential equations to real life situations. [**K3**]

CO 2: Identify and apply suitable methods in solving the higher order differential equations[**K3**]

CO 3 : Solve the partial differentiation equations.[**K3**]

CO 4 : Interpret the physical meaning of different operators as gradient, curl and divergence.[**K3**]

CO 5 : Estimate the work done against a field, circulation and flux using vector calculus.[**K5**]

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 - Simultaneous linear equations - Applications to L-C-R circuit problems and Simple harmonic motion.

UNIT-III: Partial differential equations

Introduction and formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solutions of first order linear equations using Lagrange's method - Homogeneous and Non-homogeneous linear partial differential equations with constant coefficients.

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UNIT-IV: Vector differentiation

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

UNIT-V: Vector integration

Line integral - Circulation - Work done - Surface integral, flux - Green's theorem in the plane (without proof) - Stoke's theorem (without proof) - Volume integral - Gauss divergence theorem (without proof) and related problems.

Textbooks:

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

Reference Books:

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

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I B. Tech II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	0	0	30	70	100	2
SUB CODE: R23CC1206	**COMMUNICATIVE ENGLISH**						

Course Objectives:

The main objective of introducing this course, *Communicative English,* is to facilitate effectivelistening, 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:

After completion of course student will be able to

CO1: Summarize texts based on the comprehension of the material provided**.[K2]**

CO2: Create coherent and well-structured paragraphs, essays, and letters on a range of familiar topics.**[K6]**

CO3: Use a diverse array of grammatical structures with flexibility, striving to minimize errors.**[K3]**

CO4: Use vocabulary adequately and appropriately to express and write on a variety of topics.**[K3]**

UNIT I

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

Listening: Identifying the topic, the context and specific pieces of information by listeningto 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 ofinformation.

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.

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Speaking: Discussion in pairs/small groups on specific topics followed by short structuretalks.
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 ofrelevant 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 andusage (articles, prepositions, tenses, subject verb agreement)
Vocabulary: Technical Jargons

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Textbooks:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, OrientBlack 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 UniversityPress, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building aSuperior Vocabulary. Anchor, 2014.

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I B. TECH II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23CC1207	**CHEMISTRY**						

Course Objectives:

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

Course Outcomes:

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

CO 1: Explain the concept of electron delocalization and its importance in chemical bonding. **[K2]**
CO 2: Solve problems and utilize modern materials in practical engineering scenarios. **[K6]**
CO 3: Apply scientific concepts, experimental findings and applications related to electrochemistry**. [K3]**
CO4: Explore the synthesis of polymers, with specific polymer structures, properties and applications**. [K3]**
CO5: Summarize the concepts of Instrumental methods**. [K2]**

UNIT I: Structure and Bonding Models

Molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 and CO, , calculation of bond order, etc. π-molecular orbitals of butadiene and benzene. Hydrogen Bonding-Inter molecular hydrogen bonding with examples -Intra molecular hydrogen bonding with examples.

UNIT II: Modern Engineering materials

Modern Engineering materials Semiconductors – Introduction, preparation (zone refining process and czochralski process), applications.

Super conductors: Introduction, types -applications.

Supercapacitors: Introduction, Basic Concept-Classification – Applications.

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Nano materials: Introduction, Preparation (arc discharge and laser ablation methods), properties and applications of Fullerenes, carbon nano tubes and Graphines nanoparticles.

UNIT-III: Electrochemistry and Applications

Electrochemical cell, Electrochemical series –applications, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductometric titrations (acid-base titrations).

Electrochemical sensors: potentiometric sensors with examples.

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

Unit-IV: Polymer Chemistry

Introduction to polymers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of free radical polymerisation.

Plastics –Thermo plastics and Thermosetting plastics, Moulding Techniques-Compression moulding, injection moulding, preparation, properties and applications of PVC and Bakelite.

Elastomers–Preparation, properties and applications of Buna-S, Buna-N.

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 transitions, Instrumentation, and applications. FT-IR Instrumentation and applications. NMR principle–Instrumentation –applications.

Textbooks:

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

Reference Books:

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

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I B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC1211	NETWORK ANALYSIS						

Course Objectives:

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

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

CO 1: Analyse the basic electrical circuits with nodal and mesh analysis. **(K4)**
CO 2 Analyse the circuit using network simplification theorems. **(K4)**
CO 3: Find Transient response and Steady state response of a network. **(K3)**
CO 4: Analyse electrical networks in the Laplace domain. **(K4)**
CO 5: Compute the parameters of a two-port network**.(K3)**

UNIT I1

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, Superposition, 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.

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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, Natural current, 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.

Image and iterative impedances. Image and iterative transfer constants. Insertion loss. Attenuators and pads. Lattice network and its parameters. Impedance matching networks.

Textbooks:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.
3. Network lines and Fields by John. D. Ryder 2nd 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, 7th 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.

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I B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23CC1212	**BASIC CIVIL AND MECHANICAL ENGINEERING**						

PART A: BASIC CIVIL ENGINEERING

Course Objectives:

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

Course Outcomes:

After completion of the course, the student should be able to:

CO1: Acquire knowledge on various sub-divisions of Civil Engineering and to appreciate their role inensuring better society. **[K3]**

CO2: Apply the concepts of surveying to calculate distances, anglesand levels. . **[K3]**

CO3: Realize the importance of transportation in nation's economy and to identify the importance of Water Storage and Conveyance Structures. . **[K2]**

UNIT I

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

UNIT II

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

UNIT III

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

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

Textbooks:

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

Reference Books:

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

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

Course Outcomes:

After completion of the course, the student should be able to

CO1: Illustrate the role of mechanical engineering and its technologies in various sectors and knowledge of engineering materials. **[K2]**

CO2: Explain the basics of various manufacturing processes and thermal engineering and its applications. **[K2]**

CO3: Describe the working of different powerplants, mechanical power transmission systems and basics of robotics and its applications. **[K3]**

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UNIT I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society - Mechanical Engineering Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace and Marine Engineering.
Engineering Materials – Basics of **Metals** (Ferrous & Non-ferrous), Ceramics, Composites, Smart materials.

UNIT II

Manufacturing Processes: Basics of - Principles of Casting**,** Forming and joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.
Thermal Engineering: Basics of - 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: Basics of - Working principle of Steam, Diesel, Hydro, Nuclear power plants.
Mechanical Power Transmission: Basics of - Belt Drives, Chain, Rope drives, Gear Drives and their applications.
Introduction to Robotics: Basics of - Joints & links, configurations, and applications of robotics.

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

Textbooks:

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

Reference Books:

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

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I B. TECH- II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	30	70	100	1.5
SUB CODE: R23EC12L6	NETWORK ANALYSIS AND SIMULATION LAB						

Course Objectives:

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

Course Outcomes:

After successful completion of the course, student will be able to

CO 1: Analyze Kirchhoff's laws and network theorems **(K4)**
CO 2: Measure time constants of RL & RC circuits. **(K3)**
CO 3: Analyze behavior of RLC circuit for different cases.**(K4)**
CO 4: Design resonant circuit for given specifications**. (K6)**
CO 5: Characterize and model the network in terms of all network parameters. **(K5)**

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.

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 itsvarious 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.

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References:

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

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I B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	30	70	100	1.5
SUB CODE: R23CC12L9	**ENGINEERING WORKSHOP**						

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1: Identify workshop tools and their operational capabilities.**(K3)**

CO2: Compare Manufacturing Components used in workshop trades including fitting, carpentry, foundry, welding and Plumbing.**(K2)**

CO3: Apply fitting operations in various applications.**(K3)**

CO4: Apply basic electrical engineering knowledge for House Wiring Practice **(K3)**

LIST OF EXPERIMENTS:

ENGINEERING WORKSHOP TRADES FOR EXERCISE:

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) Dovetail 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) Conical funnel
   b) Brazing
4. **Fitting**: Familiarity with different types of tools used in fitting and do the following Fitting exercises.
   a) V-fit
   b) Bicycle tire puncture

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5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make The following connections.
   a) Parallel and Series
   b) Tube light
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. Demonstration and basic repair works of two wheeler vehicle

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I B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	2	30	70	100	1
SUB CODE: R23CC12L10	**CHEMISTRY LAB**						

Course Objectives:

- Verify the fundamental concepts with experiments.

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

CO 1: Develop and perform analytical chemistry techniques to address the water related problems. **[K6]**
CO 2: Determine the strength of an acid, cell constant, potentials and conductance of solutions. **[K5]**
CO 3: Prepare advanced polymer Bakelite and nanomaterials. **[K4]**
CO 4: Explain the functioning of different analytical instruments. **[K3]**

List of Experiments:

1. Determination of hardness of water sample by EDTA method
2. Determination of alkalinity of water sample
3. Estimation of Dissolved Oxygen by Winkler's method
4. Estimation of Ferrous Iron by Dichrometry
5. Determination of Strength of an acid in Pb-Acid battery
6. Estimation of Mg in Antacid
7. Estimation of Vitamin C
8. Preparation of a polymer (Bakelite)/urea formaldehyde resin.
9. Preparation of nanomaterials by precipitation method
10. Conductometric titration of strong acid vs. strong base
11. Conductometric titration of weak acid vs. strong base
12. Determination of cell constant and conductance of solutions
13. Potentiometry - determination of redox potentials and emfs
14. Verify Lambert-Beer's law
15. Wavelength measurement of sample through UV-Visible Spectroscopy

Note: Any TEN of the listed experiments are to be conducted.

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

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I B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	2	30	70	100	1
SUB CODE: R23CC12L12	**COMMUNICATIVE ENGLISH LAB**						

Course Objectives:

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

Course Outcomes:

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

CO 1: Use connected speech, applying a range of phonological features like rhythm, stress and intonation to convey clear meaning. **[K3]**
CO 2: Create a compelling resume, cover letter and Sop. **[K6]**
CO 3: Make formal presentations and engage effectively in debates and group discussions in academic and professional contexts. **[K3]**
CO 4: Apply employability skills to confidently navigate job interviews. **[K3]**

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

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Suggested Software:

- Walden Infotech
- Young India Films

Reference Books:

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

Web Resources:

Spoken English:

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

Voice & Accent:

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

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I B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	1	100	-	100	0.5
SUB CODE: R23CC12MC1	**HEALTH AND WELLNESS, YOGA AND SPORTS**						

Course Objectives:

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

Course Outcomes:

After completion of the course the student will be able to:
CO1: Understand the importance of yoga and sports for Physical fitness and sound health. **[K2]**
CO2: Demonstrate an understanding of health-related fitness components. **[K2]**
CO3: Compare and contrast various activities that help enhance their health. **[K2]**
CO4: Assess current personal fitness levels. **[K5]**
CO5: Develop Positive Personality. **[K6]**

UNIT I

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

Activities:

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

UNIT II

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

Activities:

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

UNIT III

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

Activities:

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

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etc.

Practicing general and specific warm up, aerobics

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

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022

2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice

3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993

4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014

5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.

2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.

3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

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, totaling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

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R23 II B.Tech. ECE

Course Structure and Syllabus

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II B.Tech. I SEMESTER

S.No	Subject	Course Code	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	Probability theory and stochastic Process	R23EC2101	BS	30	70	100	3	0	0	3
2	Universal Human Values–Understanding Harmony andEthical Human Conduct	R23CC2102	HSMC	30	70	100	2	1	0	3
3	Signals and Systems	R23EC2103	ES	30	70	100	3	0	0	3
4	Electronic Devices and Circuits	R23EC2104	PC	30	70	100	3	0	0	3
5	Switching Theory and Logic Design	R23EC2105	PC	30	70	100	3	0	0	3
6	Electronic Devices and Circuits Lab	R23EC21L1	PC	30	70	100	0	0	3	1.5
7	Signals and Systems Lab	R23EC21L2	PC	30	70	100	0	0	3	1.5
8	Data Structures using Python	R23EC21L3	SEC	30	70	100	0	1	2	2
Total							**14**	**2**	**8**	**20**

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II B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC2101	PROBABILITY THEORY AND STOCHASTIC PROCESS						

COURSE OBJECTIVES:

1. Illustrate and formulate fundamental probability distribution and density functions,
2. Explain the concepts of expectation and conditional expectation, and describe their properties.
3. Explain the concepts of joint distribution, marginal distribution and statistical independence and their properties.
4. Analyze continuous and discrete-time random processes
5. Explain the concepts of stationary and wide-sense stationarity,

COURSE OUTCOMES:

After completion of this course the student should able to

CO1. Understanding of concept of random variable.

CO2.Calculate the expectation of different random variables.

CO3.Calculate the operations of multiple random variables.

CO4.Understanding types of random processes.

CO5.Understanding of random processes and its spectral characteristics.

SYLLABUS:

UNIT-I: PROBABILITY AND RANDOM VARIABLE

Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events. Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete,

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Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties.

UNIT-II: OPERATION ON ONE RANDOM VARIABLE – EXPECTATIONS

Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable.

UNIT-III: MULTIPLE RANDOM VARIABLES

Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions.

Operations on Multiple Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT- IV: RANDOM PROCESSES – TEMPORAL CHARACTERISTICS

The Random Process Concept, Classification of Processes, Deterministic and Non -deterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second- Order and Wide-Sense Stationarity, Nth-order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

UNIT-V: RANDOM PROCESSES – SPECTRAL CHARACTERISTICS

The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

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TEXT BOOKS:

1. PeytonZ. Peebles, "Probability, Random Variables & Random Signal Principles", TMH, 4th Edition, 2001.
2. Athanasios Papoulis and S.Unnikrisha, "Probability, Random Variables and Stochastic Processes", PHI, 4th Edition, 2002.

REFERENCES:

1. B. Prabhakara Rao, "Probability Theory and Stochastic Processes", Oxford University Press.
2. Henry Stark and John W. Woods, "Probability and Random Processes with Applications to Signal Processing", Pearson Education, 3rd Edition.
3. George R. Cooper, Clave D. Mc Gillem, "Probabilistic Methods of Signal & System Analysis", Oxford, 3rd Edition, 1999.
4. S. P. Eugene Xavier, "Statistical Theory of Communication", New Age Publications, 2003.
5. B.P. Lathi, "Signals, Systems & Communications", B.S. Publications, 2003.

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II B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	2	1	0	30	70	100	3
SUB CODE: R23CC2102	UNIVERSAL HUMAN VALUES– UNDERSTANDING HARMONY ANDETHICAL HUMAN CONDUCT						

Course Objectives:

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

Course Outcomes:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings inreal life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- 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 (HolisticDevelopment and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

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Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic HumanAspirations
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 thebody.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self andbody.
Lecture 9: The body as an Instrument of the selfLecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the selfLecture 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 practicesession)
Lecture 13: Harmony in the Family – the Basic Unit of Human InteractionLecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of TrustLecture 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 RelationshipLecture 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 practicesession)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment amongthe Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four

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Orders of NatureLecture 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 (6lectures 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 andUniversal 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 towardsUniversal 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 ProfessionalEthics
PS12 Exploring Ethical Human Conduct

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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 andProfessional 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

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II B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC2103	SIGNALS AND SYSTEMS						

COURSE OBJECTIVES:

1. To explain about signals and perform various operations on it and to summarize the sampling
2. To build Trigonometric and Exponential Fourier series of various signals
3. To develop Fourier transforms for various signals.
4. To solve Laplace transforms and z-transforms for various signals.
5. To summarize the principle, filter characteristics, band width of a LTI Systems and

COURSE OUTCOMES:

After completion of this course, the students will be able to

CO1: Define basic signals and its operations.
CO2: Identify Trigonometric and Exponential Fourier Series of signals.
CO3: Develop Fourier Transforms for various signals.
CO4: Solve Laplace Transform and z-Transform for various signals.
CO5: Compare LTI system responses for different inputs and illustrate sampling concepts.

SYLLABUS:

UNIT- I: SIGNAL ANALYSIS & SAMPLING:

Classification of Signals: Analog, Discrete, Digital, Deterministic & Random, Periodic & Aperiodic, Even & Odd, Energy & Power signals. Basic Operations on Signals: Time-Shifting, Time-Scaling, Time-Reversal, Amplitude Scaling and Signal Addition. Elementary Signals: Unit Step, Unit Ramp, Unit Parabolic, Impulse, Sinusoidal function, Exponential function, Gate function, Triangular function, Sinc function and Signum function, Convolution**,** Correlation, Relation between convolution & correlation.
Sampling: Sampling theorem, Types of Sampling: Impulse Sampling, Natural and flattop Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing

UNIT- II: ORTHOGONAL FUNCTIONS & FOURIER SERIES:
Orthogonal Functions: Signal approximation using orthogonal functions, Mean square error, Orthogonality in complex functions.
Fourier series: Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet conditions, Trigonometric Fourier Series and Exponential Fourier Series, Conversion of Exponential Fourier Series from Trigonometric Fourier series.

UNIT- III: FOURIER TRANSFORMS:
Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of periodic signals. Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

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UNIT- IV: LAPLACE TRANSFORMS AND Z- TRANSFORMS:

Laplace Transforms: Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of Region of Convergence (ROC), Constraints on ROC for various classes of signals, Properties of Laplace transforms, Relation between Laplace transform and Fourier transform.
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.

UNIT-V: SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS:

Signal transmission through linear systems: System and its types: Linear & Non-Linear, Time Variant & Time Invariant, Causal & Non Causal, Static & Dynamic, Stable & Unstable. Impulse response of a linear time invariant (LTI) system and linear time variant (LTV) system, Transfer function of a LTI system, Filter characteristics of linear systems, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF and its characteristics.

TEXT BOOKS:

1. B.P. Lathi, "Signals, Systems and Communications", BS Publications, 2008.

2. Simon Haykin and Van Veen, Wiley, "Signals and Systems", Second Edition, 2003.

3. A.V. Oppenheim, A.S. Will sky and S.H. Nawab, "Signals and Systems", PHI, Second Edition, 2013.

REFERENCE BOOKS:

1. Ramesh Babu, "Signals and Systems", SciTech Publications, Third Edition, 2011.
2. A. Anand Kumar, "Signals and Systems", PHI Publications, Third Edition, 2013.
3. Tarun Kumar and Rawat - SIGNALS AND SYSTEMS, Oxford Publications, 2010.

WEB RESOURCES: http://nptel.iitm.ac.in/courses/

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	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
II B. TECH I SEMESTER	3	0	**0**	30	70	100	3
SUB CODE: R23EC2104	**ELECTRONICS DEVICES AND CIRCUITS**						

COURSE OBJECTIVES:

1. Understand the operation and principles of P-N diode.
2. Understand various types of Special diodes, rectifiers and filters.
3. Know the working of BJT.
4. Know the need for transistor biasing and stabilization.
5. Know the working of FET and other Transistors.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Use P-N diodes in electronic circuits.

CO2: Use special diodes and rectifiers in electronic circuits.

CO3: Explore the operation of BJT and its applications.

CO4: Analyze the thermal stability of BJT.

CO5: Explore the operation of FET, other transistors and their applications.

SYLLABUS:

UNIT- I: PN JUNCTION DIODE CHARACTERISTICS:

Insulators, Semiconductors and Metals–Classification using Energy gap, Intrinsic and Extrinsic Semiconductors. P-N Junction Diode - Formation of P-N Junction, Open Circuited P-N Junction, Biased P-N Junction - Forward Bias, Reverse Bias, Current Components in PN Junction Diode, Law of Junction, Diode Current Equation - Quantitative Analysis, V-I Characteristics of Diode - Forward Bias, Reverse Bias, Breakdown in P-N Junction Diode, Temperature Dependence on V-I Characteristics, Diode Resistance-Static Resistance, Dynamic Resistance, Reverse Resistance, Diode Capacitance - Transition Capacitance, Diffusion Capacitance, Energy Band Diagram of PN Junction Diode.

UNIT- II: SPECIAL DIODES AND DIODE CIRCUITS:

SPECIAL DIODES:

Zener Diode - V-I Characteristics, Applications, Breakdown Mechanisms - Zener Breakdown and Avalanche Breakdown, Construction, Operation, Characteristics and applications of LED, LCD, Photodiode, Varactor Diode and Tunnel diode.

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DIODE CIRCUITS: Clipping (limiting) circuits, Clipping at Two Independent Levels, Peak Detector, Clamping circuits, Basic Rectifier setup, Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Inductive and Capacitive Filters, L– Section and π- Section, Derive and compare rectifier parameters with and without filter.

UNIT- III: BIPOLAR JUNCTION TRANSISTOR (BJT):

Bipolar Junction Transistor – Types, Symbols and Operation, Transistor Current Components, Transistor Equation - Relation among I_C, I_B, I_{CBO}, Transistor Configurations - CB, CE and CC, Transistor as a switch, Transistor switching times, Transistor as an Amplifier, Characteristics of Transistor in Common Base Configuration, Common Emitter and Common Collector Configurations - Input and output characteristics, Early effect, Transistor parameters, Current amplification factor, Relation among α, β, and γ, Comparison of CB, CE and CC Configurations, Punch Through/ Reach through, Typical transistor junction voltage values, Photo Transistor.

UNIT- IV: BJT BIASING AND THERMAL STABILITY:

Need For Biasing, Operating Point, Load Line Analysis - D.C. Load Line, A.C. Load Line, Biasing - Methods, Basic Stability, Fixed Bias, Collector-to-base Bias and Self Bias, Stabilization against variations in VBE, Ic and β, Stability Factors S, S' and S'', Bias Compensation - Thermistor, Sensistor, Diode Compensation for variation in ICO, Thermal Runaway, Thermal Stability.

UNIT- V: FET & OTHER TRANSISTORS:

FET Types and Symbols - JFET and MOSFET/IGFET, JFET: N- Channel and P-Channel Construction, Operation, Characteristics - Drain and Transfer, Parameters - Drain Resistance, Amplification factor, Transconductance, Pinch-off voltage, MOSFET - Types - Depletion MOSFET - N Channel and P Channel, Enhancement MOSFET - N-Channel and P-Channel, Construction, Operation, Characteristics - Transfer and Drain Characteristics for Depletion and Enhancement Modes , Analysis of MOSFETs, Comparison between JFET and MOSFET.

SCR- Symbol, Two-Transistor version, UJT - Negative Resistance Property and Applications.

TEXT BOOKS:

1. J. Millman, C. Halkias, "Electronic Devices and Circuits", Tata McGraw-Hill, Third edition, 2010.
2. Allen Mottershed, "Electronic Devices and Circuits", PHI, 2011.
3. Salivahanan, N. Suresh Kumar, A. Vallavaraj, "Electronic Devices and Circuits" Tata McGraw-Hill, Second Edition, 2008.

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REFERENCE BOOKS:

1. Jacob Millman, C. Halkies, C.D. Parikh, Satyabrata Jit, "Integrated Electronics", Tata McGraw-Hill, Second Edition, 2011.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Publications, Eleventh Edition, 2013

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II B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC2105	SWITCHING THEORY AND LOGIC DESIGN						

COURSE OBJECTIVES:

1. To illustrate the number representation in digital electronic circuits and to convert into different representations.
2. To demonstrate the concept of Boolean algebra and minimization of Boolean expressions.
3. To design combinational logic circuits and sequential logic circuits.
4. To Construct synchronous and asynchronous state machines using flip-flops.
5. To compare various PLD's and apply the PLD concept to realize switching functions.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO1: Classify and work on different types of number systems and codes that are used in the design of digital systems.

CO2: Make use of theorems and postulates of Boolean algebra to minimize various Boolean expressions.

CO3: Construct the basic logic circuits and combinational circuits.

CO4: Apply different models of Finite State Machines for design of sequential circuits.

CO5: Utilize the concept of PLDs to realize switching functions and code converters.

SYLLABUS:

UNIT- I: NUMBER SYSTEMS & CODES: Review of number systems – Binary, octal, Hexa decimal numbers, binary arithmetic-binary weighted and non-weighted codes, Gray codes, Ex-3 Codes, Code Conversions, Error detecting and correcting codes-Hamming codes.

UNIT- II: LOGIC OPERATIONS AND MINIMIZATION TECHNIQUES:

Logic Operations: Basic logical operations, logic gates and universal gates, Pin configurations of 74XX-IC series. Boolean postulates and theorems, representation of switching functions–standard SOP & POS forms, Minimization Techniques: Minimization of logic functions using

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Boolean theorems, minimization of switching functions using K-Map representation up to 6 variables, Tabular (Quine-McCluskey) method with only 4 variables and with single function.

UNIT- III: DESIGN OF COMBINATIONAL CIRCUITS:

Introduction, Design procedure, Design of Adders, Subtractors and their applications, Encoders, Decoder, Multiplexers, Demultiplexers, code converters, Comparators. Realization of Boolean functions using decoders, multiplexers and de-multiplexers.

UNIT- IV: DESIGN OF SEQUENTIAL CIRCUITS:

Introduction, sequential circuits versus combinational circuits, classification of sequential circuits, Latches, flip-flops and their excitation requirements. Design of sequential circuits-counters and shift registers, Design of clocked sequential circuit to detect the given sequence with and without overlapping, Realization of sequential generator. Applications of counters and shift registers. Finite State Machines-Melay and Moore machines, capabilities and limitations of finite state machine. Mealy to Moore conversion and vice-versa.

UNIT- V: INTRODUCTION TO PLDs:

Introduction to PLDs, Realization of switching functions using PROM, PLA and PAL, Basics structures, comparison of PROM, PAL and PLA, Implementation of code converters, Introduction to CPLDs and FPGAs.

TEXT BOOKS:

1. M. Morris Mano, "Digital Design", PHI, Fourth Edition, 2008.

2. A. Anand Kumar, "Switching Theory and Logic Design", PHI, Pvt. Ltd, 2nd Ed, 2014.

3. Zvi Kohavi, "Switching and Finite Automata Theory", Cambridge University Press, 3rd Edition, 2009.

REFERENCE BOOKS:

1. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 4th Edition, 2010.

2. Charles H. Roth Jr, "Fundamentals of Logic Design", CENGAGE Learning, 7th Edition.

3. A. P. Godse, D. A. Godse, "Switching Theory & Logic Design", Technical publications, 2nd Edition, 2013.

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II B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	3	30	70	100	1.5
SUB CODE: R23EC21L1	**ELECTRONIC DEVICES AND CIRCUITS LAB**						

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.

COURSE OBJECTIVE:

1. Understand the operation of PN diode and Zener diode.
2. Identify and verify the efficiency of Half wave and Full wave Rectifiers.
3. Know the working of BJT.
4. Know the characteristics of transistor.
5. Know the UJT characteristics.

COURSE OUTCOMES:

After the completion of this course the student will able to

CO1: Make use of PN junction diode and Zener diode characteristics in electronic circuits.
CO2: Analyze the operational difference between Half wave and Full wave Rectifiers.
CO3: Identify the switching characteristics of transistor.
CO4: Analyze the characteristics of transistor.
CO5: Identify and analyze the UJT characteristics and its applications.

LIST OF EXPERIMENTS: (Minimum of Ten Experiments has to be performed)

1. Clipper circuit using diode
2. Clampingcircuitusingdiode
3. Rectifiers (without and with c-filter)
   Part A:Half-wave Rectifier
   Part B: Full-wave Rectifier
4. BJT Characteristics (CEConfiguration)
   Part A: Input Characteristics
   Part B: Output Characteristics
5. FET Characteristics (CSConfiguration)
   Part A: Drain Characteristics

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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:

1. Regulated Power supplies
2. Analog/ Digital Storage Oscilloscopes
3. Analog/ Digital Function Generators
4. Digital Multi-meters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters(Analog or Digital)
8. Voltmeters(Analog or Digital)
9. Active& Passive Electronic Component

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II B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	3	30	70	100	1.5
SUB CODE: R23EC21L2	**SIGNALS AND SYSTEMS LAB**						

COURSE OBJECTIVES:

1. To build elementary signals and implement signal operations.
2. To identify various signals based on their classifications.
3. To develop correlation and convolution for samples of signal.
4. To develop Trigonometric Fourier series and Fourier transform.
5. To determine Laplace and Z- transformations.

COURSE OUTCOMES:

After completion of this course, the student will able to

CO1: Practice MATLAB as a programming tool for many of the signals and their operations

CO2: Identify various signals based on their classifications.

CO3: Perform Correlation and Convolution concepts.

CO4: Implement the concept of Fourier series and Fourier transforms.

CO5: Identify different functions of Laplace and Z-Transforms.

LIST OF EXPERIMENTS:

1. Generation of Basic Signals (Analog and Discrete)
    1. Unit step
    2. Unit impulse
    3. Unit Ramp
    4. Sinusoidal
    5. Signum
2. Operations on signals
    1. Addition & Subtraction
    2. Multiplication & Division
    3. Maximum & minimum

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3. Energy and power of signals ,even and odd signals

4. Transformation of the independent variable

    1. Shifting (Delay & Advance)
    2. Reversing
    3. Scaling

5. Convolution & Deconvolution
6. Correlation
7. Fourier Series Representation
8. Fourier Transform and Analysis of Fourier Spectrum
9. Laplace Transforms
10. Z-Transforms

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II B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	1	2	30	70	100	2
SUB CODE: R23EC21L3	DATA STRUCTURES USING PYTHON						

COURSE OBJECTIVES:

1. To Implement oops concepts in Python
2. To Develop Programs on modules and Packages
3. To Design and implementation of programs on BST and Graph Traversals.
4. To Apply Hashing techniques in real world applications
5. To Develop the programs on stacks, trees and its applications

COURSE OUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to

CO1: Implement oops concepts in Python.
CO2: Develop Programs on modules and Packages.
CO3: Design and implementation of programs on BST and Graph Traversals.
CO4: Apply Hashing techniques in real world applications
CO5: Develop the programs on stacks, trees and its applications.

LIST OF EXPERIMENTS:

1. Write a Python program for 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. Your class must include a constructor method that initializes each variable to an appropriate value, and your class should include methods for setting the value of each type, and retrieving the value of each type.
2. Develop an inheritance hierarchy based upon a Polygon class that has abstract methods area( ) and perimeter( ). Implement classes Triangle, Quadrilateral, Pentagon, that extend this base class, with the obvious meanings for the area( ) and perimeter( ) methods. Write a simple program that allows users to create polygons of the various types and input their geometric dimensions, and the program then outputs their area and perimeter
3. Write a python program to implement Method Overloading and Method Overriding.
4. Write a Python program to illustrate the following comprehensions: a)

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List Comprehensions b) Dictionary Comprehensions c) Set Comprehensions d) Generator Comprehensions

5. Write a Python program to generate the combinations of n distinct objects taken fromthe 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] [1, 4] [1, 5] [7, 8] [7, 9] [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 Singly Linked List.
11. Write a program to implement Doubly Linked list.
12. Write a program to implement Binary Search Tree

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II B.Tech. II SEMESTER

S.No	Subject	Course Code	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	Managerial Economics and Financial Analysis	R23CC2201	Management Course-1	30	70	100	2	0	0	2
2	Linear Control Systems	R23EC2202	ES	30	70	100	3	0	0	3
3	Electromagnetic Waves and Transmission Lines	R23EC2203	PC	30	70	100	3	0	0	3
4	Electronic Circuit Analysis	R23EC2204	PC	30	70	100	3	0	0	3
5	Analog Communications	R23EC2205	PC	30	70	100	3	0	0	3
6	Switching Theory and Logic Design Lab	R23EC22L1	PC	30	70	100	0	0	3	1.5
7	Electronic Circuit Analysis lab	R23EC22L2	PC	30	70	100	0	0	3	1.5
8	Soft Skills	R23EC22L4	SEC	30	70	100	0	1	2	2
9	Design Thinking &Innovation	R23EC22L3	ES	30	70	100	1	0	2	2
10	Environmental Studies	R23EC22MC	Audit Course	-	-	-	2	0	0	MC(0)
Total							**17**	**1**	**10**	**21**
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation.										

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II B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	2	0	0	30	70	100	2
SUB CODE: R23CC2201	**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**						

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:

- Define the concepts related to Managerial Economics, financial accounting and management(L2)
- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)
- Apply the Concept of Production cost and revenues for effective Business decision (L3)
- Analyze how to invest their capital and maximize returns (L4)
- Evaluate the capital budgeting techniques. (L5)
- 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- Isoquantsand Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

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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, Working capital cycle, Sources of Short-term and Long-term Capital, Features, Proposals, Methods and Evaluation. Projects– Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems).

UNIT - V Financial Accounting and Analysis

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

Textbooks:

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

Reference Books:

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

Online Learning Resources: 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

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II B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC2202	**LINEAR CONTROL SYSTEMS**						

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 assess the system performance using time domain analysis frequency domain and techniques for improving the performance. improving it
- To Study the system in terms of absolute stability and relative stability by different
- To introduce the concepts of state variable analysis, design and also the concepts of controllability and observability.

Course Outcomes:

CO1.Apply the knowledge of mathematical concepts to obtain transfer function of various systems.(K3)

CO2.Analyze the performance of a linear time invariant system in Time Domain**(K4)**

CO3. Analyze the stability of the closed and open loop systems **(K4)**

CO4. Formulate different types of analysis in frequency domain **(K3)**

CO5. Analyze state space models **(K4)**

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

Transfer Function of DC Servo motor - AC Servo motor- Synchro-transmitter and Receiver, Block diagram representation of systems considering electrical

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systems as examples –Block diagram algebra–Representation by Signal flow graph-Reduction using mason's gain formula

UNIT II – 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. Compensation techniques - Lag, Lead, Lead-Lag Controllers

UNIT V – State Space Analysis

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 it's Properties - Concepts of Controllability and Observability.

TEXT BOOKS:

1. Automatic Control Systems 8th edition– by B.C.Kuo – Johnwiley and son's, 2003.
2. Control Systems Engineering –by I. J.Nagrathand 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 Apublications, 3 edition, 2017.
2. Control Systems by A.Anandkumar, PHI, 2 Edition, 2014.

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II B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC2203	**ELECTROMAGNETIC WAVES AND TRANSMISSION LINES**						

COURSE OBJECTIVES:

1. To introduce the concepts of Electrostatics and Magneto statics.
2. To understand Electromagnetic Waves and their Propagation.
3. To understand the Maxwell's Equations and boundary conditions.
4. To familiarize with the transmission line concepts.

COURSE OUTCOMES:

After completion of this course, the students will be able to

CO1: Apply the concepts of Electric and Magnetic Fields in different applications.

CO2: Apply Maxwell's equations in electromagnetics.

CO3: Understand wave propagation and derive the Wave Equations in Perfect Dielectric and Conducting Media.

CO4: Understand wave characteristics - reflection and refraction of Electromagnetic Waves in different media and analyze different transmission lines and applications.

SYLLABUS:

UNIT- I: REVIEW OF COORDINATE SYSTEMS & STATIC FIELDS

ELECTROSTATICS: Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Field Intensity due to point charge, Infinite line charge, Infinite sheet of charge, Uniformly charged sphere, Electric Potential - Electric Potential due to point charge and infinite line charge, Energy Density, Poisson's and Laplace's Equations.

MAGNETOSTATICS: Biot-Savart Law, Ampere's Law and Applications, Magnetic Flux Density, Magnetic Vector Potential.

UNIT- II: MAXWELL'S EQUATIONS:

Faraday's Law and Transformer emf, Inconsistency of Ampere's Law and Displacement Current Density, Continuity Equation, Maxwell's Equations in Differential and Integral Forms and Word Statements for static fields and time varying fields of electric and magnetic.

UNIT- III: EM WAVES:

Types of Media, Wave Propagation in Perfect Dielectrics, Lossy (General Case - conducting) media. Uniform Plane Waves – Definition, Uniform Plane Wave Propagation in Free Space, Poynting Vector and Poynting Theorem, Electric and Magnetic Boundary Conditions, Polarization, EM Wave Normal Incidence on Perfect Conductor and

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Dielectric, EM Wave Oblique incidence on Dielectric with Parallel and Perpendicular Polarizations, Brewster Angle, Critical Angle and Total Internal Reflection

UNIT- IV: TRANSMISSION LINES -I:

Types, Parameters, Transmission Line Equations, Primary and Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless/Low Loss Characterization, Distortion – Condition for Distortion less and Minimum Attenuation, Loading - Types of Loading,

UNIT- V: TRANSMISSION LINES-II:

Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR,. UHF Lines as Circuit Elements; $\lambda/4$, $\lambda/2$ and $\lambda/8$ Lines.

TEXT BOOKS:

1. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, Second Edition, 2000.
2. Elements of Electromagnetics – Matthew N.O. Sadiku, Oxford Univ. Press, Third Edition, 2001.
3. Electromagnetic Waves and Transmission Lines – G. S. N. Raju, Pearson Education India, 2006.

REFERENCE BOOKS:

1. Electromagnetic Field Theory and Transmission Lines – G. Sasi Bhushana Rao, Wiley India Pvt Ltd, 2012.
2. Electromagnetics – J. D. Kraus, Keith R. Carver, TMH, Third Edition, 1984.
3. Schaum's Outline of Electromagnetics – J.A. Edminister, Mahmood Nahvi, TMH, Fourth Edition, 2014.
4. Transmission Lines and Networks – Umesh Sinha, Satya Prakashan (Tech. India Publications), New Delhi, 2010.

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II B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC2204	ELECTRONIC CIRCUIT ANALYSIS						

COURSE OBJECTIVES:

The main objectives of this course are:

- To learn hybrid- π parameters a thigh frequency and compare with low frequencyparameters.
- Learn and understand the purpose of cascading of single stage amplifiers and derivethe overall voltage gain.
- Analyze the effect of negative feedback on amplifier characteristics and derive thecharacteristics.
- Learn and understand the basic principle of oscillator circuits and perform the analysisof different oscillator circuits.
- Compare and analyze different Power amplifiers like Class A, Class B, Class C, ClassAB and other types of amplifiers.
- Analyze different types of tuned amplifier circuits.

SYLLABUS:

UNIT-I Small Signal High Frequency Transistor Amplifier models:

BJT: Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid πconductance, Hybrid π capacitances, validity of hybrid π model, determination of high- frequency parameters in terms of low-frequency parameters , CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product.

FET: Analysis of common Source and common drain Amplifier circuits at high frequencies.

UNIT-II

Multistage Amplifiers: Classification of amplifiers, methods of coupling**,** **c**ascaded transistor amplifier and its analysis, analysis of two stage RC coupled amplifier, high input resistance transistor amplifier circuits and their analysis- Darlington pair amplifier, Cascode amplifier, Boot-strap 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

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

Unit-IV

Oscillators: Oscillator principle, condition for oscillations, types of oscillators, RCphaseshiftandWienbridgeoscillatorswithBJTandFETandtheiranalysis,Generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators using BJT, Frequency and amplitude stability of oscillators.

UNIT-V

Power 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. Integrated Electronics- J.Millman and C.C.Halkias, Tata McGraw-Hill, 1972.
2. Electronic Devices and CircuitsTheory –Robert L.Boylestad and Louis Nashelsky,Pearson/PrenticeHall, TenthEdition, 2009.
3. Electronic Devices and Integrated Circuits – B.P. Singh, Rekha, Pearson publications,2006

REFERENCES:

1. Electronic Circuit Analysis and Design –Donald A.Neaman, McGrawHill, 2010.
2. Micro electronic Circuits-Sedra A.S. and K.C. Smith, Oxford University Press, SixthEdition, 2011.
3. Electronic Circuit Analysis-B.V.Rao, K.R.Rajeswari, P.C.R.Pantulu, K.B.R.Murthy,PearsonPublications.

COURSE OUTCOMES:

At the end of this course the student can able to

- Design and analysis of small signal high frequency transistor amplifier using BJT andFET.
- Design and analysis of multistage amplifiers using BJT and FET and Differentialamplifier using BJT.
- Derive the expressions for frequency of oscillation and condition for oscillation of RC and LC oscillators and their amplitude and frequency stability concept.
- Know the classification of the power and tuned amplifiers and their analysis withperformance comparison

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II B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC2205	ANALOG COMMUNICATIONS						

COURSE OUTCOMES:

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

- Describe the Modulation and Demodulation techniques of standard AM.
- Compare different types of Amplitude Modulation and Demodulation techniques.
- Analyse the concepts of generation and detection of Angle Modulated signals.
- Outline the Radio Receivers with different sections.
- Interpret the Radio Transmitters completely.
- Illustrate the noise performance in Analog Modulation techniques and also the concepts ofPulse Analog Modulation and Demodulation techniques.

SYLLABUS:

Unit – I

Amplitude Modulation: Introduction to Fourier transform, Introduction to communication system, Need for modulation, Frequency Division Multiplexing, Amplitude Modulation, Time domain and Frequency domain descriptions, Single tone modulation, Power relations in AM waves, Generation of AM waves: Square law Modulator, Switching modulator, Detection of AM Waves: Square law detector, Envelope detector, Related problems.

Unit – II

DSB & SSB Modulation: Double sideband suppressed carrier modulator: Time domain and frequency domain description, Generation of DSBSC Waves: Balanced Modulator, Ring Modulator, Detection of DSBSC Waves: Coherent detection, Quadrature Null Effect, COSTAS Loop, Squaring Loop.
Single sideband suppressed carrier modulator: Time domain and Frequency domain description, Generation of SSBSC Waves: Frequency discrimination method, Phasediscrimination method, Demodulation of SSB Waves: Coherent Detection.
Vestigial sideband modulation: Time domain description, Frequency domain description, Generation of VSB Modulated wave, Envelope detection of a VSB Wave pulse Carrier, Comparison of different AM Techniques, Applications of different AM Systems, Related problems.

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Unit – III

Angle Modulation: Introduction, Basic concept of phase modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave, Generation of FM Waves: Direct Method, Indirect Method, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM & AM, Related problems

Unit – IV

Radio Transmitters: Classification of Transmitters, AM Transmitter, Effect of feedback on performance of AM Transmitter, FM Transmitter: Variable reactance type and Phase modulated FM Transmitter, Frequency stability in FM Transmitter.

Radio Receivers: Receiver Types: Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristics, Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Amplitude limiting, Comparison of FM & AM Receivers, Communication Receivers, Extension of super heterodyne principle and additional circuits.

Unit – V

Noise: Review of noise and noise sources, Noise figure, Noise in Analog communicationSystems: Noise in DSB & SSB Systems, Noise in AM System and Noise in Angle Modulation Systems, Threshold effect in Angle Modulation System, Pre-emphasis & De-emphasis.

Pulse Analog Modulation: Types of Pulse modulation, PAM (Single polarity, double polarity), PWM: Generation & Detection of PWM, PPM: Generation and Detection of PPM, Time Division Multiplexing, TDM Vs FDM.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Electronics & Communication Systems, George Kennedy, Bernard Davis, S R M Prasanna,TMH, 6th Edition, 2017.
2. Communication Systems, R P Singh, S D Sapre, TMH, 3nd Edition, 2017.
3. Communication Systems (Analog and Digital), Dr. Sanjay Sharma, Katson Books, 7th ReprintEdition, 2019.

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II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	3	30	70	100	1.5
SUB CODE: R23EC22L1	**SWITCHING THEORY AND LOGIC DESIGN LAB**						

COURSE OBJECTIVE:

1. Verify the operation and use of logic gates.
2. Design various combinational and sequential circuits.
3. Illustrate and compare the operation of different flipflops.
4. Develop the internal circuits for different digital operations.

COURSE OUTCOMES:

After the completion of this course the student will able to

CO1: Identify the operation of various logic gates.
CO2: Examine basic logical and arithmetic circuit operations.
CO3: Illustrate and compare the operation of different flip flops and counters.
CO4: Develop the complex combinational digital logic circuit by using computer-aided design tools
CO5: Develop the complex sequential digital logic circuits by using computer-aided design tools

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 SOPexpression 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 to1 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 SlaveFlip–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

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9. Verify the operation of 4-bit Universal Shift Register for different Modes ofoperation.
10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip- Flops and Test It with a low frequency clock and sketch the output waveforms.
11. Design MOD–8 synchronous counter using T Flip-Flop and verify the result and sketchthe 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 and7 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 theCircuit.
3. Design an Experimental model to demonstrate the operation of 74154 De-Multiplexerusing LEDs for outputs.
4. Design of any combinational circuit using Hardware Description Language
5. Design of any sequential circuit using Hardware Description Langu

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II B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	3	30	70	100	1.5
SUB CODE: R23EC22L2	**ELECTRONIC CIRCUIT ANALYSIS LAB**						

Note: The students are required to design the circuit and perform the simulation using Multisim/ Equivalent Industrial Standard Licensed simulation software tool**.** Further they are required to verify the result using necessary hardware equipment.

COURSE OBJECTIVES:

1. The frequency response of single stage and multistage amplifiers.
2. How frequency response varies by applying negative feedback on amplifiers.
3. Working of Oscillators and Power amplifiers.
4. Working of Tuned Amplifiers.

COURSE OUTCOMES:

After the completion of this course, student must be able to

CO1: Understand the effect of frequency response of single stage and multi stage amplifiers.
CO2: Understand how frequency response varies by applying negative feedback on amplifiers.
CO3: Determine the efficiency of power amplifiers.
CO4: Construct high input impedance circuits.
CO5: Understand the operation of different Oscillators and Tuned amplifiers.

LIST OF EXPERIMENTS: (Minimum of Ten Experiments has 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. Boots trapped Emitter Follower
9. Class A Series-fed Power Amplifier
10. Transformer-coupled Class A Power Amplifier
11. Class B Push-Pull Power Amplifier

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12. Complementary Symmetry Class B Push-Pull Power Amplifier
13. Single Tuned Voltage Amplifier
14. Double Tuned Voltage Amplifier

EQUIPMENT REQUIRED: SOFTWARE:

i. Multisim/Equivalent Industrial Standard Licensed simulation software tool.

ii. Computer Systems with required specifications

HARDWARE REQUIRED:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multimeters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components

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II B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	1	2	30	70	100	2
SUB CODE: R23EC22L4	**SOFT SKILLS**						

Course Objectives:

- To prepare for global competition in employment and achieve professional excellence.
- To help students develop interpersonal and intrapersonal skills, enabling them to lead meaningful professional lives.

UNIT – 1: INTRODUCTION

Introduction- Emergence of life skills, Definition & Meaning, Importance& need, reasons for skill gap, Analysis--Soft Skills vs Hard skills, Linkage between industry and soft skills, Challenges, Personality Developments. Soft Skills, English - Improving Techniques.

UNIT – II: Intra-Personal:

Definition-Meaning – Importance-SWOT analysis, Johari windows - Goal Setting- skills quotient - Emotional Intelligence- Attitudinal skills - positive thinking- Problem Solving- Time management, stress management.

UNIT – III: Inter-Personal:

Definition – Meaning – Importance-Communications skills- Team Work, managerial skills -Negotiation skills- Leadership skills, corporate etiquettes.

UNIT – IV: Verbal Skills:

Definition and Meaning-Listening skills, need- types, advantages, Importance- Tips for Improving Listening, Speaking, need- types, advantages, Importance- Tips for Improving Reading- Writing Skills, Report, Resume, statement of purpose, need- types, advantages, Importance.

UNIT – V: Non Verbal Skills& Interview skills

Definition and Meaning – Importance- Facial Expressions- Eye Contact – Proxemics- Haptics -Posture, body language in cross cultural context , body language in interview room, appearance and dress code – Kinetics- Para Language - tone, pitch, pause, neutralization of accent, use of appropriate language, Interview skills, interview methods and questions.

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Text Books:

1) Sherfield, M. Robert at al, Cornerstone Developing Soft Skills, 4/e, Pearson Publication, New Delhi, 2014.
2) Alka Wadkar, Life Skills for Success, 1/e, Sage Publications India Private Limited, 2016.

Reference Books:

1. Sambaiah.M. Technical English, Wiley publishers 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: Principle 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, Seven 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_y-_bOO1_q&si=Fs05Xh8ZrOPsR8F4
- https://www.coursera.org/learn/people-soft-skills-assessment?language=English
- https://www.edx.org/learn/soft-skills

Course Outcomes:

COs	Statements	Blooms Level
CO1	Grasp the meaning and importance of soft skills and learn how to develop them.	L1
CO2	Comprehend 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	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

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II B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	1	0	2	30	70	100	2
CODE: R23EC22L3	**DESIGN THINKING AND INNOVATION**						

Course Objectives: The objectives of the course are to

- 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 into demand.
- Introduce product planning and product development process.

UNIT – I Introduction to Design Thinking

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

UNIT - II Design Thinking Process

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

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

UNIT - III Innovation

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

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

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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, Kritinaholden, &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

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Course Outcomes:

COs	Statements	Blooms Level
CO1	**Explain** the concepts related to design thinking.	L1
CO2	**Explain** the fundamentals of Design Thinking and innovation.	L2
CO3	**Apply** the design thinking techniques for solving problems in various sectors.	L3
CO4	**Analyze** to work in a multidisciplinary environment.	L4
CO5	**Evaluate** the value of creativity.	L5

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II B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	2	0	0				MC (0)
SUB CODE: R23EC22MC	ENVIRONMENTAL STUDIES						

Course Objectives:

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

UNIT – I

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

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

UNIT – II

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

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

Biodiversity and Its Conservation : Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife

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conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

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

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution

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

UNIT – IV

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

UNIT – V

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

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

Textbooks:

1. Erach Bharucha,Text book of Environmental Studies for Undergraduate Courses,Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.

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3. S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:

1. eeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. M.Anji Reddy, "Textbook of 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 Private limited, 1988.
5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science
- http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdf
- https://www.youtube.com/watch?v=5QxxaVfgQ3k

Course Outcomes:

COs	Statements	BloomsLevel
CO1	Understand multi-disciplinary nature of environmental studies and Analyze the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources.	L2
CO2	Explain the concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food	L2

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	web. Explain the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity.	
CO3	Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management	L2
CO4	Understand the rainwater harvesting, watershed management, ozonelayer depletion and waste land reclamation.	L2
CO5	Illustrate the causes of population explosion, value education and welfare programmes.	L3

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R23 III B.Tech. ECE

Course Structure and Syllabus

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III B.Tech. I SEMESTER

S.No	Subject	Course Code	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	Analog & Digital IC Applications	R23EC3101	PC	30	70	100	3	0	0	3
2	Digital communications	R23CC3102	PC	30	70	100	3	0	0	3
3	Antennas and Wave Propagation	R23EC3103	PC	30	70	100	3	0	0	3
4	Digital System Design through HDL	R23EC3104	PE	30	70	100	3	0	0	3
	Optical Communications	R23EC3105	PE	30	70	100	3	0	0	3
	Electronic Measurements and Instrumentation	R23EC3106	PE	30	70	100	3	0	0	3
	Computer Organization and Architecture	R23EC3107	PE	30	70	100	3	0	0	3
5	Open Elective		OE	30	70	100	3	0	0	3
6	Analog & Digital IC Applications Lab	R23EC31L1	PC	30	70	100	0	0	3	1.5
7	Analog and digital communications Lab	R23EC31L2	PC	30	70	100	0	0	3	1.5
8	Applications of Lab view for Instrumentation & Communications	R23EC31L3	SEC	30	70	100	0	1	2	2
9	Design of PCB & Antennas Lab	R23EC31L4	ES	30	70	100	0	0	2	1
10	Evaluation of Community Service Internship	R23CC31CSP1					-	-	-	2
Total							**15**	**1**	**10**	**23**
MC	Minor Course (Student may select from the same specialized minors pool)		30	70	100	3	0	3	4.5	
MC	Minor Course through SWAYAM / NPTEL (Minimum 12 Week, 3 credit course)		30	70	100	3	0	0	3	
HC	Honors Course (Student may select from the same Honors pool)		30	70	100	3	0	0	3	
HC	Honors Course (Student may select from the same Honors Pool)		30	70	100	3	0	0	3	

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III Year I Semester	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC3101	**ANALOG & DIGITAL IC APPLICATIONS**						

Course Outcomes:

CO1 Apply the operational principles and characteristics of op-amps to design and analyze analog circuits such as amplifiers and active filters.(K3: Apply)

CO2 Design waveform generators and comparator circuits using op-amps for signal processing applications.(K4: Analyze)

CO3 Implement and troubleshoot combinational and sequential logic circuits using digital ICs.(K4: Analyze)

CO4 Compare different data conversion techniques (DAC and ADC) and implement digital-to-analog and analog-to-digital conversion circuits in real-time applications.

CO5 Design and interface digital systems using programmable logic devices like PLDs and FPGAs.(K4: Analyze)

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 & IC565 Applications: Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & 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 & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, De-multiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT-V

Sequential Logic IC's and Memories: Familiarity with commonly available 74XX & CMOS40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static &

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Dynamic RAMs.

TEXTB OOKS:

1. Ramakanth A.Gayakwad-Op-Amps&Linear ICs,PHI,2003.
2. FloydandJain-DigitalFundamentals,8th Ed.,Pearson Education,2005.

REFERENCE BOOKS:

1. D.Roy Chowdhury–Linear Integrated Circuits, New Age International(p) Ltd,2nd Ed.,2003.
2. John.F.Wakerly–DigitalDesignPrinciplesandPractices,3rd Ed.,Pearson,,2009.
3. Salivahana-Linear Integrated Circuitsand Applications,TMH,2008.
4. WilliamD.Stanley-OperationalAmplifierswithLinearIntegratedCircuits,4th Ed.,Pearson Education India, 2009

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III Year I Semester	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC3102	**DIGITAL COMMUNICATIONS**						

Course Outcomes:

- To Describe basic components of Digital Communication Systems and to determine the performance of different pulse digital modulation techniques
- To determine the performance of digital modulation techniques for the generation and digital representation of the signals.
- To design optimum receiver for Digital Modulation techniques and to determine the probability of error for various digital modulation schemes
- To compute and analyze error detecting and error correction codes block codes, cyclic codes.
- To compute and analyze convolution codes and Turbo codes.

UNIT I

PULSE DIGITAL MODULATION: Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization & 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

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.

UNIT V

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.

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TEXT BOOKS:

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

RERFERENCES:

1. Digital and Analog Communication Systems - Sam Shanmugam, John Wiley, 2005.
2. Digital Communications – John Proakis, TMH, 1983. Communication Systems Analog & Digital – Singh & Sapre, TMH, 2004
3. Modern Analog and Digital Communication – B.P.Lathi, Oxford reprint, 3rd edition, 2004.

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III Year I Semester	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC3103	**ANTENNAS AND WAVE PROPAGATION**						

Course Outcomes:

- Identify basic antenna parameters.
- Quantify the fields radiated by various types of antennas
- Design and analyze antenna arrays
- Design and analyze wire antennas, loop antennas, reflector antennas, lens antennas, horn antennas and micro-strip antennas
- Analyze antenna measurements to assess antenna's 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, Beam width, 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, Beam width, Directivity, Effective Area and Effective Height. Natural current distributions, fields and patterns of Thin Linear Center-fed Antennas of different lengths, Radiation Resistance at a point which is not current maximum, 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 R_r relations for small loops

UNIT-III:

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; Concept of Scanning Arrays. Directivity Relations (no derivations), Related Problems. Binomial Arrays, 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

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Antennas –Geometry and Parameters, Impact of different parameters on characteristics, illustrated Problems.

UNIT-V

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. Antenna Theory: Analysis And Design- Constantine A. Balanis, 3rd Edition, A John Wiley & Sons, Inc., Publication
2. Antennas for All Applications – John D. Kraus and Ronald J. Marhefka, 3rd Edition, TMH, 2003.
3. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.

REFERENCES:

1. Antennas and Wave Propagation-G.S.N. Raju, Pearson publications, 2006.
2. Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol. 5, Standard Publishers Distributors, Delhi.
3. Antennas – John D. Kraus, McGraw-Hill, 2nd Edition, 1988.

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III Year I Semester	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC3104	**DIGITAL SYSTEM DESIGN THROUGH HDL (PE-I)**						

Course Outcomes:

- Understand the language constructs and programming fundamentals of Verilog HDL.
- Choose the suitable abstraction level for a particular digital design
- Construct Combinational and sequential circuits in different modelling styles using Verilog HDL
- Design and synthesize combinational and sequential logic circuits
- Analyze and Verify the functionality of digital circuits/systems using 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 & Counters in Behavioral 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 & 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" ,2nd Edition, Pearson Education,2006.
2. Michael, D. Ciletti, "Advanced digital design with the Verilog HDL", Pearson Education India,2005.

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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 Edision 2014.
3. J. Bhasker, A Verilog HDL Primer 2nd edition, BS Publications, 2001.

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III Year I Semester	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC3105	**OPTICAL COMMUNICATIONS**						

Course Outcomes:

- Choose necessary components required in modern optical communications systems.
- Design and build optical fiber experiments in the laboratory, and learn how to calculate electromagnetic modes in waveguides, the amount of light lost going through an optical system, dispersion of optical fibers.
- Use different types of photo detectors and optical test equipment to analyze optical fiber and light wave systems.
- Choose the optical cables for better communication with minimum losses
- Design, build, and demonstrate optical fiber experiments in the laboratory.

UNIT I

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:- 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 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-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&ILD, Optical detectors- Physical principles of PIN and APD, Detector response time, Comparison of Photo detectors, Related problems.

UNIT V

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

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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, Rise time budget with examples, Line coding in Optical links, WDM, Necessity, Principles, Measurement of Attenuation and Dispersion, Eye pattern.

TEXTBOOKS:

1. Optical Fiber Communications–GerdKeiser, McGraw-HillInternationaledition,3rdEdition,2000.
2. Fiber Optic Communications– JosephC.Palais, 4thEdition, Pearson Education, 2004.

RERFERENCES:

1. Fiber Optic Communications–D.K.Mynbaev ,S.C.Gupta and Lowell L.Scheiner,PearsonEducation,2005.
2. TextBookonOpticalFiberCommunicationanditsApplications–S.C.Gupta,PHI,2005.
3. Fiber Optic Communication Systems–Govind P.Agarwal ,JohnWiley,3rdEdiition,2004.

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III Year I Semester	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC3106	**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**						

Course Outcomes:

- Understand the various Analog and Digital measuring Instruments
- Aware of the principles and operations of various oscilloscopes
- Learn measurements using various bridges
- Familiarize different Signal Generators and function generators
- Learn various transducers and Intelligent sensors

UNIT I

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: 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 Book 3**)

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TEXT BOOKS

1. H. S. Kalsi, "Electronic Instrumentation", Third edition, Tata McGraw Hill, 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, DhanpatRai& Co., "A course in Electrical and Electronic Measurements and Instrumentation", 9th Edition, 2010.
2. David A. Bell, "Electronic Instrumentation & Measurements", PHI, 2nd Edition, 2006.

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III Year I Semester	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: R23EC3107	**COMPUTER ORGANIZATION AND ARCHITECTURE**						

Course Outcomes:

- Understand the representation of data, the register transfer language and Micro operations.
- Know the basic computer organization and design, programming the basic computer and design the micro programmer control unit.
- Know the development of central processing unit and explain various algorithms for computer arithmetic operations.
- Interface various Peripheral devices and various data transfer operations.
- Study the memory Hierarchy and different types of memories.

UNIT-1 :

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 Micro operations: Register transfer language, Register transfer, Bus and Memory transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit

UNIT-2

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

Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit (**Preferably from Reference Book 2**)

UNIT-3

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 – 4

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.

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UNIT– 5

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Text Book

1. M.Morris Mano," Computer System Architecture," Pearson Publishers, Revised Third Edition

Reference Books

1. John P Hayes, "Computer Architecture and Organization,"Mc-Graw Hill Publishers, Third Edition
2. Carl Hamacher, "Computer Organization," Tata Mc-Graw Hill Publishers, Fifth Edition.

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III Year I Semester	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: Open Elective	ELECTRONIC DEVICES AND CIRCUITS						

Course Outcomes:

- Apply the basic concepts of semiconductor physics.
- Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation.
- Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.
- Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.
- Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions.

UNIT-I:

Review of Semi Conductor Physics: Hall effect, continuity equation, law of junction, 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, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.

UNIT-II:

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode, Tunnel Diode, UJT, PNPN Diode, SCR. Construction, operation and V-I characteristics.

Rectifiers and Filters: Basic Rectifier setup**,** half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter(Series inductor), Capacitor filter(Stunt inductor), π-Filter, comparison of various filter circuits in terms of ripple factors.

UNIT- III: Transistor Characteristics:

BJT: Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

FET: FET types, construction, operation, characteristicsμ, g_m, $r_d$parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

UNIT- IV: 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}, Ic, and β, Stability factors, (S,S',S''), Bias compensation, Thermal runaway, Thermal stability.FET Biasing- methods and stabilization.

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UNIT- V: 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.

FET: Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

Text Books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, SecondEdition,2007
2. Electronic Devices and Circuits by David A. Bell, Oxford University Press
3. Electronics devices & circuit theory- Robert L.Boylestad and LouiNashelsky, Pearson/Prentice hall, tenth edition,2009

References:

1. Integrated Electronics-J. Millman, C. Halkias,Tata Mc-Graw Hill, Second Edition,2009
2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016.

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III Year I Semester	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: **Open Elective**	**SIGNALS AND SYSTEMS**						

Course Outcomes:

- Differentiate the various classifications of signals and systems
- Analyze the frequency domain representation of signals using Fourier concepts
- Classify the systems based on their properties and determine the response of LTI Systems.
- Know the sampling process and various types of sampling techniques.
- 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, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Relation between Trigonometric and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of standard signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Related problems

UNIT-III:

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.

SAMPLING THEOREM: Graphical and analytical proof or Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Aliasing, Related problems.

UNIT–IV:

LAPLACE TRANSFORMS: Introduction**,** Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Inverse Laplace transform, Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis.

UNIT–V:

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.

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TEXT BOOKS:

1. Signals, Systems & Communications-B.P.Lathi,BSPublications,2003.
2. Signals and Systems-A.V. Oppenheim, A.S. Willsky and S.H. Nawab,PHI,2ndEdn,1997
3. Signals & Systems-SimonHaykinandVanVeen,Wiley,2ndEdition,2007

REFERENCE BOOKS:

1. PrinciplesofLinearSystemsandSignals–BPLathi,OxfordUniversityPress,2015
2. Signals and Systems–TK Rawat, Oxford University press,2011.

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III Year I Semester	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: Open Elective	PROBABILITY THEORY AND RANDOM VARIABLES						

Course Outcomes:

- Mathematically model the random phenomena and solve simple probabilistic problems
- Identify different types of random variables and compute statistical averages of these random variables.
- Characterize the random processes in the time and frequency domains.
- Analyze the LTI systems with random inputs

UNIT I

THE RANDOM VARIABLE: Introduction, Review of Probability Theory, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties.

UNIT II

OPERATION ON ONE RANDOM VARIABLE - EXPECTATIONS: Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable.

UNIT III

MULTIPLE RANDOM VARIABLES: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions.

OPERATIONS ON MULTIPLE RANDOM VARIABLES: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT IV

RANDOM PROCESSES – TEMPORAL CHARACTERISTICS: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-order and Wide-Sense Stationarity, N^{th}-order and Strict - Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

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UNIT V

RANDOM PROCESSES - SPECTRAL CHARACTERISTICS: The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Density Spectrum and Cross-Correlation Function.

LINEAR SYSTEMS WITH RANDOM INPUTS: Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output, Band pass, Band-Limited and Narrowband Processes, Properties.

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI, 4th Edition, 2002.
3. Probability Theory and Stochastic Processes – B. PrabhakaraRao, BS Publications.

REFERENCE BOOKS:

1. Probability and Random Processes with Applications to Signal Processing, Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
2. Schaum's Outline of Probability, Random Variables, and Random Processes.
3. An Introduction to Random Signals and Communication Theory, B.P. Lathi, International Textbook, 1968.
4. Probability Theory and Random Processes, P. Ramesh Babu, McGrawHill, 2015.

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III Year I Semester	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	0	30	70	100	3
SUB CODE: Open Elective	**NETWORK ANALYSIS**						

Course Outcomes:

- Gain the knowledge on basic network elements.
- Will analyze the RLC circuit's behavior in detailed.
- Analyze the performance of periodic waveforms
- Gain the knowledge in characteristics of two port network parameters (Z,Y,ABCD,h& g).
- Analyze the filter design concepts in real world applications.

UNIT – I

Introduction to Electrical Circuits : Network elements classification, Electric charge and current, Electric energy and potential, Resistance parameter – series and parallel combination, Inductance parameter – series and parallel combination, Capacitance parameter – series and parallel combination. Energy sources: Ideal, Non-ideal, Independent and dependent sources, Source transformation, Kirchoff's laws, Mesh analysis and Nodal analysis problem solving with resistances only including dependent sources also.

Definitions of terms associated with periodic functions: Time period, Angular velocity and frequency, RMS value, Average value, Form factor and peak factor- problem solving, Phase angle, Phasor representation, Addition and subtraction of phasors, mathematical representation of sinusoidal quantities, explanation with relevant theory, problem solving. Principal of Duality with examples

Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, basic tie set schedule, basic cut set schedule.

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. Solutions using Laplace transform method.

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.

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

UNIT – IV Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, Condition for maximum impedance, current in anti resonance, Bandwidth of parallel resonance, general case-resistance present in both branches, anti resonance at all frequencies.

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

UNIT – V Two-port Networks: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h-parameters, Inverse h-parameters, Inverse Transmission line parameters, Relationship between parameter sets, Parallel connection of two port networks, Cascading of two port networks, series connection of two port networks, problem solving including dependent sources also.

TEXT BOOKS:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, 3rd Edition, 2000.
2. Network Analysis by K.Satya Prasad and S Sivanagaraju, Cengage Learning
3. Electric Circuit Analysis by Hayt and Kimmarle, TMH

REFERENCES:

1. Network lines and Fields by John. D. Ryder 2nd edition, Asia publishing house.
2. Basic Circuit Analysis by DR Cunninghan, Jaico Publishers.
3. Network Analysis and Filter Design by Chadha, Umesh Publications.

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III B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	3	30	70	100	1.5
SUB CODE: R23EC31L1	**ANALOG AND DIGITAL IC APPLICATIONS LAB**						

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 & 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.

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III B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	3	30	70	100	1.5
SUB CODE: R23EC31L2	**ANALOG AND DIGITAL COMMUNICATIONS LAB**						

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

Software:

i) Computer Systems with latest specifications

ii) Connected in LAN(Optional)

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iii) Operating system(Windows/Linux software)

iv) Simulations software(Simulink &MATLAB)

Equipment:

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

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III B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	1	2	30	70	100	2
SUB CODE: R23EC31L3	**APPLICATIONS OF LAB VIEW FOR INSTRUMENTATION & COMMUNICATIONS**						

Course Outcomes:

- Develop loops, case structures, arrays, and clusters.
- Realize real time applications using NI DAQ hardware
- Implement Coding techniques using LabVIEW
- Design automation and process control application
- Apply LabVIEW for data processing applications

Unit I:

Introduction to LabVIEW & 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 & 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 & 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 & Wi-Fi in LabVIEW, IoT Integration-Cloud-based monitoring and remote data access, Project-based learning-

Textbooks & References

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

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III B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	2	30	70	100	1
SUB CODE: R23EC31L4	**DESIGN OF PCB & ANTENNAS LAB**						

Merits of PCB Machine:

1. CNC based for Better Accuracy and results.
2. Etching, Engraving and Drilling can be done with 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 ability to run on ups systems unlike other Machines.
9. High precision lead screw
10. 5umeter 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 proto type 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 carbon fiber sheets, Drone frames, Engraved
5. Acrylic sheets. Engraving on aluminium.
6. Latest multi domain projects extension 3D printing and Additive Manufacturing.
7. Exposure to design the proto type 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 calculation
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

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III Year **I Semester**	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**2**	30	70	100	**1**
SUB CODE: R23EC31L4	**DESIGN THINKING AND IDEA LAB**						

COURSE OBJECTIVES

1. To accelerate development of indigenous products in line with the "Make in India" campaign.
2. To encourage aspiring engineers to actualize their ideas under one roof.
3. To impart multidisciplinary education to all students to promote innovation and product development.
4. To promote experiential learning and entrepreneur skills.

COURSE CONTENTS

DESIGN THINKING

Design Thinking: Definition, Need and Objective, Concepts and Brainstorming, Stages – Empathize, Define, Ideate, Prototype, Test. Practical Examples of Customer Challenges, Alignment of Customer Expectations with Product Design - Feedback, Re-Design and Re-Create.

INTRODUCTION TO TOOLS AND EQUIPMENT

Introduction to Hand Tools and Power Tools - 3-axis CNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc.Basic 2D and 3D designing using CAD tools such as FreeCAD, Sketchup, Prusa Slicer, FlatCAM, Inkspace and OpenBSP - 2D and 3D structures for prototype building using CNC machine - Basic welding and other joining techniques for assembly - Basics of 3D scanning, Point cloud data generation for reverse engineering.Exposure to PCB prototype fabrication - Familiarity and use of soldering and de-soldering equipment - Usage of Breadboard, Arduino, Raspberry Pi.

EXPERIMENTAL LEARNING

1. 2D profile cutting of press fit box / casing in acrylic (3 or 6 mm thickness) / polymer / cardboard / MDF (2 mm thickness) board using laser cutter and engraver.
2. Machine 3D geometry on soft material such as soft wood using CNC router.
3. Fabricate products like trusses using cutting and welding tools.
4. 3D printing of scanned geometry using FDM or SLA printer.
5. Designing a suitable PCB layout, fabrication and testing of the circuit.
6. Assemble and disassemble electronic components on a PCB using soldering and de-soldering equipment.

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7. Embedded programming using Arduino, Raspberry Pi and BeagleBone.

DESIGN THINKING PROJECT

1. Design and implementation of a capstone project.

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Recall the basic concepts of Design Thinking.	[K2]
CO2	Use the equipment, tools and inventories associated with Design Thinking Laboratory.	[K3]
CO3	Perform fundamental fabrication operation using hand tools, power tools, welding equipment, laser cutter and engraver.	[K3]
CO4	Perform fundamental electrical and electronic circuit design using PCB machine.	[K3]
CO5	Develop innovative products by implementing the design thinking approach	[K4]

TEXT BOOKS

1. Veeranna D.K, "Workshop / Manufacturing Practices (with Lab Manual)", AICTE's Prescribed Textbook, Khanna Book Publishing, 2022.

2. E. Balaguruswamy, "Developing Thinking Skills (The way to Success)", Khanna Book Publishing Company,2022.

REFERENCE BOOKS

1. Lal, D. M., "Design Thinking- Beyond the Sticky Notes", Sage Publications India Pvt. Ltd., 2021.

2. Malik, A. D. M., "Design Thinking for Educators", Notion Press, Chennai, India, 2019.

3. Panke, S., "Design Thinking in Education: Perspectives, Opportunities and Challenges", Open Education Studies, 2021.

WEB RESOURCES

1. https://fab-coep.vlabs.ac.in/List%20of%20experiments.html
2. https://www.innovationtraining.org/how-to-use-design-thinking-to-design-an-innovation-lab/
3. https://www.erdster.co.in/design-thinking-lab.html

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R23 III B.Tech. II Semester Syllabus

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S.No	Subject	Course Code	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	VLSI Design	R23EC3201	PC	30	70	100	3	0	0	3
2	Microprocessors & Microcontrollers	R23EC3202	PC	30	70	100	3	0	0	3
3	Digital Signal Processing	R23EC3203	PC	30	70	100	3	0	0	3
4	Analog IC Design	R23EC3204	PE-II	30	70	100	3	0	0	3
5	Satellite Communication	R23EC3205	PE-II	30	70	100	3	0	0	3
6	Smart and Wireless Instrumentation	R23EC3206	PE-II	30	70	100	3	0	0	3
7	Machine Learning	R23EC3207	PE-II	30	70	100	3	0	0	3
8	Bio Medical Instrumentation	R23EC3208	PE-III	30	70	100	3	0	0	3
9	Microwave Engineering	R23EC3209	PE-III	30	70	100	3	0	0	3
10	Embedded Systems	R23EC32010	PE-III	30	70	100	3	0	0	3
11	Artificial Intelligence	R23EC32011	PE-III	30	70	100	3	0	0	3
12			OE-II	30	70	100	3	0	0	3
13	VLSI Design Lab	R23EC32L1	PC	30	70	100	0	0	3	1.5
14	Microprocessors & Microcontrollers Lab	R23EC32L2	PC	30	70	100	0	0	3	1.5
15	Machine Learning Lab	R23EC32L3	SEC	30	70	100	0	1	2	2
16	Research methodology and IPR	R23EC32MC	AC	30	70	100	2	0	0	0
Total							**20**	**1**	**8**	**23**
MC	Student may select from the same minors pool			30	70	100	3	0	3	4.5
MC	Minor Course (Student may select from the same specialized minors pool)			30	70	100	3	0	0	3
HC	Student may select from the same honors pool			30	70	100	3	0	0	3
HC	Honors Course (Student may select from the honors pool)			30	70	100	3	0	0	3

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III B. TECH II SEMESTER	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: R23EC3201	**VLSI DESIGN**						

Course Outcomes:

- Demonstrate a clear understanding of CMOS fabrication flow and technology scaling.
- Design MOSFET based logic circuit.
- Design basic building blocks in Analog IC design.
- Design various CMOS logic circuits for design of Combinational logic circuits.
- Analyze the behavior of static and dynamic 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.

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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.

TEXTBOOKS:

1. Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas and A. Pucknell
2. And Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
3. Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill, 2003
4. Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, 2nd edition,2016.

REFERENCES:

1. "Introduction to VLSI Circuits and Systems", John P. Uyemura, John Wiley & Sons, reprint 2009.
2. Integrated Nanoelectronics: Nanoscale CMOS, Post-CMOS and Allied Nanotechnologies Vinod Kumar Khanna, Springer India, 1st edition, 2016.
3. FinFETs and other multi-gate transistors, ColingeJP, Editor New York, Springer,2008.

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: R23EC3202	**MICROPROCESSOR AND MICROCONTROLLERS**						

Course Outcomes:

- Understand the architecture of 8086 and its operation.
- Develop the students to compose the assembly language program for 8086.
- Applying 8086 processor to interface with necessary peripherals.
- Understand the architecture of 8051 and interfacing with necessary peripherals.
- Understand the introductory concepts of advanced processors, viz., 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.

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TEXTBOOKS:

1. Advanced microprocessors and peripherals by K. M. Bhurchandi, A. K. Ray 3e
2. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.McKinlay; Pearson 2-Edition,2011
3. TheDefinitiveGuidetoARMCortex-M3andCortex-M4ProcessorsbyJosephYiu.,Newnes Third edition.

REFERENCEBOOKS:

1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm EducationMedia,2017.
2. Cortex-M3TechnicalReference Manual.

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III B. TECH II SEMESTER	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: R23EC3203	**DIGITAL SIGNAL PROCESSING**						

Course Outcomes:

- Understand the concepts of discrete signals and discrete systems with its characteristics
- Calculate z-Transform, Fourier Transform, Discrete Fourier Transform of discrete signals.
- Understand the algorithms for the efficient computation of DFT coefficients of signals
- Design the FIR and IIR filters.
- Know the architectures of various DSP processors and its addressing modes, assembly language instructions.

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 entirez – 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.

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

Reference Books:

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

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II B. TECH II SEMESTER	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: R23EC3204	**ANALOG IC DESIGN**						

Course Outcomes:

- Understand the concepts of MOS Devices and Modeling.
- Design and analyze any Analog Circuits in real time applications.
- Extend the Analog Circuit Design to Different Applications in Real Time.
- Understand of Open-Loop Comparators and Different Types of Oscillators

UNIT -I:

MOS Devices and Modelling: The MOS Transistor, Passive Components- Capacitor & 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 & 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. Design of Analog CMOS Integrated Circuits- BehzadRazavi, TMH Edition, Second Edition.
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition,2010.

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REFERENCES:

1. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition,2010.

2. Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn,2013.

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III B. TECH II SEMESTER	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: R23EC3205	**SATELLITE COMMUNICATION**						

Course Outcomes:

- Understand the concepts, applications and subsystems of Satellite communications.
- Derive the expression for G/T ratio and to solve some analytical problems on satellite link design.
- Understandthevarioustypesofmultipleaccesstechniquesandarchitectureofearthstationd esign
- Understand the concepts of GPS and its architecture.

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 & 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-

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introduction, IRNSS satellites, IRNSS constellation, IRNSS configuration, IRNSS services, navigation data, applications of IRNSS; multi GNSS.

TEXT BOOKS:

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 3RD Edition, 2020.
2. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, 2nd Edition, Pearson Publications, 2003.

REFERENCES:

1. Satellite Communications: Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003.
2. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed.
3. Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004
4. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996.

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: R23EC3206	**SMART AND WIRELESS INSTRUMENTATION**						

Course Outcomes:

- Analyze Smart and Wireless Instrumentation with respect to various performance parameters.
- Design and develop Applications using WSN (Wireless sensor Network).
- Demonstration of various Node architectures.
- Demonstration of Fundamentals of wireless digital communication
- Analyze the power sources, Demonstrate an ability to design strategies as per needs and specifications

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.

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Text Books:

1. Fundamentals of wireless sensor networks : theory and practice - WaltenegusDargie, Christian Poellabauer, A John Wiley and Sons, Ltd., Publication.
2. Smart Sensors, Measurement and Instrumentation ,Subhas Chandra Mukhopadhyay, Springer Heidelberg, New York, Dordrecht London, 2013.
3. Wireless Sensors and Instruments: Networks, Design and Applications, HalitEren, CRC Press, Taylor and Francis Group, 2006.

Reference Books:

1. UvaisQidwai, Smart Instrumentation: A data flow approach to Interfacing“, Chapman & Hall; 1st Edn, December 2013.
2. Wireless Sensor Networks: Architectures and Protocols, Edgar H. Callaway Jr. and Ed gar H. Callaway.

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: R23EC3207	**MACHINE LEARNING**						

Course Outcomes:

- Define machine learning and its different types and understand their applications.
- Explain the various techniques involved in pre-processing of data for Data Analysis
- Apply various supervised learning algorithms including decision trees and k-nearest neighbours (k-NN) etc.
- Implement unsupervised learning techniques, viz., K-means clustering etc.
- Learn about various performance metrics and explore them in various applications of implementing Machine learning Algorithms.

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

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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. "Introduction to Machine Learning with Python", Andreas C.Muller&Sarah Guido, O'Reilly Publications
2. "Hands-on Machine Learning with Scikit-Learn, Keras& TensorFlow", Aurelien Geron, O'Reilly Publications
3. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

Reference Books:

1. "Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017
2. "Machine Learning in Action",Peter Harrington, DreamTech
3. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: R23EC3208	**BIO-MEDICAL INSTRUMENTATION**						

Course Outcomes:

- Demonstrate a foundational understanding of the anatomy and physiology of the human body.
- Apply knowledge of different techniques used for measuring various physiological parameters.
- Explain modern imaging techniques employed in medical diagnosis and identify the diverse therapeutic equipment utilized in the biomedical field.
- Understand and apply bio-telemetry principles for transmitting bioelectrical variables.
- Analyze patient safety measures and evaluate recent advancements in the medical field.

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, Plethysmo graphy, Measurement of Heart Sounds, Event detection, PQRS & T-Waves inECG, the first & 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 & 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.

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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. Biomedical Instrumentation and Measurements C.Cromwell,F.J.Weibell,E.A.Pfeiffer – Pearson education.
2. Biomedical Signal Analysis – Rangaraj, M. Rangayya – Wiley Inter Science – JohnWilley & Sons Inc.

Reference Books:

1. Hand Book of Bio-Medical Instrumentation – R.S. Khandpur, TMH.
2. Introduction to Bio-Medical Engineering – Domach, Pearson.
3. Introduction to Bio-Medical Equipment Technology – Cart, Pearson.

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: R23EC3209	**MICROWAVE ENGINEERING**						

Course Outcomes:

- Design different mode sin waveguide structures
- Calculate S-matrix for various waveguide components and splitting the microwave energy in a desired direction
- Distinguish between Microwave tubes and Solid State Devices, calculation of efficiency of devices.
- Measure various microwave parameters using a Micro wave test bench

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, Zo 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,S-Matrix Calculations Ferrite Components– Faraday Rotation, Gyrator, Isolator, Circulator, Related Problems.

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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. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.
2. Microwave Engineering- Annapurna Das and Sisir K.Das, Mc Graw Hill Education, 3rd Edition.

REFERENCES:

1. Microwave Devices and Circuits – Samuel Y. Liao, PHI, 3rd Edition,1994.
2. Microwave Engineering – G S N Raju , I K International
3. Microwave and Radar Engineering-M.Kulkarni, Umesh Publications, 3rd Edition

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: R23EC32010	**EMBEDDED SYSTEMS**						

Course Outcomes:

- Know basics of embedded system, classification, memories, different communication interface and what embedded firmware is and its role in embedded system, different system components.
- Distinguish all communication devices in embedded system, other peripheral device.
- DistinguishconceptsofCversusembeddedCandcompilerversuscross-compiler.
- Choose an operating system, and learn how to choose an RTOS

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, Watch dog 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, Dissembler/De-compiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools.

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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 hostmachine, Simulators, Laboratory Tools. Test and evolution of an embedded systems (Build in selftest etc).
Case study-typical embedded system design flow with an example.

Text Books:

1. Embedded Systems Architecture By Tammy Noergaard, Elsevier Publications,2005
2. Embedded System Design, Frank Vahid,Tony Givargis, John Wiley Publications.

References:

1. Embedding system building blocks By Labrosse,CMP publishers.

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: R23EC32011	**ARTIFICIAL INTELLIGENCE**						

Course Outcomes:

- Understand the concepts of computational intelligence like machine learning
- Ability to get the skill to apply machine learning techniques to address the real time Problems in different areas
- Understand the Neural Networks and its usage in machine learning application.
- Apply principles and algorithms evaluate models generated from data
- Apply the algorithms to a real world problems

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 & 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

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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", 3rd Edition, Prentice Hall, 2009.

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: Open Elective	**LINEAR AND DIGITAL IC APPLICATIONS**						

Course Outcomes:

- Analyze and design various configurations of operational amplifiers, and applications such as instrumentation amplifiers, voltage regulators, comparators, and waveform generators.
- Design and implement active filters and waveform generators using op-amps, IC-555, and IC-565, and evaluate their performance for signal processing applications
- Compare different data conversion techniques (DAC and ADC) and implement digital-to-analog and analog-to-digital conversion circuits in real-time applications.
- Apply combinational logic ICs such as multiplexers, de-multiplexers, encoders, decoders, and arithmetic circuits to solve complex digital design problems.
- Develop sequential circuits using flip-flops, counters, and shift registers, and analyze their use in digital memory systems, including ROM, RAM, and their variants

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 & IC565 Applications: Introduction to Active Filters, Characteristics of Bandpass, Band reject and All Pass Filters, Analysis of 1st order LPF & 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 & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, De-multiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT-V

Sequential Logic IC's and Memories: Familiarity with commonly available 74XX & CMOS40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

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Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

TEXTBOOKS:

1. Ramakanth A.Gayakwad-Op-Amps & LinearICs, PHI,2003.
2. FloydandJain-DigitalFundamentals,8th Ed.,Pearson Education,2005.

REFERENCEBOOKS:

1. D.Roy Chowdhury–Linear Integrated Circuits, NewAge International(p)Ltd ,2nd Ed.,2003.
2. John.F.Wakerly–DigitalDesignPrinciplesandPractices,3rd Ed.,Pearson,,2009.
3. Salivahana-Linear Integrated Circuits and Applications,TMH,2008.
4. William D.Stanley-Operational Amplifiers with Linear Integrated Circuits, 4th Ed.,Pearson Education India, 2009

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: Open Elective	**PRINCIPLES OF COMMUNICATIONS**						

Course Outcomes:

- Analyze the performance of analog modulation schemes in time and frequency domains.
- Analyze the performance of angle modulated signals.
- Characterize analog signals in time domain as random processes and noise
- Characterize the influence of channel on analog modulated signals
- Determine the performance of analog communication systems in terms of SNR
- Analyze pulse amplitude modulation, pulse position modulation, pulse code modulation and TDM systems.

UNIT1 : Basic tools for communication, Fourier Series/Transform, Properties, Autocorrelation, Energy Spectral Density, Parsevals Relation, Amplitude Modulation (AM), Spectrum of AM, Envelope Detection, Power Efficiency, Modulation Index.

UNIT2 : Double Sideband Suppressed Carrier (DSB-SC) Modulation, Demodulation, Costas Receiver, Single Sideband Modulation (SSB), Hilbert Transform, Complex Pre-envelope/ Envelope, Demodulation of SSB, Vestigial Sideband Modulation (VSB)

UNIT 3 : Angle Modulation, Frequency Modulation (FM), Phase Modulation (PM), Modulation Index, Instantaneous Frequency, Spectrum of FM Signals, Carsons Rule for FM Bandwidth, Narrowband FM Generation, Wideband FM Generation via Indirect Method, FM Demodulation

UNIT 4 : Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion, Signal Reconstruction from Sampled Signal, Pulse Amplitude Modulation**,** Quantization, Uniform Quantizers – Midrise and Midtread, Quantization noise, , Non uniform Quantizers, Delta Modulation, Differential Pulse Code Modulation (DPCM)

UNIT 5: : Basics of Probability, Conditional Probability, MAP Principle, Random Variables, Probability Density Functions, Applications in Wireless Channels, Basics of Random Processes ,Gaussian Random Process, Noise.

TEXTBOOKS:

1. Simon Haykin, Communications Systems, 4th Edition. John Wiley and Sons, Inc
2. Fundamentals of Wireless Communication by David Tse

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: Open Elective	**PRINCIPLES OF SIGNAL PROCESSING**						

Course Outcomes:

- Acquire the knowledge in signals and systems.
- Get familiarized with various transforms to analyze continuous time signals.
- Understand sampling theorem and z-transform.
- Get familiarized with the transforms of discrete time signals.
- Design the digital filter design

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, impulse Function, step function, signum function and ramp function. Introduction, Linear system, impulse response, Linear time invariant (LTI) system, Linear time invariant(LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system, Related problems.

Unit-II: Analysis of continuous time signals

Fourier Series and Fourier Transform:

Fourier series representation of continuous time periodic signals, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series,. Deriving Fourier transform from Fourier series, Fourier transform of standard signals, properties of Fourier transforms, Related problems.

Laplace Transforms:

Introduction, Concept of region of convergence (ROC) for Laplace transforms, Properties of L.T's, Inverse Laplace transform, Relation between Laplace Transform and Fourier Transform of a signal.

Unit III:

Sampling Theorem: Graphical and analytical proof or Band Limited Signals, impulse sampling, Reconstruction of signal from its samples, Aliasing

Z–Transforms: Concept of Z-Transform of a discrete sequence. Region of convergence in Z-Transform, Inverse Z-transform, properties of Z-transforms

Unit IV:

Fourier Transforms of discrete signal: Fourier Transform of Discrete Signal, Properties, and Inverse Fourier Transforms, related problems

Discrete Fourier Transforms: Definition, Properties, Inverse DFT, related problems.

Fast Fourier Transform: Decimation in Time domain and Decimation in Frequency Algorithms.

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Unit V:

Digital Filters: **Structures of IIR filters and FIR filters**: Director form–1 and Direct form 2; cascade form; parallel form **Analog filter design** LPF, BPF, HPF and BEF filter design using Butterworth **Frequency Transformations:** Analog to Analog; Digital and Digital **IIR Filter Design:** IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation. **FIR Filter Design:** Filter design using windowing techniques. Rectangular Window, Hamming Window, Hanning Window

Text Books:

1. Signals, Systems & Communications - B. P. Lathi, BS Publications, 2003.
2. Digital Signal Processing - P. Ramesh Babu, 5th Edition, SCITECH Publishers.

Reference Books:

1. Signals & Systems – Simon Haykin and VanVeen, Wiley, 2nd Edition, 2007.
2. Signals and Systems-A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2ndEdn, 1997.
3. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, 3rd Edition, Pearson, 2014.

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: Open Elective	**MICROPROCESSORS & MICROCONTROLLERS**						

Course Outcomes:

- Understand the architecture of 8086 and its operation.
- Develop the students to compose the assembly language program for 8086.
- Applying 8086 processor to interface with necessary peripherals.
- Understand the architecture of 8051 and interfacing with necessary peripherals.
- Understand the introductory concepts of advanced processors, viz., ARM processors.

UNIT-1:

Introduction: Microprocessor based system, Origin of microprocessors, Harvard and Von Neumann architectures with examples, Microprocessor Unit versus Microcontroller Unit.

8086 Architecture: internal architecture of 8086 microprocessor, register organization, physical memory organization, general bus operation.

UNIT-2:

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

UNIT-3:

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, stepper motor, A/D and D/A converters

UNIT-4:

Intel 8051 MICROCONTROLLER and Interfacing

Introduction to microcontrollers, internal architecture of 8051 microcontroller, I/O ports and memory organization, MCS51 addressing modes and instruction set, assembly language programming, simple programs, counters/timers, serial data input/output, interrupts. Interfacing to 8051: A/D and D/A Convertors, keyboard, LCD Interfacing.

UNIT-5:

ARM Architectures and Processors: introduction to CISC and RISC architectures, ARM Architecture, ARM Processors Families, Introduction to 16/32 bit processors, ARM7 architecture and organization, Thumb instructions, ARM Cortex-M3 Processor Functional Description.

TEXTBOOKS:

1. Advanced microprocessors and peripherals by K. M. Bhurchandi, A. K. Ray 3e
2. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.McKinlay; Pearson 2-Edition,2011.
3. Microprocessors and Microcontrollers by N. Senthil Kumar, M. Saravanan and S. Jeevanathan Oxford higher education

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REFERENCEBOOKS:

1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm EducationMedia,2017.
2. Cortex-M3TechnicalReference Manual.
3. TheDefinitiveGuidetoARMCortex-M3andCortex-M4ProcessorsbyJosephYiu.,Newnes Third edition

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE: Open Elective	**INTERNET OF THINGS**						

COURSE OUTCOMES:

- Understand the new computing technologies
- Able to apply the latest computing technologies like cloud computing technology and Big Data
- Ability to introduce the concept of M2M (machine to machine) with necessary protocols
- Get the skill to program using python scripting language which is used in many IoT devices

Unit I

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT Communication Models, Iot Communication APIs IoT enabaled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle(Chap 1 and 2)

Unit II

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANGNETCONF, YANG, SNMP NETOPEER(Chapter 3 and 4)

Unit III

IOT Platform design Methodology, Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib(Chapter 5 and 6)

Unit IV

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins., other IOT Devices(Chapter 7)

Unit V

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API, Amazon web services for IOT, Skynet IOT messaging platform(Chapter 8)

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Text Books:

1. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD),2014, ISBN: 9789350239759

Reference Books:

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

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**3**	30	70	100	1.5
SUB CODE: R23EC32L1	**VLSI DESIGN LAB**						

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.

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**3**	30	70	100	1.5
SUB CODE: R23EC32L2	**MICROPROCESSOR AND MICROCONTROLLERS LAB**						

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 to8086
5. Interfacing DAC to8086.
6. Interfacing stepper motor to8086.
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 in8051.
4. Interfacing Traffic Light Controller to8051.
5. UART operation in8051
6. Interfacing LCD to8051.
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

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3. 8086 Microprocessor kits
4. 8051 microcontroller kits
5. ADC module, DAC module
6. Stepper motor module
7. Key board module
8. LED, 7-SegemtUnits, 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 MDKARM, Digital Multi-meters

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	1	**2**	30	70	100	2
SUB CODE: R23EC32L3	**MACHINE LEARNING LAB**						

Course Outcomes:

- Understand the need for simulation/implementation for the verification of mathematical functions
- Understand the main features of the SCILAB program development environment to enable their usage in the higher learning.
- Implement simple mathematical functions/equations in numerical computing environment such as SCILAB
- Interpret and visualize simple mathematical functions and operations thereon using plots/display
- Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using SCILAB tools & Develop graphs by running Scilab programs

UNIT-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

UNIT -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, ROCAUC, Tuning models with grid search, Multi-class classification, Multi-class classification performance metrics, Multi-label classification and problem transformation, Multi-label classification performance metrics

UNIT -3:

Decision trees ,Training decision trees, Selecting the questions, Information gain, Giniimpurity, Decision trees with scikit-learn, Treeensembles, The advantages and disadvantages of decision trees Clustering with the K-Means algorithm, Localoptima, The elbow method, Evaluating clusters, Image quantization, Clustering to learn features.

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UNIT -4:

An overview of PCA ,Performing Principal Component Analysis, Variance, Covariance, and Covariance Matrices, Eigenvectors and eigen values, Dimensionality reduction with Principal Component Analysis ,Using PCA to visualize high-dimensional data, Face recognition with PCA

UNIT -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. Mastering Machine Learning with scikit-learn, Gavin Hackeling,Packt Publishing

REFERENCE BOOKS

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow, Aurélien Géron

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III B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	2	0	**0**	30	70	100	0
SUB CODE: R23EC32MC	**RESEARCH METHODOLOGY AND IPR**						

Course Outcomes:

- Understand research problem formulation.
- Analyze research related information, Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

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 instrumentations

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& engineering students"".
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

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REFERENCE BOOKS

1. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.
3. Mayall , "Industrial Design", McGraw Hill,1992.

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HONORS SUBJECTS
AND
SYLLABUS

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HONORS:

The following points may be considered to choose appropriate theory and laboratories to obtain B.Tech (Honors).

- The Student has to opt for any of the Six subjects / Five Theory and Two laboratories with the approval of the University BoS Chairman.
- Further, if any of these subjects are opted as Open Electives or Program Electives then such Subjects should not be considered to obtain the B.Tech (Honors).
- The Student can opt for the NPTEL/SWAYAM online Courses with 12 weeks/16 weeks duration and also with Proctored Examinations.
- Further, the student has to take permission for such NPTEL/SWAYAM Courses from the University BoS Chairman.
- In addition to the program elective given in Regular Courses &Structure, the following subjects are also included, that can be opted for B.Tech (Honors)
- In case of Laboratories, student may opt for virtual Laboratories only with the permission from chairman BoS.
- It is recommended to choose the laboratories along with pre-requisite theory subjects is mandatory

S.No.	SUBJECT	L-T-P	CREDITS
1	Advanced Communications	3-0-0	3
2	EMI/EMC	3-0-0	3
3	VLSI Signal Processing	3-0-0	3
4	CMOS Mixed Signal Design	3-0-0	3
5	Adaptive Signal Processing	3-0-0	3
6	RTOS	3-0-0	3
7	PC based Data Acquisition Systems	3-0-0	3
8	Digital Control Systems	3-0-0	3
9	Microstrip Antennas	3-0-0	3
10	Image & Video Processing	3-0-0	3
11	Advanced Communications Lab	0-0-3	1.5
12	CMOS Mixed Signal Design Lab	0-0-3	1.5
13	RTOS Lab	0-0-3	1.5
14	Digital Control Systems Lab	0-0-3	1.5
15	Antennas and Microwave Lab	0-0-3	1.5
16	Image & Video Processing Lab	0-0-3	1.5

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Student shall take up at least TWO NPTEL/SWAYAM of 12-week duration for 3 credits.

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**ADVANCED COMMUNICATIONS**						

COURSE OUTCOMES:

- Learn 5G Technology advances and their benefits
- Learn the key MIMO,SDR changes required to support 5G
- Learn Device to device communication with Wireless Networks
- Implementation options for 5G

UNIT I:

SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES: Introduction, Pseudo noise sequence, DS spread spectrum with coherent binary PSK, processing gain, FH spread spectrum, multiple access techniques wireless communication, TDMA and CDMA in wireless communication systems, source coding of speech for wireless communications.

UNIT II:

Wireless channel modeling (microwave, mmWave, and teraHertz): Propagation mechanism, reflection, refraction, diffraction and scattering. Fading channels- Multipath and small-scale fading Doppler shift, statistical multipath channel models, narrowband and wideband fading models, coherence bandwidth, and coherence time.

UNIT III:

Multiple-Input, Multiple-Output (MIMO) wireless communication: Basic MIMO model, MIMO capacity in fading channels, Diversity multiplexing trade off, Space-time code for MIMO wireless communication.

Software Define Radio (SDR): Characteristics and benefits of a software radio, design principles of software radio, enhanced flexibility with software radios, receiver design challenges.

UNIT IV:

Wireless Networks Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, HiperLan, WLL

UNIT V:

5G Communication: 5G spectrum landscape and requirements, Spectrum access modes and sharing scenarios, 5G spectrum technologies. 5G CHANNEL MODEL: The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in the 5G modeling. 5G USE CASES AND SYSTEM CONCEPT: Use cases and requirements, 5G system concept.5G waveforms, OFDM, OTFS, OFDMA, carrier aggregation, dual connectivity. Beyond 5G key enablers: Intelligent reflecting surfaces (IRS), wireless energy harvesting, SWIPT, integrated sensing and communication

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Text Books:

1. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2nd Ed., 2002, PHI.
2. S. Haykin and M. Moher, Modern Wireless Communication, Pearson Education, 2005.
3. Jeffrey H. Reed, Software Radio: A Modern Approach to Radio Engineering, Prentice Hall, May 2002

References Books:

1. C. Oestges and B. Clerckx, MMIO Wireless Communications, 1st Ed, 2007.
2. Paul Burns, Software Defined Radio for 3G, Artech House Inc., 2003.
3. Afif Osseiran, Jose F Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016
4. Wireless Sensor Networks: An Information Processing Approach, 1st edition, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**EMI/EMC**						

COURSE OUTCOMES:

- Discuss effects of EMI and counter measures by EMC-techniques.
- Apply the knowledge gained in selecting proper gadget/device/appliance/system, as per EMC- norms specified by regulating authorities.
- Students shall choose career in the fields of EMI/EMC as an Engineer/Researcher/Entrepreneur in India/abroad.
- Understand the various aspects of shielding & PCB Tracing ,termination& Implementation
- Identifying of EMI Hotspot and various techniques like grounding filtering soldering etc

UNIT – I:

Natural and Nuclear sources of EMI / EMC: Introduction, Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations. An overview of EMI/ EMC, Natural and Nuclear sources of EMI

UNIT – II:

EMI from apparatus, circuits and open area test sites: Electromagnetic emissions, noise from relays and switches, non-linearity in circuits, passive inter-modulation, cross talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.

UNIT – III:

Radiated and conducted interference measurements: Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents / voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI detectors and measurements.

UNIT – IV:

ESD, Grounding, shielding, bonding and EMI filters: Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design. ESD, Electrical fast transients / bursts, electrical surges.

UNIT – V:

Cables, connectors, components: Introduction, EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, Transient and Surge Suppression Devices.

EMC standards- National / International: Introduction, Standards for EMI and EMC, MIL-Standards, IEEE/ANSI standards, CISPR/IEC standards, FCC regulations, EMI/EMC standards in JAPAN, Conclusions.

Text Books:

1. Engineering Electromagnetic Compatibility by Dr. V.P. Kodali, IEEE Publication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.

References Books:

1. Introduction to Electromagnetic Compatibility, NY, John Wiley, 1992, by C.R. Pal.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT – Delhi.

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**VLSI SIGNAL PROCESSING**						

COURSE OUTCOMES:

- Understand Pipelining, and parallel processing.
- Use VLSI design for digital filters
- Optimize VLSI architectures for basic DSP algorithms
- Analyze various parallel processing algorithms
- Be familiar with VLSI algorithms and architectures for DSP.
- Be able to implement basic architectures for DSP using CAD tools

UNIT-I:

Introduction to DSP: Typical DSP algorithms, DSP algorithms benefits, Representation of DSP algorithms. **Pipelining and Parallel Processing:** Introduction, Pipelining of FIR Digital filters, Parallel Processing, Pipelining and Parallel Processing for Low Power. **Retiming:** Introduction – Definitions and Properties – Solving System of Inequalities – Retiming Techniques

UNIT-II:

Folding: Introduction -Folding Transform - Register minimization Techniques – Register minimization in folded architectures – folding of multirate systems

Unfolding: Introduction – An Algorithm for Unfolding – Properties of Unfolding – critical Path, Unfolding and Retiming – Applications of Unfolding

UNIT-III:

Systolic Architecture Design

Introduction – Systolic Array Design Methodology – FIR Systolic Arrays – Selection of Scheduling Vector – Matrix Multiplication and 2D Systolic Array Design – Systolic Design for Space Representations contain Delays

UNIT-IV:

Fast Convolution

Introduction – Cook-Toom Algorithm – Winograd algorithm – Iterated Convolution – Cyclic Convolution – Design of Fast Convolution algorithm by Inspection

UNIT-V:

Low Power Design

Scaling Vs Power Consumption –Power Analysis, Power Reduction techniques – Power Estimation Approaches Programmable DSP: Evaluation of Programmable Digital Signal Processors, DSP Processors for Mobile and Wireless Communications, Processors for Multimedia Signal Processing.

TEXT BOOKS:

1. VLSI Digital Signal Processing- System Design and Implementation – Keshab K. Parhi, 1998, Wiley Inter Science.
2. VLSI and Modern Signal Processing – Kung S. Y, H. J. While House, T. Kailath, 1985, Prentice Hall.

REFERENCE BOOKS:

1. Design of Analog – Digital VLSI Circuits for Telecommunications and Signal Processing – Jose E. France, YannisTsividis, 1994, Prentice Hall.

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**CMOS MIXED SIGNAL DESIGN**						

COURSE OUTCOMES:

- Appreciate the fundamentals of data converters and also optimized their performances.
- Understand the design methodology for mixed signal IC design
- Analyze the design of PLL and operational amplifiers
- Design the CMOS digital circuits and implement its layout.
- Design the Switched Capacitor Circuits for different applications.

UNIT-I: Switched Capacitor Circuits

Introduction to Switched Capacitor circuits- basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor integrators first order filters, Switch sharing, biquad filters.

UNIT-II: Phased Lock Loop (PLL)

Basic PLL topology, Dynamics of simple PLL, Charge pump PLLs-Lock cquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL, Non-ideal effects in PLLs-PFD/CP non-idealities, Jitter in PLLs, Delay locked loops, applications.

UNIT-III: Data Converter Fundamentals

DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters

UNIT-IV: Nyquist Rate A/D Converters

Successive approximation converters, Flash converter, Two-step A/D converters, Interpolating A/D converters, Folding A/D converters, Pipelined A/D converters, Time-interleaved converters.

UNIT-V: Oversampling Converters

Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multibitquantizers, Delta sigma D/A

TEXT BOOKS:

1. Analog Integrated Circuit Design- David A. Johns,Ken Martin, Wiley Student Edition, 2016
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
3. Design of Analog CMOS Integrated Circuits- BehzadRazavi, TMH Edition, 2002

REFERENCE BOOKS:

1. CMOS Integrated Analog-to- Digital and Digital-to-Analog converters-Rudy Van De Plassche, Kluwer Academic Publishers, 2003
2. Understanding Delta-Sigma Data converters-Richard Schreier, Wiley Interscience, 2005.
3. CMOS Mixed-Signal Circuit Design - R. Jacob Baker, Wiley Interscience, 2009.

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**ADAPTIVE SIGNAL PROCESSING**						

COURSE OUTCOMES:

- Review the Adaptive Systems and Understand the various measures to be opted for developing adaptive systems
- Understand different algorithms to develop the adaptive filtering
- Apply adaptive filter theory for different problems
- Perform RLS & Kalman Filtering

Unit -I

Introduction to Adaptive Systems: Adaptive Systems: Definitions, Characteristics, Applications, Example of an Adaptive System. The Adaptive Linear Combiner - Description, Weight Vectors, Desired Response, Performance function - Gradient & Mean Square Error.

Unit-II

Development of Adaptive Filter Theory & Searching the Performance surface: Introduction to Filtering - Smoothing and Prediction – Linear Optimum Filtering, Problem statement, Principle of Orthogonality - Minimum Mean Square Error, Wiener- Hopf equations, Error Performance surface Searching the performance surface – Methods & Ideas of Gradient Search methods, Gradient Searching Algorithm & its Solution, Stability& Rate of convergence , Learning Curve.

Unit-III

Steepest Descent Algorithms: Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves.

Unit-IV

LMS Algorithm & Applications: Overview - LMS Adaptation algorithms, Stability &Performance analysis of LMS Algorithms - LMS Gradient & Stochastic algorithms - Convergence of LMS algorithm. Applications: Noise cancellation – Cancellation of Echoes inlong distance telephone circuits, Adaptive Beam forming.

Unit-V

RLS &Kalman Filtering: Introduction to RLS Algorithm, Statement of Kalman filtering problem, The Innovation Process, Estimation of State using the Innovation Process- Expression of Kalman Gain, Filtering Examples using Kalman filtering.

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Text Books

1. Adaptive Signal Processing - Bernard Widrow, Samuel D. Strearns, 2005, PE.

2. Adaptive Filter Theory - Simon Haykin-, 4th Ed., 2002, PE Asia.

Reference Books

1. Optimum signal processing: An introduction – Sophocles .J. Orfamadis, 2nd Ed., 1988,McGraw-Hill, New York
2. Adaptive signal processing-Theory and Applications - S.Thomas Alexander, 1986,Springer –Verlag.
3. Signal analysis – Candy, McGraw Hill Int. Student Edition
4. James V. Candy - Signal Processing: A Modern Approach, McGraw-Hill, International Edition, 1988

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**RTOS**						

COURSE OUTCOMES:

- List the mathematical model of the system and to develop real time algorithm for task scheduling.
- Categorize capabilities Handling Resource Sharing and dependencies among Real-time Tasks generate a high-level analysis for Scheduling Real-time tasks in multiprocessor and distributed systems
- Analyze the working of real time operating systems and real time database.
- Apply the fault tolerance techniques, evaluation of reliability.

UNIT-I: Introduction

OS Services, Process Management, Timer Functions, Event Functions, Memory Management, Device, File and IO Systems Management, Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls, Real-Time Operating Systems, Basic Design Using an RTOS, RTOS Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Metrics, OS Security Issues.

UNIT-II: RTOS Programming

Basic Functions and Types of RTOS for Embedded Systems, RTOS mCOS-II, RTOS Vx Works, Programming concepts of above RTOS with relevant Examples, Programming concepts of RTOS Windows CE, RTOS Linux 2.6.x and RTOS RT Linux.

UNIT-III: Program Modeling – Case Studies

case study of digital camera hardware and software architecture, Case Study of Embedded System for an Adaptive Cruise Control (ACC) System in Car, Case Study of Embedded System for a Smart Card, Case Study of Embedded System of Mobile Phone Software for Key Inputs.

UNIT-IV: Target Image Creation & Programming in Linux

Operating System Software, Target Image Creation for Window XP Embedded, Porting RTOS on a Micro Controller based Development Board. Overview and programming concepts of Unix/Linux Programming, Shell Programming, System Programming

UNIT-V: Programming in RT Linux

Overview of RT Linux, Core RT Linux API, Program to display a message periodically, semaphore management, Mutex, Management, Case Study of Appliance Control by RT Linux System

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TEXT BOOKS:

1. Rajkamal: "Embedded Systems-Architecture, Programming and Design", Tata McGraw Hill Publications, Second Edition, 2008.
2. Dr. K.V.K.K. Prasad: "Embedded/Real-Time Systems" Dream Tech Publications, 2005 Edition, Black pad book.

REFERENCES:

1. Labrosse, "Embedding system building blocks ", CMP publishers.
2. Rob Williams," Real time Systems Development", Butterworth Heinemann Publications.

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**PC BASED DATA ACQUISITION SYSTEMS**						

COURSE OUTCOMES:

- Be able to identify a data acquisition system, objectives and different configurations
- Be familiar with different methods of linear/Nonlinear Analog-to-Digital conversion and their role in real time applications
- Be familiar with different methods of linear/Nonlinear Digital to Analog Conversion. and their role in real time applications
- Be able to identify the type of interface used to get a digital signal/Analog signal into a microprocessor and familiar with Monolithic Converters.
- Be familiar with different noise reduction techniques in DAS and case studies of Data Converter

UNIT-I

INTRODUCTION: Objective of a DAS, single channel DAS, Multi-channel DAS, Components used in DAS– Converter Characteristics-Resolution-Non-linearity, settling time, Monotonicity.

UNIT-II

ANALOG TO DIGITAL CONVERTERS (ADCS): Classification of A/D converters. Parallel feed back – Successive approximation – Ramp comparison – Dual slope integration – Voltage to frequency – Voltage to Time – Logarithmic types of ADCS.

NON-LINEAR DATA CONVERTERS (NDC): Basic NDC configurations – Some Common NDACS and NADCS – Programmable non-linear ADCS – NADC using optimal sized ROM –High speed hybrid NADC – PLS based NADC – Switched capacitor NDCS.

ADC APPLICATIONS: Data Acquisition systems – Digital signal processing systems –PCM voice communication systems – Test and measurement instruments – Electronic Weighing machines.

UNIT-III

DIGITAL TO ANALOG CONVERTERS (DACS): Principles and design of – Parallel R–2R, Weighted resistor, inverted ladder, D/A decoding – Codes other than ordinary binary.

DATA CONVERTER APPLICATIONS: DAC applications – Digitally programmable V/I sources – Arbitrary waveform generators – Digitally programmable gain amplifiers – Analog multipliers/ dividers – Analog delay lines.

UNIT-IV

Monolithic data converters: typical study of monolithic DACS and ADCS. Interfacing of DACS and ADCS to a μP.

UNIT-V

Error budget of DACS and ADCS: Error sources, error reduction and noise Reduction techniques in DAS. Error budget analysis of DAS, case study of a DAC and an ADC.

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TEXT BOOKS:

1. Electronic data converters fundamentals and applications – Dinesh K. Anvekar, B.S. Sonde –Tata McGraw Hill.

REFERENCES:

1. Electronic Analog/ Digital conversions – Hermann Schmid – Tata McGraw Hill.
2. E.R. Hanateck, User's Handbook of D/A and A/D converters - Wiley
3. Electronic instrumentation by HS Kalsi- TMH 2 ndEdition, 2004.
4. Data converters by G.B. Clayton

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**DIGITAL CONTROL SYSTEMS**						

COURSE OUTCOMES:

- Have the awareness of Discrete Time Control Systems
- Calculate the Z-transforms and use its concepts of Discrete control systems
- Get familiarize with design of Discrete control systems using various Approaches
- Understand the State Space approach to analyze the discrete system
- Have the concepts of Controllability and Observability of discrete control system

UNIT –I: Introduction to Discrete Time Control Systems:
Introduction, Digital Control Systems, Quantizing and Quantization Error, Data Acquisition, Conversion, and Distribution Systems

UNIT-II:
The Z – Transforms:
Introduction, The Z Transform, Z-Transform of elementary functions, properties and theorems of Z-Transform, Inverse Z-Transform, Z-Transform method for solving difference equations
Z-Plane Analysis of Discrete-Time Control System:
Introduction, Impulse Sampling and Data Hold, Obtaining the Z-Transform by the convolutional integral method, Reconstruction of original signals from sampled signals, Pulse transfer function,
Realization of digital controllers and digital filters

UNIT –III: Design of Discrete Time Control Systems by Conventional Methods:
Introduction, Mapping between the s plane and the z plane, stability analysis of closed loop systems in the z plane, transient and steady response analysis, design based on the Root-Locus method, design based on the frequency response method, Analytical design method.

UNIT-IV: State Space Analysis:
Introduction, State Space Representation of discrete time systems, solving discrete time state space equations, Pulse Transfer function matrix, Discretization of continuous time state – space equations, Liapunov stability analysis

UNIT –V: Controllability and Observability:
Introduction, Controllability, Observability, Useful Transformations in State Space Analysis and Desig.

TEXT BOOKS:

1. K. Ogata - "Discrete-Time Control systems" - Pearson Education/PHI, 2nd Edition.

REFERENCE BOOKS:

1. Kuo - "Digital Control Systems"- Oxford University Press, 2nd Edition, 2003.
2. M. Gopal - "Digital Control and State Variable Methods"- TMH

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**MICROSTRIP ANTENNAS**						

Course Outcomes:

- Remember the antenna basics and planar antennas.
- Describe and discuss characteristics and principles of microstrip antennas.
- Demonstrate and implement the CP patch antennas and micro strip antenna arrays.
- Analyze planar slot antennas and planar monopole antennas.
- Evaluate characteristics and design aspects of electrically small antennas.
- Investigate planar antennas for special applications for wireless access.

UNIT –I:

Planar Radiators: Introduction to antennas (radiation pattern, directivity, efficiency, gain, impedance, axial ratio etc.), different types of planar antennas, applications of planar antennas, Brief description of fabrication process of planar antennas.

UNIT –II:

Microstrip Patch Antennas-I: Characteristics of microstrip patch antennas, radiation from microstrip antenna, field configurations, different types of feeding techniques. Design equations for rectangular and circular microstrip patches, analysis of microstrip antennas using transmission line model and cavity method. Broadband techniques using stacked patch antennas, proximity-coupled and aperture-coupled microstrip antennas, slot-loaded and slit-loaded microstrip antennas, microstrip antennas with shorted pin, effect of finite ground plane on the performance of microstrip antennas, principle of planar fractal antennas.

UNIT –III:

Microstrip Patch Antennas-II: Methods of generating circular polarization in microstrip antennas using single feed and double feed, methods of generating multiple frequencies using microstrip antennas, miniaturization techniques for mcirostrip antennas. Design techniques of microstrip antenna arrays with feed network, effect of mutual coupling, microstrip phased array antenna design.

UNIT –IV:

Planar Slot Antennas: Geometry and design of microstrip slot antenna, radiation pattern, CPW-fed slot antennas, design of folded slot antenna, annular slot antenna.

Planar Monopole Antennas: Feeding methods and characteristics of planar triangle monopole,

Sierpinski monopole, planar bi-conical monopole antenna and roll monopole antenna.

UNIT –V:

Planar Antennas for Special Applications: Planar mobile handset antennas, planar laptop computer antennas, planar antennas for USB modem, planar antennas for WLAN and UWB communication.

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**IMAGE & VIDEO PROCESSING**						

COURSE OUTCOMES:

- Describe the Image Processing system, scope of digital image processing and compare various image transforms.
- Apply filtering operations on images both in spatial and frequency domain; describe image restoration in presence of noise and degradation.
- Analyze various segmentation techniques and compression methods on digital images.
- Describe the fundamental of digital video, sampling and filtering of video signals.
- Explain various methods for two dimensional motion estimation and their applications in video processing

Unit – I

Introduction: Introduction to Image Processing, Examples of fields that use Digital Image Processing, Fundamental steps in digital image processing, components of an image processing system, Examples of the fields that use Digital Image Processing. Image sensing and acquisition, image sampling and quantization, Some basic relationships between pixels.

Image Transforms: Need for image transforms, Image transforms, Fourier Transform, 2D Discrete Fourier Transform and its properties, Walsh Transform, Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, Singular Value Decomposition.

Unit – II

Image Enhancement:

Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.

Filtering in frequency domain: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.

Image Restoration:

A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering.

Unit – III

Image segmentation: Fundamentals, point, line, edge detection, thresholding, and Region – based segmentation. Image compression: Fundamentals, Basic compression methods: Huffman coding, Golom bcoding, Arithmetic coding, LZW coding, Run-Length coding, Block Transform coding, Predictive coding.

Unit – IV

Basic Steps of Video Processing:

Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

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Unit – V

2-D Motion Estimation:

Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation

TEXT BOOKS:

1. Digital Image Processing – Gonzaleze and Woods, 3rd Ed., Pearson.
2. Digital Video Processing – M. Tekalp, Prentice Hall International.
3. Video Processing and Communication – Yao Wang, JoemOstermann and Ya–quin Zhang. 1st Ed., PH Int.

REFRENCE BOOKS:

5. Fundamentals of Digital Image Processing – Anil K. Jain, Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
6. Digital Image Processing –S. Jayaraman, S. Esakkirajan, and T. Veerakumar, McGraw-Hill Education, 2018.

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Honor Course	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**3**	30	70	100	1.5
SUB CODE:	**ADVANCED COMMUNICATIONS LAB**						

List of Experiments :(Minimum of Twelve Experiments has to be performed)

1. Implementation of Linear Block Code Encoder and Decoder
2. Implementation of Binary Cyclic Codes Encoder and Decoder
3. Implementation of Convolution Encoder- Decoder
4. Determination of Losses in Optical Fiber
5. Characteristics of LASER Diode.
6. Study of Satellite Communication System, uplink transmitter, down link receiver and transponder
7. Signal to noise ratio and Link Failure operations in satellite communication
8. Carrier to Noise Ratio in Satellite Communication
9. Study of Direct Sequence Spread Spectrum Modulation & Demodulation using CDMA-DSS BER Trainer
10. Efficiency of DS Spread- Spectrum Technique
11. Simulation of Frequency Hopping (FH) system
12. Generation of PN sequence and Gold Sequence
13. Outdoor propagation model - Okumura model and Hata model
14. Free space propagation – path loss model
15. Study of WLAN / network topologies

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Honor Course	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**3**	30	70	100	1.5
SUB CODE:	**CMOS MIXED SIGNAL DESIGN LAB**						

List of Experiments:

Cycle 1:
1) Fully compensated op-amp with resistor and miller compensation
2) High speed comparator design
i. Two stage cross coupled clamped comparator ii. Strobed Flip-flop
3) Data converter

Cycle 2:
1) Switched capacitor circuits i. Parasitic sensitive integrator ii. Parasitic insensitive integrator
2) Design of PLL
3) Design of VCO
4) Band gap reference circuit
5) Layouts of All the circuits Designed and Simulated

Lab Requirements:

Software: Mentor Graphics/ Cadence/ Tanner/Industry Equivalent Standard Software Tools
Hardware: Personal Computer with necessary peripherals, configuration and operating System.

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Honor Course	**L**	**T**	**P**	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**3**	30	70	100	1.5
SUB CODE:	**RTOS Lab**						

• The Students are required to write the programs using C-Language according to the Experiment requirements using RTOS Library Functions and macros ARM-926 developer kits and ARM-Cortex.
• The following experiments are required to develop the algorithms, flow diagrams, source code and perform the compilation, execution and implement the same using necessary hardware kits for verification. The programs developed for the implementation should be at the level of an embedded system design.
• The students are required to perform at least SIX experiments from Part-I and TWO experiments from Part-II.

List of Experiments:
Part-I: Experiments using ARM-926 with PERFECT RTOS

1. Register a new command in CLI.
2. Create a new Task.
3. Interrupt handling.
4. Allocate resource using semaphores.
5. Share resource using MUTEX.
6. Avoid deadlock using BANKER'S algorithm.
7. Synchronize two identical threads using MONITOR.
8. Reader's Writer's Problem for concurrent Tasks.

Part-II: Experiments on ARM-CORTEX processor using any open source RTOS.
(Coo-Cox-Software-Platform)

1. Implement the interfacing of display with the ARM- CORTEX processor.
2. Interface ADC and DAC ports with the Input and Output sensitive devices.
3. Simulate the temperature DATA Logger with the SERIAL communication with PC.
4. Implement the developer board as a modem for data communication using serial port communication between two PC's.

Lab Requirements:
Software:

- Eclipse IDE for C and C++ (YAGARTO Eclipse IDE), Perfect RTOS Library, COO-COX Software Platform, YAGARTO TOOLS, and TFTP SERVER.
- LINUX Environment for the compilation using Eclipse IDE & Java with latest version.

Hardware:

- The development kits of ARM-926 Developer Kits and ARM-Cortex Boards.
- Serial Cables, Network Cables and recommended power supply for the board.

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**3**	30	70	100	1.5
SUB CODE:	**DIGITAL CONTROL SYSTEMS LAB**						

1. To study
   a. Conversion of a transfer function from continuous domain to discrete domain.
   b. Conversion of a transfer function from the continuous domain to the digital domain.
   c. Pole Zero Map of a discrete transfer function
2. To determine
   a. Z transform of a discrete-time signal
   b. Inverse Z transform of a discrete-time signal
   c. Factored form and partial fraction form of a rational z function d. Pole zero map of a digital system
3. To study
   a. Closed loop response of a discrete-time system
   b. Comparison of time responses of continuous time and discrete time systems
   c. Effect of sampling time on system response and system parameters
4. To design a lead compensator to obtain system response with the desired accuracy, and less overshoot.
5. To design a lag compensator to meet performance specification parameters
6. To study a. The effect of variation in controller parameters on system response
7. To obtain
   a. Transfer function model from a state model
   b. State model from transfer function model
   c. Step response of a system represented by its state model
8. To determine
   a. Eigenvalues from state model
   b. Eigenvalues from transfer function model
   c. Stability of a system
9. To study the effect of common nonlinearities such as relay, dead zone, and saturation on the response of a 2nd order control system

Softwares Required

1. Matlab Software
2. Simulink Tool

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**3**	30	70	100	1.5
SUB CODE:	**ANTENNAS and MICROWAVE LAB**						

LIST OF EXPERIMENTS : (Minimum of Ten Experiments has to be performed)

1. Calculation of transmission line parameters (R, L, G and C) for two wire line, coaxial line and Strip line.
2. Study on the standing wave pattern along a transmission line when the line is open-circuited, Short circuited and terminated by a resistive load at the load end.
3. Investigate the effect of length of transmission line on the input impedance at the sending end.
4. Familiarization of Smith chart on MATLAB platform.
5. Radiation resistance of electric and magnetic dipoles as a function of electrical size.
6. Feed (input terminal) impedance of an electric dipole as a function of antenna length.
7. 3D radiation pattern of a half-wavelength dipole antenna in both horizontal and vertical Orientations
8. Radiation patterns for electric dipoles of various electrical lengths.
9. Characteristics and radiation patterns of Linear array, Planar and Circular arrays.
10. Variation of normalized input impedance with Feeding position in Inset-Fed Microstrip patch Antenna
11. Design of Rectangular Microstrip Patch antenna.

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Honor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**3**	30	70	100	1.5
SUB CODE:	**IMAGE & VIDEO PROCESSING LAB**						

List of Experiments:

Note: In the first 10 experiments, atleast 8 experiments; In the last three experiments, atleast 2 experiments must be executed.

1. Perform basic operations on images like addition, subtraction etc.
2. Perform Pixel based operations (Point based operations) for Image enhancement
3. Plot the histogram of an image and perform histogram equalization
4. Filtering in Spatial Domain
5. Computation of 2D-DFT and Perform filtering in Frequency domain
6. Implementation of Image Restoration methods
7. Implementation of JPEG compression Algorithm (Without using Library function)
8. Comparison of coding Techniques for image compression (Bit plane, Predictive, Arithmetic, Huffman coding).
9. Detections of edges in an image (Prewitt, Sobel, Krisch and Laplacian of Gaussian Operators, Canny operators) and compare
10. Image Segmentation based on thresholding.
11. Basic operations on Video, and identification of key frame
12. Computation of optical flow velocities for a moving object in a Video
13. Implementation of two dimensional motion estimation

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MINORS SUBJECTS
AND
SYLLABUS

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MINOR:

Student can choose any SIX Theory or any FIVE theory and TWO Laboratories in the list given below which are not chosen as Open electives/in Regular Courses, are to be considered for Minor Degree. Prior Approval BoS Chairman is required

S.No.	SUBJECT	L-T-P	CREDITS
1	Electronics Devices and Basic Circuits	3-0-0	3
2	Digital Electronics	3-0-0	3
3	Principles of Communication	3-0-0	3
4	Signal Analysis	3-0-0	3
5	Microcontrollers and Applications	3-0-0	3
6	Embedded System Design	3-0-0	3
7	Internet of things	3-0-0	3
8	Digital Signal Processing	3-0-0	3
9	Electronics Devices and Basic Circuits LAB	0-0-3	1.5
10	Digital Electronics LAB	0-0-3	1.5
11	Internet of things LAB	0-0-3	1.5
12	Digital Signal Processing LAB	0-0-3	1.5
Student shall take up at least ONE NPTEL/SWAYAM of 12-week duration for 3 credits.			

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Minor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**ELECTRONICS DEVICES AND BASIC CIRCUITS**						

COURSE OUTCOMES:

- Understand the semiconductor physics, their concepts and characteristics of p-n junction diode.
- Understand V-I characteristics of various semiconductor devices.
- Learn the operation of transistor and its characteristics in various configurations, Biasing of transistor
- Analyze the transistor using h-parameters and its equivalent model.
- Describe the operation of FET and MOSFET, their application as an amplifier.

UNIT I:

Review of Semiconductor Physics: Mobility and Conductivity, Intrinsic and extrinsic semiconductors**,** Hall effect

Junction Diode Characteristics : Energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in p-n junction Diode, Qualitative explanation of Diode equation (Derivation not required) , V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance

UNIT II:

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, Zener diode applications, Varactor Diode, LED, Photodiode, Tunnel Diode and its characteristics with the help of energy band diagram, UJT and its application, PNPN Diode, SCR, Construction, operation and V-I characteristics.

Diode Circuits: Clipping (limiting) circuits, Peak Detector, Clamping circuits, Comparators, Basic Rectifier setup**,** half wave rectifier, full wave rectifier, bridge rectifier, Inductor filter, Capacitor filter

UNIT III:

Transistor Characteristics: Junction transistor, transistor current components, transistor equation in CB configuration, transistor as an amplifier, characteristics of transistor in Common Base and Common Emitter configurations, punch through/ reach through, typical transistor junction voltage values.

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}, Ic, 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, Millers theorem and Dual of Millers theorem, Analysis of CB, CE and CC amplifiers using exact analysis, Comparison of transistor amplifiers.

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UNIT V:

FET: FET types, JFET operation and characteristics (qualitative explanation only), small signal model of JFET.

MOSFET: MOSFET Structure, Operation of MOSFET, MOSFET as a variable resistor, derivation of V-I characteristics of MOSFET, Comparison of Bipolar and MOS devices.

CMOS amplifiers: General Considerations, Common Source Stage, Common Gate Stage, Source Follower, comparison of FET amplifiers.

Text Books:

1. Electronic Devices and Circuits- J. Millman, C. C. Halkias, Mc-Graw Hill Education.
2. Integrated Electronics-J. Millman, C. Halkias, Mc-Graw Hill Education.
3. Fundamentals of Microelectronics-Behzad Razavi, Wiley, 3rd edition, 2021.

References:

1. Electronics devices & circuit theory- Robert L.Boylestad and LouiNashelsky, Pearson, 11th edition, 2015.
2. Electronic Devices and Circuits - David A. Bell, Oxford University Press, 5th edition, 2008.
3. Electronic Devices and Circuits- S. Salivahanan, N. Suresh Kumar, Mc-Graw Hill, 5th edition, 2022.

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Minor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**DIGITAL ELECTRONICS**						

COURSE OUTCOMES:

- Classify different number systems and apply to generate various codes.
- Use the concept of Boolean algebra in minimization of switching functions
- Design different types of combinational logic circuits.
- Apply knowledge of flip-flops in designing of Registers and counters
- The operation and design methodology for synchronous sequential circuits and algorithmic state machines.
- Produce innovative designs by modifying the traditional design techniques.

UNIT – I

REVIEW OF NUMBER SYSTEMS & CODES:

Representation of numbers of different radix, conversation from one radix to another radix, r 1's compliments and r's compliments of signed members. 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.

UNIT – II

BOOLEAN THEOREMS AND LOGIC OPERATIONS:

Boolean theorems, principle of complementation & duality, De-Morgan theorems. Logic operations ; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EX-NOR operations. Standard SOP and POS Forms, NAND-NAND and NOR-NOR realizations, Realization of three level logic circuits. Study the pin diagram and obtain truth table for the following relevant ICs 7400,7402,7404,7408,7432,7486.

MINIMIZATION TECHNIQUES: Minimization and realization of switching functions using Boolean theorems, K-Map (up to 6 variables)and tabular method(Quine-mcCluskey method) with only four variables and single function.

UNIT – III

COMBINATIONAL LOGIC CIRCUITS DESIGN: Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders; 4 bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit and carry look-a-head adder circuit, Design code converts using Karnaugh method and draw the complete circuit diagrams.

COMBINATIONAL LOGIC CIRCUITS DESIGN USING MSI &LSI :

Design of encoder ,decoder, multiplexer and de-multiplexers, Implementation of higher order circuits using lower order circuits .Realization of Boolean functions using decoders and multiplexers. Design of Priority encoder, 4-bit digital comparator and seven segment decoder. . Study the relevant ICs pin diagrams and their functions 7442,7447,7485,74154.

UNIT – IV SEQUENTIAL CIRCUITS : Classification of sequential circuits (synchronous and asynchronous) , operation of NAND & NOR Latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip-flop. Design of 5ripple counters,

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design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi directional shift register, universal shift, register.

UNIT-V INTRODUCTION OF PLD's : PLDs: PROM, PAL, PLA -Basics structures, realization of Boolean functions, Programming table. ROM: Internal structure, Static RAM: Internal structure, Dynamic RAM: Internal structure.

TEXT BOOKS:

1. Switching and finite automata theory Zvi.KOHAVI, Niraj.K.Jha 3rd Edition, Cambridge University Press,2009
2. Digital Design by M.Morris Mano, Michael D Ciletti,4th edition publication,2008 PHI
3. Switching theory and logic design by Hill and Peterson, Mc-Graw Hill TMH edition, 2012.

REFERENCES:

1. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers,2006
2. Digital electronics by R S Sedha.S.Chand& company limited,2010
3. Switching Theory and Logic Design by A. Anand Kumar, PHI Learning pvt ltd,2016.
4. Digital logic applications and design by John M Yarbough, Cengage learning, 2006.

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Minor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**PRINCIPLES OF COMMUNICATION**						

COURSE OUTCOMES:

- Analyze the performance of analog modulation schemes in time and frequency domains.
- Analyze the performance of angle modulated signals.
- Characterize analog signals in time domain as random processes and noise
- Characterize the influence of channel on analog modulated signals
- Determine the performance of analog communication systems in terms of SNR

UNIT I : Basic tools for communication, Fourier Series/Transform, Properties, Autocorrelation, Energy Spectral Density, Parsevals Relation, Amplitude Modulation (AM), Spectrum of AM, Envelope Detection, Power Efficiency, Modulation Index

UNIT II : Double Sideband Suppressed Carrier (DSB-SC) Modulation, Demodulation, Costas Receiver,Single Sideband Modulation (SSB), Hilbert Transform, Complex Pre-envelope/ Envelope, Demodulation of SSB, Vestigial Sideband Modulation (VSB)

UNIT III : Angle Modulation, Frequency Modulation (FM), Phase Modulation (PM), Modulation Index, Instantaneous Frequency, Spectrum of FM Signals, Carsons Rule for FM Bandwidth, Narrowband FM Generation, Wideband FM Generation via Indirect Method, FM Demodulation

UNIT IV : Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion, Signal Reconstruction from Sampled Signal, Pulse Amplitude Modulation,Quantization, Uniform Quantizers – Midrise and Midtread, Quantization noise, , Non uniform Quantizers, Delta Modulation, Differential Pulse Code Modulation (DPCM)

UNIT V: : Basics of Probability, Conditional Probability, MAP Principle, Random Variables, Probability Density Functions, Applications in Wireless Channels, Basics of Random Processes ,Gaussian Random Process, Noise.

TEXT BOOKS:

1. Simon Haykin, Communications Systems, 4th Edition. John Wiley and Sons, Inc
2. Fundamentals of Wireless Communication by David Tse

References:

1. Principles of Communication Systems – Simon Haykin, John Wiley, 2nd Edition.
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004.

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Minor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**SIGNAL ANALYSYS**						

COURSE OUTCOMES:

- To be able to determine if a given system is linear/causal/stable
- Capable of determining the frequency components present in a deterministic signal
- Capable of characterizing LTI systems in the time domain and frequency domain
- To be able to compute the output of an LTI system in the time and frequency domains

UNIT I: CLASSIFICATION OF SIGNALS AND SYSTEMS

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_ Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT II: ANALYSIS OF CONTINUOUS TIME SIGNALS Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and properties

UNIT III: LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV: ANALYSIS OF DISCRETE TIME SIGNALS

Baseband signal Sampling – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties

UNIT V: LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS

Impulse response – Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, —Signals and Systems‖, Pearson, 2015

REFERENCES BOOKS

1. B. P. Lathi, —Principles of Linear Systems and Signals‖, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, —Signals & Systems - Continuous and Discrete‖, Pearson,
3. John Alan Stuller, —An Introduction to Signals and Systems‖, Thomson, 2007.

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Minor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**MICROCONTROLLERS AND APPLICATIONS**						

Course Outcomes:

- Understand the architecture and operation of common microcontrollers.
- Write and debug assembly/C programs for microcontrollers.
- Interface microcontrollers with input/output devices.
- Interface microcontrollers with various advanced peripherals.
- Design and implement microcontroller-based applications.

Unit 1: Introduction to Microcontrollers

Evolution of microcontrollers and comparison with microprocessors, Microcontroller families (8051, PIC, AVR, ARM), Architecture of 8051 microcontroller, Memory organization, registers, and flags, Overview of development tools (IDE, simulators, programmers)

Unit 2: Programming of Microcontrollers

Instruction set of 8051, Assembly language programming, Introduction to Embedded C programming, Debugging and simulation tools

Unit 3: Interfacing with Input/Output Devices

Basics of interfacing and role of GPIO, Interfacing LEDs, switches, and push buttons, Interfacing 7-segment displays and buzzers, Interfacing LCDs (16x2 and 20x4, Keypad interfacing for user inputs

Unit 4: Interfacing with Advanced Peripherals and Communication Devices

Interfacing sensors (temperature, light, and proximity sensors),
Interfacing actuators (motors: DC, stepper, and servo).
Communication interfaces:UART (serial communication with PC), SPI and I2C (interfacing EEPROM and sensors), ADC/DAC interfacing (e.g., analog sensors and audio signals).
Interfacing wireless modules (Bluetooth, ZigBee, ESP8266/ESP32 for IoT applications)

Unit 5: Advanced Microcontrollers
Introduction to ARM Cortex-M series, Comparison of ARM with 8051 and PIC, Overview of Arduino and Raspberry Pi platforms, Embedded IoT basics
Real-Time Applications and Case Studies: Microcontroller applications in robotics, automation, and consumer electronics, Designing energy-efficient systems with microcontrollers; Case studies:Home automation, Smart agriculture systems, Healthcare monitoring.

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Textbook:

1. Mazidi and Mazidi, The 8051 Microcontroller and Embedded Systems, 4th Impression, PHI, 2000.
2. Raj Kamal, Microcontrollers Architecture, Programming, Interfacing and System Design, 2nd Edition, Pearson Education, 2005.

Reference Books:

1. Kenneth J. Ayala, *The 8051 Microcontroller: Architecture, Programming, and Applications*, Cengage Learning.
2. John Boxall, *Arduino Workshop: A Hands-On Introduction with 65 Projects*, No Starch Press.

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Minor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**EMBEDDED SYSTEM DESIGN**						

COURSE OUTCOMES:

- Understand the basic concepts of an embedded system and able to know an embedded system design approach to perform a specific function.
- The hardware components required for an embedded system and the design approach of an embedded hardware.
- The various embedded firmware design approaches on embedded environment.
- Understand how to integrate hardware and firmware of an embedded system using real time operating system.

UNIT-I

INTRODUCTION: Embedded system-Definition, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system.

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, Task Scheduling, Threads, Processes and Scheduling, Task communication, Task synchronization.

HARDWARE SOFTWARE CO-DESIGN: Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware.

UNIT-V:

EMBEDDED SYSTEM DEVELOPMENT, IMPLEMENTATION AND TESTING: The integrated development environment, Types of files generated on cross-compilation, Deassembler/ De-compiler, Simulators, Emulators and Debugging, Target hardware debugging, Embedded Software development process and tools, Interpreters, Compilers and Linkers, debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools.

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Text Books:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.

References:

1. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
2. Embedded Systems-Lyla B.Das-Pearson Publications,2013.

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Minor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**INTERNET OF THINGS**						

COURSE OUTCOMES:

- Understand the new computing technologies
- Able to apply the latest computing technologies like cloud computing technology and Big Data
- Ability to introduce the concept of M2M (machine to machine) with necessary protocols
- Get the skill to program using python scripting language which is used in many IoT devices

Unit I

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT Communication Models, Iot Communication APIs IoT enabaled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle(Chap 1 and 2)

Unit II

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANGNETCONF, YANG, SNMP NETOPEER(Chapter 3 and 4)

Unit III

IOT Platform design Methodology, Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib(Chapter 5 and 6)

Unit IV

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins., other IOT Devices(Chapter 7)

Unit V

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API, Amazon web services for IOT, Skynet IOT messaging platform(Chapter 8)

Text Books:

1. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD),2014, ISBN: 9789350239759

Reference Books:

1. 1.The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).

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2. From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence, Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
3. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
4. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.

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Minor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	3	0	**0**	30	70	100	3
SUB CODE:	**DIGITAL SIGNAL PROCESSING**						

COURSE OUTCOMES:

- Understand the concepts of discrete signals and discrete systems with its characteristics
- Calculate z-Transform, Fourier Transform, Discrete Fourier Transform of discrete signals.
- Understand the algorithms for the efficient computation of DFT coefficients of signals
- Know the various filter structures for FIR and IIR filters.
- Design the FIR and IIR filters.

Unit -I

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.

Unit –II

Frequency Domain Analysis of LTI Systems: Frequency domain characteristics of LTI systems, Frequency response of LTI systems.

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.

Unit –III

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

Efficient Computation of the DFT: Fast Fourier Transform Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms.

Unit –IV

Implementation of Discrete Time Systems: Structures for the Realization of Discrete Time Systems. **Structures for FIR Systems**: Direct Form Structure, Cascade Form Structures.

Structures for IIR Systems: Discrete Form Structures, Signal Flow Graphs and Transposed Structures, Cascade Form Structures, Parallel Form Structures.

Unit –V

Design of Analog Filters: Butterworth filters… Low Pass Filter, High Pass filter, Band Pass Filter, Band Reject Filter. **Design of Digital Filters**: General Considerations: Causality and Its Implications, Characteristics of Practical Frequency Selective Filters.

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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.

TEXT BOOKS:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis, 4th Edition, Pearson Education, 2007.

Reference Books:

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

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Minor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**3**	30	70	100	1.5
SUB CODE:	**ELECTRONICS DEVICES AND BASIC CIRCUITS LAB**						

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

1. P-N Junction Diode Characteristics

Part A: Germanium Diode (Forward bias& Reverse bias)

Part B: Silicon Diode (Forward Bias only)

2. Zener Diode Characteristics

3. Part A: V-I Characteristics

Part B: Zener Diode as Voltage Regulator

4. Rectifiers (without)

Part A: Half-wave Rectifier

Part B: Full-wave Rectifier

5. BJT Characteristics (CE Configuration)

6. FET Characteristics (CS Configuration)

7. Transistor Biasing

8. CRO Operation and its Measurements

9. BJT-CE Amplifier

10. Emitter Follower-CC Amplifier

11. FET-CS Amplifier

Equipment required:

1. Regulated Power supplies
2. Analog/Digital Storage Oscillo scopes
3. Analog/Digital Function Generators
4. Digital Multi-meters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analogor Digital)
8. Voltmeters (Analogor Digital)
9. Active & Passive Electronic Components

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Minor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**3**	30	70	100	1.5
SUB CODE:	**DIGITAL ELECTRONICS LAB**						

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

1. Verification of truth tables of 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. four variable logic function verification using 8 to1 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 Slav Flip–Flop (iii) DFlip-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 a circuit using T- Flip-Flops and Test it with a low frequency clock and Sketch the output wave forms.
11. Design MOD–8 synchronous counter using T Flip- Flop and verify the result and Sketch the output wave forms.
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.

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Minor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**3**	30	70	100	1.5
SUB CODE:	**INTERNET OF THINGS LAB**						

List of Experiments: (Minimum of Twelve Experiments has to be performed)

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE(integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.
3. Display a word on LCD, Interfacing with Raspberry Pi.
4. Using Raspberry Pi, Display Seven Segment.
5. Servo Motor Controlling with Interfacing using Raspberry Pi.
6. Soil Moisture detecting with soil moisture sensor using Raspberry Pi.
7. Calculate the distance using distance sensor Using Node MCU.
8. Basic LED functionality Using Node MCU
9. Familiarization with ARM keil MDK for programming and debugging an application on the PSoC 4 BLE chip and perform necessary software installation.
10. To interface Push button/Digital sensor (IR/LDR) with ARM keil MDKonPSoC4BLEchipandwriteaprogramtoturnONLED when push button is pressed or at sensor detection.
11. Setup a Bluetooth Low Energy (namely Bluetooth Smart)connection between the PSoC BLE kit and a smart phone and use an app to send and receive data to and from the BLE Pioneer kit.
12. To interface capacitor sensor (touch sensor) with smart phone and write a program to turn RGBLEDON/OFFwhen„1“/“0“ is received from smart phone using Bluetooth.
13. Automatic street light control to control the street light (Turn on and off based on the light)using Arduino/Node MCU/Raspberry Pi
14. SmokeDetectionusingMQ-2GasSensor
15. Detecting obstacle with IR Sensor and Arduino/NodeMCU/Raspberry Pi

Equipment required for Laboratories:

- Arduino/NodeMCU/Raspberry Pi+PSoC4 BLE Bluetooth Low Energy Pioneer Kit + Hardware, MQ-2 Gas Sensor, Ultrasonic sound sensor.

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Minor Course	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	TOTAL CREDITS
	0	0	**3**	30	70	100	1.5
SUB CODE:	**DIGITAL SIGNAL PROCESSINGLAB**						

(Note: Students have to perform at least FIVE experiments from each part.)

PART-A

List of the Experiments

1. Generation of DT signals.

2. Verify the Linear Convolution of two DT signals

a) Using MATLAB

b) Using Code Composer Studio(CCS)

3. Verify the Circular Convolution of two DT signals

a) Using MATLAB
b) Using Code Composer Studio (CCS)

4. Find the sum of DT sinusoidal signals.

5. Computation of Discrete Fourier Transform (DFT) and Inverse Discrete Fourier Transform (IDFT)

a) Using MATLAB
b) Using Code Composer Studio (CCS)

6. Compute N-point DFT of a given DT sequence using Decimation in Time. (Without Using Library Function)

7. Compute N-point DFT of a given DT sequence using Decimation in Frequency. (Without Using Library Function)

PART-B : Following Experiments are to be done using a TI DSP Starter Kit.

8. Generation of a sinusoidal signal.

9. Linear and circular convolution of DT sequences.

10. Compute N-point DFT of a given DT sequence

11. Design and implementation of FIR filters.

12. Design and implementation of IIR filters.

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