



Sri Krishnadevaraya University  
College of Engineering & Technology, Ananthapuramu – 515 003 (A.P) India

Electronics & Communication Engineering  
Academic Regulations (R23) for B. Tech (Regular-Full time)

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

1. Award of the Degree

- (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:
  - i Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).
  - ii Registers for 160 credits and secures all 160 credits.
- (b) Award of B.Tech. degree with Honors if he/she fulfils the following:
  - i. Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 160 credits.
  - ii. Registering for Honors is optional.
  - iii. Honors is to be completed simultaneously with B.Tech. programme.

(c) Programs offered by the College:

The following programs are offered at present as specializations for the B. Tech. course from 2023-2024.

S. No.	Branch	Program Code
01.	Computer Science & Engineering	01
02.	Electronics and Communication Engineering	02
03.	Mechanical Engineering	03
04.	Electrical and Electronics Engineering	04
05.	Civil Engineering	05

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

3. Admissions

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

4. Program related terms

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



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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 students to select from the prescribed courses.

**5. Semester/Credits:**

- i) A semester comprises 90 working days excluding mid-semester Examination and End Examination dates. 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)	Percentage of total credits	AICTE Recommendation (%)
1.	Humanities and Social Science including Management (HM)	13	8 %	8 – 9%
2.	Basic Sciences (BS)	20	13 %	12 - 16%
3.	Engineering Sciences (ES)	23.5	14%	10 – 18%
4.	Professional Core (PC)	54.5	34 %	30 – 36%
5.	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21 %	19 - 23%
6.	Internships & Project work (PR)	16	10 %	8 – 11%
7.	Mandatory Courses (MC)	Non-credit	Non-credit	-

**7. Course Classification:**

All subjects/ courses offered for the undergraduate 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 Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses
2.	Core Courses	Professional Core Courses (PC)	Includes subjects related to the parent discipline/department/branch of Engineering
3.	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/ branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
		Domain specific skill enhancement courses (SEC)	interdisciplinary/job-oriented/domain courses which are relevant to the industry
4.	Project & Internships	Project	B.Tech. Project or Major Project
		Internships	Summer Internships – Community based and Industry Internships; Industry oriented Full Semester Internship
5.	Audit Courses	Mandatory non-credit courses	Covering subjects of developing desired attitude among the learners

### 8. Programme Pattern

- i. The total duration of the B. Tech (Regular) Programme is four academic years.
- ii. Each academic year of study is divided into two semesters.
- iii. The minimum number of instruction days in each semester is 90 days excluding mid-semester Examination and End Examination dates.
- iv. There shall be a 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 NSS /NSS /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduate students.
- vi. Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
- vii. Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.
- viii. Increased flexibility for students through 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



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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 eight weeks duration at the end of the 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. An undergraduate degree with Honors is introduced by the University for the students having good academic record.
- xvi. Each college shall take measures to implement Virtual Labs (<https://www.vlab.co.in>) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.
- xvii. Each college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/ other competitive exams etc.
- xviii. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

**9. Evaluation Process**

The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks for theory and 100 marks for practical subject. Summer Internships shall be evaluated for 50 marks, Full Internship & Project work in final semester shall be evaluated for 200 marks, mandatory courses with no credits shall be evaluated for 30 mid semester marks. A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. In the case of a mandatory course, he/she should secure 40% of the total marks.

Theory Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
<b>Total</b>	<b>100</b>

- i) For the theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.
- ii) For practical subjects, the distribution shall be 30 marks for the Internal Evaluation and 70 marks for the End- Examination.
- iii) If any course contains two different branch subjects, the syllabus shall be written in two parts with



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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 has 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 question. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

Note:

- The objective paper shall be prepared in line with the quality of competitive examinations questions.
  - The subjective paper shall contain 3 either or type questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
  - The objective paper shall be conducted by the respective institution on the day of subjective paper test.
  - Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered.
- iii) If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.
- iv) The 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) Finalized mid marks of first and second mid semesters 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 Marks:  $(25 \times 0.8) + (20 \times 0.2) = 24$

If the student is absent for any one midterm examination, the finalized 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 Marks:  $(25 \times 0.8) + (0 \times 0.2) = 20$

**b) End Examination Evaluation:**

End examination of theory subjects shall have the following pattern:

- i) There shall be 6 questions and all questions are compulsory.
- ii) Question I shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks.



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- iii) There shall be 2 short answer questions from each unit.
a) In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Students shall answer any one of them.
iv) The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

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

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

Practical Courses

Table with 2 columns: Assessment Method, Marks. Rows include Continuous Internal Assessment (30), Semester End Examination (70), and Total (100).

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

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

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

Table with 2 columns: Assessment Method, Marks. Rows include Continuous Internal Assessment (30), Semester End Examination (70), and Total (100).

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and



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20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

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

- f) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case the student fails, a re-examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.
- g) The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

#### **10. 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 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 equivalent marks/grades.
- vi) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the University at the beginning of the semester. The principal of the respective college shall forward such proposals to the University for approval.
- 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 University.



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### 11. Massive Open Online Courses (MOOCs):

A Student must pursue and complete one course compulsorily through MOOCs approved by the University. 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 12 weeks) offered through MOOCs with the approval of the Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's progression. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. The examination fee, if any, will be borne by the student.

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

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

### 12. Credit Transfer Policy

Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the University shall allow up to a maximum of 20% of the total courses being offered in a particular programme i.e., maximum of 32 credits through MOOCs platform.

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

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



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### 13. Academic Bank of Credits (ABC)

The University 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 digital platforms.
- iii. facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC
- iv. execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students' account.

### 14. Mandatory Internships

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

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

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

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

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



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**15. Guidelines for offering a Minor.**

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

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

**Note:** A total of 4 (Four) Open Electives are offered in the curriculum. A student can complete the requirement for Minor by opting for the courses offered through various verticals/tracks under Open Electives.

**16. Guidelines for offering Honors.**

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

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

**Enrolment into Honors:**

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



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same Department/Discipline

- ii) The enrolment of students into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7.0 CGPA without any backlog subjects will be permitted to register for Honors.
- iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.
- iv) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.
- v) Honors are to be completed simultaneously with a Major degree program.

**Registration for Honors:**

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

**17. Attendance Requirements:**

- i) A student shall be eligible to appear for the University external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects.
  - 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 attendance to the University.
- iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
- v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.
- vi) If any candidate 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.

**18. Promotion Rules:**

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

- i) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university 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 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,



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the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

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

19. Grading:

As a measure of the student’s performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed: After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Table with 3 columns: Range in which the marks in the subject fall, Grade, Grade points Assigned. Rows include ranges from 90 & above to Absent, with corresponding grades (Superior, A, B, C, D, E, F, Ab) and grade points (10, 9, 8, 7, 6, 5, 0, 0).

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

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

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

SGPA = Σ (Ci × Gi)/Σ Ci

where, Ci is the number of credits of the i<sup>th</sup> subject and Gi is the grade point scored by the student in the i<sup>th</sup> 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 = Σ (Ci × Si)/ Σ Ci

where “Si” is the SGPA of the i<sup>th</sup> 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. While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade:



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It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

Award of Class:

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

Table with 2 columns: Class Awarded, CGPA Secured. Rows include First Class with Distinction (CGPA >= 7.5), First Class (CGPA >= 6.5 < 7.5), Second Class (CGPA >= 5.5 < 6.5), and Pass Class (CGPA >= 5.0 < 5.5).

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

20. With-holding of Results

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

21. Multiple Entry / Exit Option

a. Exit Policy:

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

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

b. Entry Policy:

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

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

22. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time...



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the maximum time for graduation. The principal of the respective college shall forward such proposals submitted by the students to the University. An evaluation committee constituted by the University shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not

**23. Transitory Regulations**

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

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

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

The minimum instruction days including exams for each semester shall be 90 days excluding mid semester examination and End Examination dates.

**25. 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.

**26. Student Transfers:**

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

**27. General Instructions:**

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

**Academic Regulations (R23) for B. Tech (Lateral Entry Scheme)****(Effective for the students admitted into II year from the Academic Year 2024-25 onwards)****1. Award of the Degree**

- (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:
- (i) Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).
  - (ii) Registers for 120 credits and secures all 120 credits.
- (b) **Award of B.Tech. degree with Honors** if he/she fulfils the following:
- Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 120 credits.
- (i) Registering for Honors is optional.
  - (ii) 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.

**4. Course Pattern**

- i) The entire course of study is three academic years on semester pattern.
  - ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.
  - iii) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.
5. All other regulations applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).



<b>SKUCET Curriculum</b>
<b>B. Tech Course Structure – R23</b>
<b>ELECTRONICS AND COMMUNICATION ENGINEERING</b>

<b>Semester – 0 Common for All Branches of Engineering</b>				
S.No	Course 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 -- correspondinglabs, tools and platforms	EC	2-0-3-0
5		Proficiency Modules & Productivity Tools	ES	2-1-2-0
6		Assessment on basic aptitude and mathematicalskills	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



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<b>Dept. of Electronics and Communication Engineering</b>					
<b>I Year I Semester</b>					
<b>S.No</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.		Chemistry	BS&H	3-0-0	3
2.		Linear Algebra & Calculus	BS&H	3-0-0	3
3.		Basic Electrical & Electronics Engineering	ES	3-0-0	3
4.		Engineering Graphics	ES	1-0-4	3
5.		Introduction to Programming	ES	3-0-0	3
6.		I.T.Workshop	BS&H	0-0-2	1
7.		Electrical & Electronics Engineering Workshop	ES	0-0-3	1.5
8.		Chemistry Lab	ES	0-0-2	1
9		Introduction to Programming lab	ES	0-0-3	1.5
10		NCC/NSS./Scouts & Guides/Community service	BS&H	0-0-1	0.5
<b>Total</b>					<b>20.5</b>

<b>Category</b>	<b>CREDITS</b>
Engineering Science Courses	7.5
Basic Science and Humanities	12.5
<b>TOTAL CREDITS</b>	<b>20.5</b>



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<b>Dept. Electronics and Communication Engineering</b>					
<b>I Year II Semester</b>					
<b>S.No</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.		Communicative English	BS&H	2-0-0	2
2.		Engineering Physics	BS & H	3-0-0	3
3.		Differential Equations and Vector calculus	ES	3-0-0	3
4.		Basic Civil & Mechanical Engineering	ES	3-0-0	3
5.		Network Analysis	PC	3-0-0	3
6.		Communicative English Lab	BS& H	0-0-2	1
7.		Engineering Physics Lab	BS& H	0-0-2	1
8.		Engineering Workshop	ES	0-0-3	1.5
9.		Network Analysis and Simulation Lab	PC	0-0-3	1.5
10.		Health & Wellness, YOGA and Sports	BS&H	0-0-1	0.5
				<b>Total</b>	<b>19.5</b>

<b>Category</b>	<b>CREDITS</b>
Basic Sciences and Humanities course	7.5
Engineering Science Courses	7.5
Professional Core Courses	4.5
<b>TOTAL CREDITS</b>	<b>19.5</b>



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<b>Sri Krishnadevaraya University College of Engineering &amp; Technology</b>					
<b>Dept. of Electronics and Communication Engineering</b>					
<b>II Year I Semester</b>					
<b>S.No</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.		Probability and Complex Variables	BS&H	3-0-0	3
2.		Universal Human Values– Understanding Harmony and Ethical Human Conduct	ES	3-0-0	3
3.		Signals Systems and Stochastic Process	PC	3-0-0	3
4.		Electronic Devices and Circuits	BS&H	2-1-0	3
5.		Digital Logic Design	PC	3-0-0	3
6.		Electronic Devices and Circuits Lab	PC	0-0-3	1.5
7.		Digital Design & Signal Simulation Lab	PC	0-0-3	1.5
8.		Data Structures	SC	0-1-2	2
<b>Total</b>					<b>20</b>

<b>Category</b>	<b>Credits</b>
Basic Science and Humanities	6
Professional Core	3
Engineering Sciences	11
<b>TOTAL CREDITS</b>	<b>20</b>



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<b>II Year II Semester</b>					
<b>S.No</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T- P</b>	<b>Credits</b>
1.		Managerial Economics and Financial Analysis	MG	2-0-0	2
2.		Linear Control Systems	ES	3-0-0	3
3.		Electronic Circuit Analysis	PC	3-0-0	3
4.		EM Waves and Transmission Lines	PC	3-0-0	3
5.		Analog and Digital Communications	PC	3-0-0	3
6.		Electronic Circuit Analysis Lab	PC	0-0-3	1.5
7.		Analog and Digital Communications Lab	PC	0-0-3	1.5
8.		Soft Skills	SC	0-1-2	2
9.		Design Thinking and Innovation	BS& H	0-1-2	2
10.		Environmental Science	MC	2-0-0	-
<b>Total</b>					<b>21</b>
<b>Mandatory Community Service Project Internship of 08 weeks duration during Summer Vacation</b>					

<b>Category</b>	<b>CREDITS</b>
Management Course	2
Engineering Science Courses	3
Basic Science Courses	2
Skill Course	2
Professional Core Courses	12
<b>TOTAL CREDITS</b>	<b>21</b>



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<b>Dept. Electronics and Communication Engineering</b>					
<b>III Year I Semester</b>					
<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.		Analog and Digital IC Applications	PC	3-0-0	3
2.		Antennas & Wave Propagation	PC	3-0-0	3
3.		Microprocessors and Microcontrollers	PC	3-0-0	3
4.		1. Computer Architecture & Organization 2. Fuzzy & Neural Networks 3. Detection and Estimation Theory	PE-1	3-0-0	3
5.		1. Fundamentals of Microprocessors and Microcontrollers 2. Fundamentals of Digital Electronics 3. Basics of Signals and Systems	OE-1	3-0-0	3
6.		Analog & Digital IC Applications Lab	PC	0-0-3	1.5
7.		Microprocessors and Microcontrollers Lab	PC	0-0-3	1.5
8.		PCB Design and Prototype development (SEC – III)	SOC	0-1-2	2
9.		Tinkering Lab	ES	0-0-2	1
10.		Evaluation of Community Service Internship	PR	0-0-0	2
<b>Total</b>					<b>23</b>

<b>Category</b>	<b>CREDITS</b>
Professional Core Courses	12
Professional Elective courses	3
Open Elective Course/Job oriented elective	3
Skill Enhancement course/soft skill course*	2
Engineering Science	1
Community Service Internship	2
<b>TOTAL CREDITS</b>	<b>23</b>



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<b>III Year II Semester</b>					
<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.		Digital Signal Processing	PC	3-0-0	3
2.		Microwave Engineering & Optical Communications	PC	3-0-0	3
3.		VLSI Design	PC	3-0-0	3
4.		1. Electronic Measurements and Instrumentation 2. Artificial Intelligence & Machine learning 3. Speech Processing	PE-II	3-0-0	3
5.		1. Embedded systems 2. Information Theory and Coding 3. Satellite communications'	PE-III	3-0-0	3
6.		1. Microcontroller & Applications 2. Principles of Signal Processing 3. Electronic Instrumentation	OE-II	3-0-0	3
7.		Digital Signal Processing Lab	PC	0-0-3	1.5
8.		VLSI Design Lab/ Microwave and Optical Communications Lab	PC	0-0-3	1.5
9.		RF System Design tools/ Industrial IOT & Automation (SEC – V)	SOC	0-1-2	2
10.		Technical Paper Writing & IPR	AC	2-0-0	-
Total					23
Industrial/Research Internship (Mandatory) for 8 weeks duration during summer vacation					

<b>Category</b>	<b>CREDITS</b>
Professional Core Courses	12
Professional Elective courses	6
Open Elective Course/Job oriented elective	3
Skill Enhancement course/soft skill course*	2
Audit Course	0
<b>TOTAL CREDITS</b>	<b>23</b>



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Dept. Electronics and Communication Engineering					
IV Year I Semester					
S.No.	Course Code	Course Name	Category	L-T-P	Credits
1.		Digital Image Processing	PC	3-0-0	3
2.		Entrepreneurship and Incubation Management Science Human Resource Management	MGT	2-0-0	2
3.		1. Real-Time Operating Systems 2. DSP Processors & Architectures 3. Cellular & Mobile Communications	PE-IV	3-0-0	3
4.		1. Internet of things 2. Radar Engineering 3. MEMS and Micro Systems	PE-V	3-0-0	3
5.		1. Embedded Systems 2. Consumer Electronics 3. Fundamentals of Communication Systems	OE-III	3-0-0	3
6.		1. Introduction to Image Processing 2. Transducers and Sensors 3. Introduction to Internet of things	OE-IV	3-0-0	3
7.		System Verilog	SOC	0-1-2	2
8.		Gender Sensitization	AC	2-0-0	0
9.		Evaluation of Industry Internship	PR	0-0-0	2
<b>Total</b>					<b>21</b>

Category	Credits
Professional Core Courses	3
Management Elective	2
Professional Elective courses	6
Open Elective Course/Job oriented elective	6
Skill Enhancement course/soft skill course*	2
Industrial/Research Internship	2
<b>TOTAL CREDITS</b>	<b>21</b>



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Dept. Electronics and Communication Engineering					
IV Year II Semester					
S.No.	Course Code	Course Name	Category	L-T-P	Credits
1.		Internship	PR	-	4
2.		Project	PR	-	8
Total					12

Category	CREDITS
Internship	4
Project work	8
<b>TOTAL CREDITS</b>	<b>12</b>



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<b>Dept. Electronics and Communication Engineering</b>					
<b>Honors in VLSI</b>					
<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.		Analog IC Design.	PC	3-0-0	3
2.		Digital IC Design	PC	3-0-0	3
3.		Low power VLSI	PC	3-0-0	3
4.		Testing and Verification	PC	3-0-0	3
5.		FPGA architectures	PC	3-0-0	3
6.		Analog and Digital IC Design Lab	PC	0-0-3	1.5
7.		Physical Design Automation Lab	PC	0-0-3	1.5
Total					18

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<b>Dept. Electronics and Communication Engineering</b>				
<b>List of Minors Offered by ECE</b>				
<b>S.No.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L-T-P</b>	<b>Credits</b>
1.		Embedded Systems Technology	3-0-0	3
2.		Real Time Embedded systems design and Analysis	3-0-0	3
3.		Principles of IoT	3-0-0	3
4.		Wireless Sensor Networks	3-0-0	3
5.		Industrial Internet of things	3-0-0	3
6.		Principles of IoT Lab	0-0-3	1.5
7.		Industrial Internet of things Lab	0-0-3	1.5



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Dept. of Electronics and Communication Engineering					
I Year I Semester					
S.No	Course Code	Course Name	Category	L-T-P	Credits
1.		Chemistry	BS&H	3-0-0	3
2.		Linear Algebra & Calculus	BS&H	3-0-0	3
3.		Basic Electrical & Electronics Engineering	ES	3-0-0	3
4.		Engineering Graphics	ES	1-0-4	3
5.		Introduction to Programming	ES	3-0-0	3
6.		I.T.Workshop	BS&H	0-0-2	1
7.		Electrical & Electronics Engineering Workshop	ES	0-0-3	1.5
8.		Chemistry Lab	ES	0-0-2	1
9		Introduction to Programming lab	ES	0-0-3	1.5
10		NCC/NSS./Scouts & Guides/Community service	BS&H	0-0-1	0.5
<b>Total</b>					<b>20.5</b>

Category	CREDITS
Engineering Science Courses	7.5
Basic Science and Humanities	12.5
<b>TOTAL CREDITS</b>	<b>20.5</b>



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Course Code	<b>CHEMISTRY</b>				L	T	P	C
	<b>(Common to EEE, ECE, CSE, IT &amp; allied branches)</b>				<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>I Year 1<sup>st</sup> Semester</b>								
<b>Course Objectives:</b>								
<ul style="list-style-type: none"> <li>• To familiarize engineering chemistry and its applications</li> <li>• To train the students on the principles and applications of electrochemistry and polymers</li> <li>• To introduce instrumental methods, molecular machines and switches.</li> </ul>								
<b>Course Outcomes (CO):</b>								
At the end of the course, the students will be able to:								
<b>CO1:</b> Compare the materials of construction for battery and electrochemical sensors.								
<b>CO2:</b> Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.								
<b>CO3:</b> Explain the principles of spectrometry, slc in separation of solid and liquid mixtures. <b>CO4:</b> Apply the principle of Band diagrams in the application of conductors and semiconductors.								
<b>CO5:</b> Summarize the concepts of Instrumental methods.								
<b>UNIT - I</b>	<b>Structure and Bonding Models</b>							
Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of $\Psi$ and $\Psi^2$ , particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O <sub>2</sub> and CO, etc. $\pi$ -molecular orbitals of butadiene and benzene, calculation of bond order.								
<b>UNIT II</b>	<b>Modern Engineering materials</b>							
Semiconductors – Introduction, basic concept, application Super Conductors-Introduction basic concept, applications. Supercapacitors: Introduction, Basic Concept-Classification – Applications. Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphines nanoparticles.								
<b>UNIT - III</b>	<b>Electrochemistry and Applications</b>							
Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations). Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples. Primary cells – Zinc-air battery, Secondary cells – lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell – working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).								
<b>UNIT - IV</b>	<b>Polymer Chemistry</b>							
Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation. Plastics – Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres. Elastomers – Buna-S, Buna-N – preparation, properties and applications. Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).								
<b>UNIT - V</b>	<b>Instrumental Methods and Applications</b>							
Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.								



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**Sri Krishnadevaraya University College of Engineering & Technology**  
**Ananthapuramu – 515 003 (A.P) India**  
**Electronics & Communication Engineering**

<b>Textbooks:</b>
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| <ol style="list-style-type: none"><li>1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.</li><li>2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.</li></ol> |
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<b>Reference Books:</b>
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| <ol style="list-style-type: none"><li>1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.</li><li>2. J.D. Lee, Concise Inorganic Chemistry, 5<sup>th</sup> Edition, Wiley Publications, Feb.2008</li><li>3. Textbook of Polymer Science, Fred W. Billmeyer Jr, 3rd Edition</li></ol> |
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**Sri Krishnadevaraya University College of Engineering & Technology**  
**Ananthapuramu – 515 003 (A.P) India**  
**Electronics & Communication Engineering**

Course Code	LINEAR ALGEBRA & CALCULUS (Common to All Branches of Engineering)	L	T	P	C
		3	0	0	3
<b>I Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications</li> </ul>					
<b>Course Outcomes (CO):</b>					
At the end of the course, the student will be able to CO1: Develop and use of matrix algebra techniques that are needed by engineers for practical applications. CO2: Utilize mean value theorems to real life problems. CO3: Familiarize with functions of several variables which is useful in optimization.CO4: Learn important tools of calculus in higher dimensions. CO5: Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.					
<b>UNIT - I</b>	<b>Matrices</b>				
Rank of a matrix by echelon form, normal form. Cauchy–Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solvingsystem of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.					
<b>UNIT II</b>	<b>Eigenvalues, Eigenvectors and Orthogonal Transformation</b>				
Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation					
<b>UNIT - III</b>	<b>Calculus</b>				
Mean Value Theorems: Rolle’s Theorem, Lagrange’s mean value theorem with their geometrical interpretation, Cauchy’s mean value theorem, Taylor’s and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems					
<b>UNIT - IV</b>	<b>Partial differentiation and Applications (Multi variable calculus)</b>				
Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Directional derivative, Taylor’s and Maclaurin’s series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.					
<b>UNIT - V</b>	<b>Multiple Integrals (Multi variable Calculus)</b>				
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, 44<sup>th</sup> Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10<sup>th</sup> Edition.

**Reference Books:**

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



**Electronics & Communication Engineering**

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to All branches of Engineering)	L	T	P	C
		3	0	0	3

**I Year 1<sup>st</sup> Semester**

**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 (CO):**

After the completion of the course students will be able to

**CO1:** Remember the fundamental laws, operating principles of motors, generators, MC and Mlinstruments.

**CO2:** Understand the problem-solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.

**CO3:** Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.

**CO4:** Analyze different electrical circuits, performance of machines and measuring instruments.

**CO5:** Evaluate different circuit configurations, Machine performance and Power systems operation.

**PART A: BASIC ELECTRICAL ENGINEERING**

**UNIT I**

**DC & AC Circuits**

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

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

**UNIT II**

**Machines and Measuring Instruments**

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

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

**UNIT - III**

**Energy Resources, Electricity Bill & Safety Measures**

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

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

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

**Textbooks: Electronics & Communication Engineering**

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, FirstEdition
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, ThirdEdition

**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

Basic Electrical and Electronics Engineering, S. K. Bhattacharya, 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.

**UNIT I****SEMICONDUCTOR DEVICES**

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

**UNIT II****BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION**

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

**UNIT III****DIGITAL ELECTRONICS**

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

**Textbooks:**

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

**Reference Books:**

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow 4<sup>th</sup> Version, Pearson Education, 2009.



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Ananthapuramu – 515 003 (A.P) India

Electronics & Communication Engineering

Course Code	ENGINEERING GRAPHICS (Common to All branches of Engineering)	L	T	P	C
		1	0	4	3
<b>I Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing</li> <li>To impart knowledge on the projection of points, lines and plane surfaces</li> <li>To improve the visualization skills for better understanding of projection of solids</li> <li>To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.</li> <li>To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.</li> </ul>					
<b>Course Outcomes (CO):</b>					
CO1: Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections. CO2: Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views. CO3: Understand and draw projection of solids in various positions in first quadrant.CO4: Explain principles behind development of surfaces. CO5: Prepare isometric and perspective sections of simple solids.					
<b>UNIT - I</b>					
<b>Introduction:</b> Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods. <b>Curves:</b> construction of ellipse, parabola and hyperbola by general, Cycloids, Involutés, Normal and tangent to Curves. <b>Scales:</b> Plain scales, diagonal scales and vernier scales.					
<b>UNIT II</b>					
<b>Orthographic Projections:</b> Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants. <b>Projections of Straight Lines:</b> 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 referenceplanes <b>Projections of Planes:</b> 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.					
<b>UNIT - III</b>					
<b>Projections of Solids:</b> Types of solids: Polyhedra and Solids of revolution. Projections of solids in simplepositions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallelto both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane, inclined to both the reference planes.					
<b>UNIT - IV</b>					
<b>Sections of Solids:</b> Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only. <b>Development of Surfaces:</b> Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone					
<b>UNIT - V</b>					
<b>Conversion of Views:</b> Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views. <b>Computer graphics:</b> Creating 2D&3D drawings of objects including PCB and Transformation using Auto CAD (Not for end examination).					



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**Ananthapuramu – 515 003 (A.P) India**  
**Electronics & Communication Engineering**

**Textbooks:**

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016
2. Engineering Drawing by K.L. Narayana & P. Kannaiah Tata Mcgrawhill Publications as textbook
3. Engineering Drawing - R.K. Dhawan, S Chand Publications

**Reference Books:**

1. Engineering Drawing - K.R. Gopala Krishna, Subhas publications, as reference books .
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, TataMcGraw Hill, 2017.



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**Sri Krishnadevaraya University College of Engineering & Technology**  
**Ananthapuramu – 515 003 (A.P) India**  
**Electronics & Communication Engineering**

Course Code	INTRODUCTION TO PROGRAMMING (Common to All branches of Engineering)	L	T	P	C
		3	0	0	3
<b>I Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>● To introduce students to the fundamentals of computer programming.</li> <li>● To provide hands-on experience with coding and debugging.</li> <li>● To foster logical thinking and problem-solving skills using programming.</li> <li>● To familiarize students with programming concepts such as data types, control structures, functions, and arrays.</li> <li>● To encourage collaborative learning and teamwork in coding projects.</li> </ul>					
<b>Course Outcomes (CO):</b>					
A student after completion of the course will be able to CO1: Understand basics of computers, the concept of algorithm and algorithmic thinking. CO2: Analyse a problem and develop an algorithm to solve it. CO3: Implement various algorithms using the C programming language. CO4: Understand more advanced features of C language. CO5: Develop problem-solving skills and the ability to debug and optimize the code					
<b>UNIT - I</b>	<b>Introduction to Programming and Problem Solving</b>				
History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting. Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms					
<b>UNIT II</b>	<b>Control Structures</b>				
Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue.					
<b>UNIT - III</b>	<b>Arrays and Strings</b>				
Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.					
<b>UNIT - IV</b>	<b>Pointers &amp; User Defined Data types</b>				
Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.					
<b>UNIT - V</b>	<b>Functions &amp; File Handling</b>				
Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling <b>Note: The syllabus is designed with C Language as the fundamental language of implementation.</b>					



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**Textbooks:**

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

**Reference Books:**

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



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**Ananthapuramu – 515 003 (A.P) India**  
**Electronics & Communication Engineering**

Course Code	IT WORKSHOP (Common to all branches of Engineering)	L	T	P	C
		0	0	2	1
<b>I Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>● To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables</li> <li>● To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS</li> <li>● To teach basic command line interface commands on Linux.</li> <li>● To teach the usage of Internet for productivity and self-paced life-long learning</li> <li>● To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.</li> </ul>					
<b>Course Outcomes (CO):</b>					
CO1: Perform Hardware troubleshooting. CO2: Understand Hardware components and inter dependencies. CO3: Safeguard computer systems from viruses/worms. CO4: Document/ Presentation preparation. CO5: Perform calculations using spreadsheets.					
<b>PC Hardware &amp; Software Installation</b>					
<p><b>Task 1:</b> 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.</p> <p><b>Task 2:</b> Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.</p> <p><b>Task 3:</b> Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.</p> <p><b>Task 4:</b> Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva</p> <p><b>Task 5:</b> Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva</p>					
<b>Internet &amp; World Wide Web</b>					
<p><b>Task 1:</b> Orientation &amp; Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.</p> <p><b>Task 2:</b> 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.</p> <p><b>Task 3:</b> Search Engines &amp; Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.</p> <p><b>Task 4:</b> Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.</p>					

**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 TeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

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

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

**Task 4:** Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

**EXCEL**

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

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

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

**LOOKUP/VLOOKUP**

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

**POWER POINT**

**Task 1:** Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

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

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

**AI TOOLS – ChatGPT**

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

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

**Task 2: Creative Writing:** Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

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

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

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



**Reference Books:**

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



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**Electronics & Communication Engineering**

Course Code	<b>ELECTRICAL &amp; ELECTRONICS ENGINEERING WORKSHOP</b> (Common to All branches of Engineering)	L	T	P	C
		0	0	3	1.5
<b>I Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations					
<b>Course Outcomes (CO):</b>					
<p><b>CO1:</b> Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.</p> <p><b>CO2:</b> Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.</p> <p><b>CO3:</b> Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.</p> <p><b>CO4:</b> Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.</p> <p><b>CO5:</b> Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.</p>					
<b>Activities:</b>					
<p>Familiarization of commonly used Electrical &amp; 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.</p> <p>Provide some exercises so that hardware tools and instruments are learned to be used by the students.</p> <p>Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.</p> <p>Provide some exercises so that measuring instruments are learned to be used by the students.</p> <p>Components: Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.</p> <p>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</p>					
<b>PART A: ELECTRICAL ENGINEERING LAB</b>					
<b>List of experiments:</b>					
<ol style="list-style-type: none"> <li>1. Verification of KCL and KVL</li> <li>2. Verification of Superposition theorem</li> <li>3. Measurement of Resistance using Wheat stone bridge</li> <li>4. Magnetization Characteristics of DC shunt Generator</li> <li>5. Measurement of Power and Power factor using Single-phase wattmeter</li> <li>6. Measurement of Earth Resistance using Megger</li> <li>7. Calculation of Electrical Energy for Domestic Premises</li> </ol>					



<b>Reference Books:</b> <ol style="list-style-type: none"><li>1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, FirstEdition</li><li>2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai &amp; Co, 2013</li><li>3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, ThirdEdition</li></ol> <p><b>Note:</b> Minimum Six Experiments to be performed.</p>
<b>PART B: ELECTRONICS ENGINEERING LAB</b>
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>• To impart knowledge on the principles of digital electronics and fundamentals of electron devices &amp; its applications.</li></ul>
<b>Course Outcomes:</b> At the end of the course, the student will be able to CO1: Identify & testing of various electronic components. CO2: Understand the usage of electronic measuring instruments. CO3: Plot and discuss the characteristics of various electron devices. CO4: Explain the operation of a digital circuit.
<b>List of Experiments:</b> <ol style="list-style-type: none"><li>1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.</li><li>2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.</li><li>3. Implementation of half wave and full wave rectifiers</li> <li>4. Plot Input &amp; Output characteristics of BJT in CE and CB configurations</li><li>5. Frequency response of CE amplifier.</li><li>6. Simulation of RC coupled amplifier with the design supplied</li><li>7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.</li><li>8. Verification of Truth Tables of S-R, J-K&amp; D flip flops using respective ICs.</li></ol> <p>Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.</p>
<b>References:</b> <ol style="list-style-type: none"><li>1. R. L. Boylestad &amp; Louis Nashlesky, Electronic Devices &amp; Circuit Theory, Pearson Education, 2021.</li><li>2. R. P. Jain, Modern Digital Electronics, 4<sup>th</sup> Edition, Tata Mc Graw Hill, 2009</li><li>3. R. T. Paynter, Introductory Electronic Devices &amp; Circuits – Conventional Flow Version, Pearson Education, 2009.</li></ol> <p><b>Note:</b> Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.</p>



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**Sri Krishnadevaraya University College of Engineering & Technology**  
**Ananthapuramu – 515 003 (A.P) India**  
**Electronics & Communication Engineering**

Course Code	CHEMISTRY LAB	L	T	P	C
		0	0	2	1
<b>I Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
Verify the fundamental concepts with experiments.					
<b>Course Outcomes (CO):</b>					
At the end of the course, the students will be able to CO1: Determine the cell constant and conductance of solutions. CO2: Prepare advanced polymer Bakelite materials. CO3: Measure the strength of an acid present in secondary batteries. CO4: Analyse the IR spectra of some organic compounds. CO5: Calculate strength of acid in Pb-Acid battery					
<b>Experiments</b>					
<ol style="list-style-type: none"><li>1. Measurement of 10Dq by spectrophotometric method</li><li>2. Conductometric titration of strong acid vs. strong base</li><li>3. Conductometric titration of weak acid vs. strong base</li><li>4. Determination of cell constant and conductance of solutions</li><li>5. Potentiometry - determination of redox potentials and emfs</li><li>6. Determination of Strength of an acid in Pb-Acid battery</li><li>7. Preparation of a Bakelite</li><li>8. Verify Lambert-Beer's law</li><li>9. Wavelength measurement of sample through UV-Visible Spectroscopy</li><li>10. Identification of simple organic compounds by IR</li><li>11. Preparation of nanomaterials by precipitation method</li><li>12. Estimation of Ferrous Iron by Dichrometry</li></ol>					
<b>Reference:</b>					
"Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar					



**Sri Krishnadevaraya University College of Engineering & Technology**  
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**Electronics & Communication Engineering**

Course Code	INTRODUCTION TO PROGRAMMING LAB (Common to All Branches of Engineering)	L	T	P	C
		0	0	3	1.5
<b>I Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• The course aims to give students hands – on experience and train them on the concepts of the C- programming language</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• CO1: Read, understand, and trace the execution of programs written in C language. CO2: Select the right control structure for solving the problem.</li> <li>• CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers.</li> <li>• CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C</li> </ul>					
<b>List of Experiments:</b>					
<p><b>UNIT I WEEK 1</b></p> <p><b>Objective:</b> Getting familiar with the programming environment on the computer and writing the first program.</p> <p><b>Suggested Experiments/Activities:</b></p> <p><b>Tutorial 1:</b> Problem-solving using Computers.</p> <p><b>Lab1:</b> Familiarization with programming environment</p> <p>i) Basic Linux environment and its editors like Vi, Vim &amp; Emacs etc.</p> <p>ii) Exposure to Turbo C, gcc</p> <p>iii) Writing simple programs using printf(), scanf()</p> <p>iv)</p> <p><b>WEEK 2</b></p> <p><b>Objective:</b> Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.</p> <p><b>Suggested Experiments /Activities:</b></p> <p><b>Tutorial 2:</b> Problem-solving using Algorithms and Flow charts.</p> <p><b>Lab 1:</b> Converting algorithms/flow charts into C Source code. Developing the algorithms/flowcharts for the following sample programs</p> <p>i) Sum and average of 3 numbers</p> <p>ii) Conversion of Fahrenheit to Celsius and vice versa</p> <p>iii) Simple interest calculation</p> <p><b>WEEK 3</b></p> <p><b>Objective:</b> 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.</p> <p><b>Suggested Experiments/Activities:</b></p> <p><b>Tutorial 3:</b> Variable types and type conversions:</p> <p><b>Lab 3:</b> Simple computational problems using arithmetic expressions.</p> <p>i) Finding the square root of a given number</p> <p>ii) Finding compound interest</p> <p>iii) Area of a triangle using heron's formulae</p> <p>iv) Distance travelled by an object.</p>					



#### **UNIT II WEEK 4**

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

#### **Suggested Experiments/Activities:**

**Tutorial 4:** Operators and the precedence and as associativity:

**Lab 4:** Simple computational problems using the operator' precedence and associativity

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

#### **WEEK 5**

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

#### **Suggested Experiments/Activities:**

**Tutorial 5:** Branching and logical expressions:

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

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

#### **WEEK 6**

**Objective:** Explore the full scope of iterative constructs namely while loop, do-while loop and

for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

#### **Suggested Experiments/Activities:**

**Tutorial 6:** Loops, while and for loops

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

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

#### **UNIT III WEEK 7:**

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



**Suggested Experiments/Activities:**

**Tutorial 7:** 1 D Arrays: searching.

**Lab 7:** 1D Array manipulation, linear search

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

**WEEK 8:**

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

**Suggested Experiments/Activities:**

**Tutorial 8:** 2 D arrays, sorting and Strings.

**Lab 8:** Matrix problems, String operations, Bubble sort

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

**UNIT IV WEEK 9:**

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

**Suggested Experiments/Activities:**

**Tutorial 9:** Pointers, structures and dynamic memory allocation

**Lab 9:** Pointers and structures, memory dereference.

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

**WEEK 10:**

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

**Suggested Experiments/Activities:**

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

**Lab 10 :** Bitfields, linked lists

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

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

**UNIT V WEEK 11:**

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



**Suggested Experiments/Activities:**

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

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

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

**WEEK 12:**

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

**Suggested Experiments/Activities:**

**Tutorial 12:** Recursion, the structure of recursive calls

**Lab 12:** Recursive functions

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

**WEEK 13:**

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

**Suggested Experiments/Activities:**

**Tutorial 13:** Call by reference, dangling pointers

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

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

**WEEK 14:**

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

**Suggested Experiments/Activities:**

**Tutorial 14:** File handling

**Lab 14:** File operations

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



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**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



Course Code	NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE (Common to All branches of Engineering)	L	T	P	C
			0	0	1
<b>I Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<p>After completion of the course the students will be able to</p> <p>CO1: Understand the importance of discipline, character and service motto.  CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques. CO3: Explore human relationships by analyzing social problems.  CO4: Determine to extend their help for the fellow beings and downtrodden people. CO5: Develop leadership skills and civic responsibilities</p>					
<p><b>UNIT I      Orientation</b></p> <p>General Orientation on NSS/NCC/ Scouts &amp; Guides/Community Service activities, careerguidance.</p> <p><b>Activities:</b></p> <ol style="list-style-type: none"> <li>Conducting –ice breaking sessions-expectations from the course-knowing personaltalents and skills</li> <li>Conducting orientations programs for the students –future plans-activities-releasingroad map etc.</li> <li>Displaying success stories-motivational biopics- award winning movies on societalissues etc.</li> <li>Conducting talent show in singing patriotic songs-paintings- any other contribution.</li> </ol> <p><b>UNIT II      Nature &amp; CareActivities:</b></p> <ol style="list-style-type: none"> <li>Best out of waste competition.</li> <li>Poster and signs making competition to spread environmental awareness.</li> <li>Recycling and environmental pollution article writing competition.</li> <li>Organising Zero-waste day.</li> <li>Digital Environmental awareness activity via various social media platforms.</li> <li>Virtual demonstration of different eco-friendly approaches for sustainable living.</li> <li>Write a summary on any book related to environmental issues.</li> </ol> <p><b>UNIT III      Community Service</b></p> <p><b>Activities:</b></p> <ol style="list-style-type: none"> <li>Conducting One Day Special Camp in a village contacting village-area leaders- Surveyin the village, identification of problems- helping them to solve via media- authorities-experts-etc.</li> <li>Conducting awareness programs on Health-related issues such as General Health,Mental health, Spiritual Health, HIV/AIDS,</li> <li>Conducting consumer Awareness. Explaining various legal provisions etc.</li> <li>Women Empowerment Programmes- Sexual Abuse, Adolescent Health and PopulationEducation.</li> <li>Any other programmes in collaboration with local charities, NGOs etc.</li> </ol> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>Nirmalya Kumar Sinha &amp; Surajit Majumder, <i>A Text Book of National Service Scheme</i> Vol;.I, Vidya Kutir Publication, 2021 ( ISBN 978-81-952368-8-6)</li> </ol>					



2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defense, 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 Narendran R. “Introduction to Environmental Engineering and Science”, Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

**General Guidelines:**

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

**Evaluation Guidelines:**

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



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<b>Sri Krishnadevaraya University College of Engineering &amp; Technology</b>					
<b>Dept. Electronics and Communication Engineering</b>					
<b>I Year II Semester</b>					
<b>S.No</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.		Communicative English	BS&H	2-0-0	2
2.		Engineering Physics	BS & H	3-0-0	3
3.		Differential Equations and Vector calculus	ES	3-0-0	3
4.		Basic Civil & Mechanical Engineering	ES	3-0-0	3
5.		Network Analysis	PC	3-0-0	3
6.		Communicative English Lab	BS& H	0-0-2	1
7.		Engineering Physics Lab	BS& H	0-0-2	1
8.		Engineering Workshop	ES	0-0-3	1.5
9.		Network Analysis and Simulation Lab	PC	0-0-3	1.5
10.		Health & Wellness, YOGA and Sports	BS&H	0-0-1	0.5
				<b>Total</b>	<b>19.5</b>

<b>Category</b>	<b>CREDITS</b>
Basic Sciences and Humanities course	7.5
Engineering Science Courses	7.5
Professional Core Courses	4.5
<b>TOTAL CREDITS</b>	<b>19.5</b>



**Sri Krishnadevaraya University College of Engineering & Technology**  
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**Electronics & Communication Engineering**

Course Code	COMMUNICATIVE ENGLISH (Common to All Branches of Engineering)	L	T	P	C
		2	0	0	2
<b>I Year 2nd Semester</b>					
<b>Course Objectives:</b>					
<p>The main objective of introducing this course, <i>Communicative English</i>, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.</p>					
<b>Course Outcomes (CO):</b>					
<p><b>CO1:</b> Understand the context, topic, and pieces of specific information from social or Transactional dialogues.  <b>CO2:</b> Apply grammatical structures to formulate sentences and correct word forms.  <b>CO3:</b> Analyze discourse markers to speak clearly on a specific topic in informal discussions.  <b>CO4:</b> Evaluate reading / listening texts and to write summaries based on global comprehension of these texts.  <b>CO5:</b> Create a coherent paragraph, essay, and resume.</p>					
UNIT - I					
<p><b>Lesson: HUMAN VALUES: Gift of Magi (Short Story)</b>  <b>Listening:</b> Identifying the topic, the context, and specific pieces of information by listening to short audio texts and answering a series of questions.  <b>Speaking:</b> Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.  <b>Reading:</b> Skimming to get the main idea of a text; scanning to look for specific pieces of information.  <b>Writing:</b> Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.  <b>Grammar:</b> Parts of Speech, Basic Sentence Structures-forming questions  <b>Vocabulary:</b> Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.</p>					
UNIT - II					
<p><b>Lesson: NATURE: The Brook by Alfred Tennyson (Poem)</b>  <b>Listening:</b> Answering a series of questions about main ideas and supporting ideas after listening to audio texts.  <b>Speaking:</b> Discussion in pairs/small groups on specific topics followed by short structure talks.  <b>Reading:</b> Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.  <b>Writing:</b> Structure of a paragraph - Paragraph writing (specific topics) <b>Grammar:</b> Cohesive devices - linkers, use of articles and zero article; prepositions. <b>Vocabulary:</b> Homonyms, Homophones, Homographs</p>					
UNIT - III					
<p><b>Lesson: BIOGRAPHY: Elon Musk</b>  <b>Listening:</b> Listening for global comprehension and summarizing what is listened to.  <b>Speaking:</b> Discussing specific topics in pairs or small groups and reporting what is discussed  <b>Reading:</b> Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.  <b>Writing:</b> Summarizing, Note-making, paraphrasing  <b>Grammar:</b> Verbs - tenses; subject-verb agreement; Compound words, Collocations  <b>Vocabulary:</b> Compound words, Collocations</p>					



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<b>UNIT IV</b>		
<b>Lesson: INSPIRATION: The Toys of Peace by Saki</b> <b>Listening:</b> Making predictions while listening to conversations/ transactional dialogues without video; listening with video. <b>Speaking:</b> Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. <b>Reading:</b> Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. <b>Writing:</b> Letter Writing: Official Letters, Resumes <b>Grammar:</b> Reporting verbs, Direct & Indirect speech, Active & Passive Voice <b>Vocabulary:</b> Words often confused, Jargons		
<b>UNIT V</b>		
<b>Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)</b> <b>Listening:</b> Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. <b>Speaking:</b> Formal oral presentations on topics from academic contexts <b>Reading:</b> Reading comprehension. <b>Writing:</b> Writing structured essays on specific topics. <b>Grammar:</b> Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement) <b>Vocabulary:</b> Technical Jargons		
<b>Textbooks:</b> <ul style="list-style-type: none"><li>• Pathfinder: Communicative English for Undergraduate Students, 1<sup>st</sup> Edition, Orient Black Swan, 2023 (Units 1,2 &amp; 3)</li><li>• Empowering with Language by Cengage Publications, 2023 (Units 4 &amp; 5)</li></ul> <b>Reference Books:</b> <ol style="list-style-type: none"><li>1. Dubey, Sham Ji &amp; Co. English for Engineers, Vikas Publishers, 2020</li><li>2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.</li><li>3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.</li><li>4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.</li></ol> <b>Web Resources:</b> GRAMMAR: <ul style="list-style-type: none"><li>• <a href="http://www.bbc.co.uk/learningenglish">www.bbc.co.uk/learningenglish</a></li><li>• <a href="https://dictionary.cambridge.org/grammar/british-grammar/">https://dictionary.cambridge.org/grammar/british-grammar/</a></li><li>• <a href="http://www.eslpod.com/index.html">www.eslpod.com/index.html</a></li><li>• <a href="https://www.learngrammar.net/">https://www.learngrammar.net/</a></li><li>• <a href="https://english4today.com/english-grammar-online-with-quizzes/">https://english4today.com/english-grammar-online-with-quizzes/</a></li><li>• <a href="https://www.talkenglish.com/grammar/grammar.aspx">https://www.talkenglish.com/grammar/grammar.aspx</a></li></ul> <b>VOCABULARY</b> <ol style="list-style-type: none"><li>1. <a href="https://www.youtube.com/c/DailyVideoVocabulary/videos">https://www.youtube.com/c/DailyVideoVocabulary/videos</a></li><li>2. <a href="https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA">https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA</a></li></ol>		



**Sri Krishnadevaraya University College of Engineering & Technology**  
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**Electronics & Communication Engineering**

Course Code	<b>ENGINEERING PHYSICS</b>				L	T	P	C
	<b>(Common for all branches of Engineering)</b>				3	0	0	3
<b>I Year 2nd Semester</b>								
<b>Course Objectives:</b>								
To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.								
<b>Course Outcomes (CO):</b>								
CO1: Analyze the intensity variation of light due to polarization, interference, and diffraction. CO2: Familiarize with the basics of crystals and their structures. CO3: Explain fundamentals of quantum mechanics and apply it to one dimensional motion of particles. CO4: Summarize various types of polarization of dielectrics and classify the magnetic materials. CO5: Explain the basic concepts of Quantum Mechanics and the band theory of solids.CO6: Identify the type of semiconductor using Hall effect								
<b>UNIT - I</b>	<b>Wave Optics</b>							
Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colors in thin films- Newton’s Rings, Determination of wavelength and refractive index. Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol’s Prism -Half wave and Quarter wave plates.								
<b>UNIT - II</b>	<b>Crystallography and X-ray diffraction</b>							
<b>Crystallography:</b> Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes. 1. <b>ray diffraction:</b> Bragg’s law - X-ray Diffractometer – crystal structure determination by Laue’s and powder methods								
<b>UNIT - III</b>	<b>Dielectric and Magnetic Materials</b>							
<b>Dielectric Materials:</b> Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss <b>Magnetic Materials:</b> Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.								
<b>UNIT - IV</b>	<b>Quantum Mechanics and Free electron Theory</b>							
<b>Quantum Mechanics:</b> Dual nature of matter – Heisenberg’s Uncertainty Principle – Significance and properties of wave function – Schrodinger’s time independent and dependent wave equations– Particle in a one-dimensional infinite potential well. <b>Free Electron Theory:</b> Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy								



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<b>UNIT - V</b>	<b>Semiconductors</b>
<p><b>Semiconductors:</b> Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein’s equation – Hall effect and its applications.</p>	
<p><b>Textbooks:</b></p> <ol style="list-style-type: none"><li>1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar &amp; TVS ArunMurthy, S. Chand Publications, 11th Edition 2019.</li><li>2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)</li></ol>	
<p><b>Reference Books:</b></p> <ol style="list-style-type: none"><li>1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.</li><li>2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.</li><li>3. Engineering Physics” - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.2010</li><li>4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).</li></ol>	
<p><b>Web Resources:</b> <a href="https://www.loc.gov/rr/scitech/selected-internet/physics.html">https://www.loc.gov/rr/scitech/selected-internet/physics.html</a></p>	



Course Code	<b>DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common for all branches of Engineering)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>I Year 2nd Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To enlighten the learners in the concept of differential equations and multivariable calculus.</li> <li>• 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.</li> </ul>					
<b>Course Outcomes (CO):</b>					
At the end of the course, the student will be able to					
CO1: Solve the differential equations related to various engineering fields.					
CO2: Identify solution methods for partial differential equations that model physical processes.					
CO3: Interpret the physical meaning of different operators such as gradient, curl and divergence.					
CO4: Estimate the work done against a field, circulation and flux using vector calculus.					
<b>UNIT - I</b>	<b>Differential equations of first order and first degree</b>				
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.					
<b>UNIT - II</b>	<b>Linear differential equations of higher order (Constant Coefficients)</b>				
Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion					
<b>UNIT - III</b>	<b>Partial Differential Equations</b>				
Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange’s method. Homogeneous Linear Partial differential equations with constant coefficients.					
<b>UNIT - IV</b>	<b>Vector differentiation</b>				
Scalar and vector point functions, vector operator Del, Del applies to scalar point functions- Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.					
<b>UNIT V</b>	<b>Vector integration</b>				
Line integral-circulation-work done, surface integral-flux, Green’s theorem in the plane (without proof), Stoke’s theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.					



**Textbooks:**

1. 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).
5. Higher Engineering Mathematics, B. V. Ramana, McGraw Hill Education, 2017



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Course Code	BASIC CIVIL AND MECHANICAL ENGINEERING (Common to All branches of Engineering)	L	T	P	C
		3	0	0	3
<b>I Year 2nd Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• Get familiarized with the scope and importance of Civil Engineering sub-divisions.</li> <li>• Introduce the preliminary concepts of surveying.</li> <li>• Acquire preliminary knowledge on Transportation and its importance in nation's economy.</li> <li>• Get familiarized with the importance of quality, conveyance and storage of water.</li> <li>• Introduction to basic civil engineering materials and construction techniques</li> </ul>					
<b>Course Outcomes (CO):</b>					
<p>After the completion of the course students will be able to</p> <p>CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.</p> <p>CO2: Know the concepts of surveying and to understand the measurement of distances, angles, and levels through surveying.</p> <p>CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.</p> <p>CO4: Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.</p> <p>CO5: Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.</p>					
<b>PART A: BASIC CIVIL ENGINEERING</b>					
<b>UNIT I</b>					
<p><b>Basics of Civil Engineering:</b> 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.</p>					
<b>UNIT II</b>					
<p><b>Surveying:</b> Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.</p>					
<b>UNIT - III</b>					
<p><b>Transportation Engineering</b> 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.</p> <p><b>Water Resources and Environmental Engineering:</b> Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs)</p>					
<b>Textbooks:</b>					
<ol style="list-style-type: none"> <li>1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt.Ltd. Fourth Edition.</li> <li>2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers.2022. First Edition.</li> <li>3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition</li> </ol>					



<b>Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.</li> <li>2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, KhannaPublishers, Delhi. 2016</li> <li>3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, KhannaPublishers, Delhi 2023. 38<sup>th</sup> Edition.</li> <li>4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand andBrothers Publications 2019. 10<sup>th</sup> Edition.</li> <li>5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.</li> </ol>

**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:** On completion of the course, the student should be able toCO1:

Understand the different manufacturing processes.

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

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

CO4: Describe the basics of robotics and its applications

**UNIT I**

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

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

**UNIT II**

**Manufacturing Processes:** Principles of Casting, Forming, joining processes, Machining.

**Thermal Engineering** – Introduction to Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, Components of Electric and Hybrid Vehicles.

**UNIT III**

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

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

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

**Textbooks:**

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



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**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 MPandey, 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, TataMcGraw Hill publications (India) Pvt. Ltd.
5. Elements of Mechanical Engineering, - Sadhu Singh, S Chand Publications,
6. Elements of Mechanical Engineering - R. K. Rajput, Laxmi Publications as textbooks.



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Course Code	NETWORK ANALYSIS	L	T	P	C
		3	0	0	3
<b>I Year 2nd Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To introduce basic laws, mesh &amp; nodal analysis techniques for solving electrical circuits</li> <li>• To impart knowledge on applying appropriate theorem for electrical circuit analysis</li> <li>• To explain transient behavior of circuits in time and frequency domains</li> <li>• To teach concepts of resonance</li> <li>• To introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship.</li> </ul>					
<b>Course Outcomes (CO):</b>					
At the end of this course students will demonstrate the ability to CO1: Understand basic electrical circuits with nodal and mesh analysis. CO2: Analyse the circuit using network simplification theorems. CO3: Find Transient response and Steady state response of a network. CO4: Analyse electrical networks in the Laplace domain. CO5: Compute the parameters of a two-port network					
<b>UNIT - I</b>					
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 dependentsources also.					
<b>UNIT - II</b>					
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.					
<b>UNIT - III</b>					
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.					
<b>UNIT - IV</b>					
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.					
<b>UNIT-V</b>					
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 constant <sup>5</sup> t <sup>2</sup> s. Insertion loss. Attenuators and pads. Lattice network and its parameters. Impedance matching networks.					



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**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, 9<sup>th</sup> Edition 2020.
3. Network lines and Fields by John. D. Ryder 2<sup>nd</sup> Edition, PHI

**Reference Books:**

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



Course Code	COMMUNICATIVE ENGLISH LAB (Common to All Branches of Engineering)	L	T	P	C
		0	0	2	1
<b>I Year 2nd Semester</b>					
<b>Course Objectives:</b>					
The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews					
<b>Course Outcomes (CO):</b>					
CO1: Understand the different aspects of the English language proficiency with emphasison LSRW skills. CO2: Apply communication skills through various language learning activities. CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable divisionfor better listening and speaking comprehension. CO4: Evaluate and exhibit professionalism in participating in debates and group discussions.CO5: Create effective Course Objectives					
<b>List of Topics:</b>					
<ol style="list-style-type: none"> <li>1. Vowels &amp; Consonants</li> <li>2. Neutralization/Accent Rules</li> <li>3. Communication Skills &amp; JAM</li> <li>4. Role Play or Conversational Practice</li> <li>5. E-mail Writing</li> <li>6. Resume Writing, Cover letter, SOP</li> <li>7. Group Discussions-methods &amp; practice</li> <li>8. Debates - Methods &amp; Practice</li> <li>9. PPT Presentations/ Poster Presentation</li> <li>10. Interviews Skills</li> </ol>					
<b>Suggested Software:</b>					
<ul style="list-style-type: none"> <li>• Walden Infotech</li> <li>• Young India Films</li> </ul>					
<b>Reference Books:</b>					
<ol style="list-style-type: none"> <li>1. Raman Meenakshi, Sangeeta-Sharma. <i>Technical Communication</i>. Oxford Press.2018.</li> <li>2. Taylor Grant: <i>English Conversation Practice</i>, Tata McGraw-Hill Education India,2016</li> <li>3. Hewing's, Martin. <i>Cambridge Academic English (B2)</i>. CUP, 2012.</li> <li>4. J. Sethi &amp; P.V. Dhamija. <i>A Course in Phonetics and Spoken English</i>, (2<sup>nd</sup> Ed),Kindle, 2013</li> </ol>					
<b>Web Resources:</b>					
<b>Spoken English:</b>					
<ol style="list-style-type: none"> <li>1. <a href="http://www.esl-lab.com">www.esl-lab.com</a></li> <li>2. <a href="http://www.englishmedialab.com">www.englishmedialab.com</a></li> <li>3. <a href="http://www.englishinteractive.net">www.englishinteractive.net</a></li> <li>4. <a href="https://www.britishcouncil.in/english/online">https://www.britishcouncil.in/english/online</a></li> <li>5. <a href="http://www.letstalkpodcast.com/">http://www.letstalkpodcast.com/</a></li> <li>6. <a href="https://www.youtube.com/c/mmmEnglish_Emma/featured">https://www.youtube.com/c/mmmEnglish_Emma/featured</a></li> <li>7. <a href="https://www.youtube.com/c/ArnelsEverydayEnglish/featured">https://www.youtube.com/c/ArnelsEverydayEnglish/featured</a></li> </ol>					



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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](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](https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc)
- [https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp\\_IA](https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA)



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Course Code	ENGINEERING PHYSICS LAB (Common to All Branches of Engineering)	L	T	P	C
		0	0	2	1
<b>I Year 2nd Semester</b>					
<b>Course Objectives:</b>					
To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.					
<b>Course Outcomes (CO):</b>					
The students will be able to CO1: Operate optical instruments like travelling microscope and spectrometer. CO2: Estimate the wavelengths of different colours using diffraction grating. CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance. CO4: Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively. CO5: Calculate the band gap of a given semiconductor. CO6: Identify the type of semiconductor using Hall effect.					
<b>List of Experiments:</b>					
<ol style="list-style-type: none"> <li>1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.</li> <li>2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.</li> <li>3. Verification of Brewster's law</li> <li>4. Determination of dielectric constant using charging and discharging method.</li> <li>5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).</li> <li>6. Determination of wavelength of Laser light using diffraction grating.</li> <li>7. Estimation of Planck's constant using photoelectric effect.</li> <li>8. Determination of the resistivity of semiconductors by four probe methods.</li> <li>9. Determination of energy gap of a semiconductor using p-n junction diode.</li> <li>10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.</li> <li>11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.</li> <li>12. Determination of temperature coefficients of a thermistor.</li> <li>13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.</li> <li>14. Determination of magnetic susceptibility by Kundt's tube method.</li> <li>15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.</li> <li>16. Sonometer: Verification of laws of stretched string.</li> <li>17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.</li> <li>18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.</li> </ol>					
<b>Note:</b> Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.					
<b>References:</b>					
<ul style="list-style-type: none"> <li>• A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.</li> </ul>					
<b>Web Resources</b>					
<ul style="list-style-type: none"> <li>• <a href="http://www.vlab.co.in">www.vlab.co.in</a></li> <li>• <a href="https://phet.colorado.edu/en/simulations/filter?subjects=physics&amp;type=html,prototype">https://phet.colorado.edu/en/simulations/filter?subjects=physics&amp;type=html,prototype</a></li> </ul>					



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Course Code	ENGINEERING WORKSHOP (Common to All branches of Engineering)	L	T	P	C
		0	0	3	1.5
<b>I Year 2nd Semester</b>					
<b>Course Objectives:</b>					
To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills					
<b>Course Outcomes (CO):</b>					
CO1: Identify workshop tools and their operational capabilities. CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding. CO3: Apply fitting operations in various applications. CO4: Apply basic electrical engineering knowledge for House Wiring Practice					
<b>List of Experiments:</b>					
<ul style="list-style-type: none"><li>• <b>Demonstration:</b> Safety practices and precautions to be observed in workshop.</li><li>• <b>Wood Working:</b> Familiarity with different types of woods and tools used in wood working and make following joints. a) Half – Lap joint    b) Mortise and Tenon joint    c) Corner Dovetail joint or Bridle joint</li><li>• <b>Sheet Metal Working:</b> Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets. Tapered tray b) Conical funnel    c) Elbow pipe d) Brazing</li><li>• <b>Fitting:</b> Familiarity with different types of tools used in fitting and do the following fitting exercises. a) V-fit    b) Dovetail fit    c) Semi-circular fit    d) Bicycle tire puncture and change of two-wheeler tyre</li><li>• <b>Electrical Wiring:</b> Familiarity with different types of basic electrical circuits and make the following connections. a) Parallel and series    b) Two-way switch    c) Godown lighting d) Tube light    e) Three phase motor    f) Soldering of wires</li><li>• <b>Foundry Trade:</b> Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.</li><li>• <b>Welding Shop:</b> Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.</li><li>• <b>Plumbing:</b> Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.</li></ul>					
<b>Textbooks:</b>					
<ul style="list-style-type: none"><li>• Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.</li><li>• A Course in Workshop Technology Vol I. &amp; II, B.S. Raghuvanshi, Dhanpath Rai &amp; Co., 2015 &amp; 2017.</li></ul>					
<b>Reference Books:</b>					
<ul style="list-style-type: none"><li>• Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury &amp; Others, Media</li><li>• Promoters and Publishers, Mumbai. 2007, 14th edition</li><li>• Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.</li><li>• Wiring Estimating, Costing and Contracting; Soni P.M. &amp; Upadhyay P.A.; AtulPrakashan, 2021-22.</li></ul>					



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**Electronics & Communication Engineering**

Course Code	NETWORK ANALYSIS AND SIMULATION LABORATORY	L	T	P	C
		0	0	3	1.5
<b>I Year 2nd Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"><li>• To gain hands on experience in verifying Kirchoff's laws and network theorems</li><li>• To analyze transient behavior of circuits</li><li>• To study resonance characteristics</li><li>• To determine 2-port network parameters</li></ul>					
<b>Course Outcomes (CO):</b>					
CO1: Verify Kirchoff's laws and network theorems. CO2: Measure time constants of RL & RC circuits. CO3: Analyze behavior of RLC circuit for different cases. CO4: Design resonant circuit for given specifications. CO5: Characterize and model the network in terms of all network parameters					
<b>List of Experiments:</b>					
<p>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.</p> <ol style="list-style-type: none"><li>1. Study of components of a circuit and Verification of KCL and KVL.</li><li>2. Verification of mesh and nodal analysis for AC circuits</li><li>3. Verification of Superposition, Thevenin's &amp; Norton theorems for AC circuits</li><li>4. Verification of maximum power transfer theorem for AC circuits</li><li>5. Verification of Tellegen's theorem for two networks of the same topology.</li><li>6. Study of DC transients in RL, RC and RLC circuits</li><li>7. To study frequency response of various 1<sup>st</sup> order RL &amp; RC networks</li><li>8. To study the transient and steady state response of a 2<sup>nd</sup> order circuit by varying its various parameters and studying their effects on responses</li><li>9. Find the Q Factor and Bandwidth of a Series and Parallel Resonance circuit.</li><li>10. Determination of open circuit (Z) and short circuit (Y) parameters</li><li>11. Determination of hybrid (H) and transmission (ABCD) parameters</li><li>12. To measure two port parameters of a twin-T network and study its frequency response.</li></ol> <p><b>Hardware Requirements:</b> Regulated Power supplies, Analog/Digital Function Generators, Digital Multimeters, Decade Resistance Boxes/Rheostats, Decade Capacitance Boxes, Ammeters (Analog or Digital), Voltmeters (Analog or Digital), Active &amp; Passive Electronic Components</p> <p><b>Software requirements:</b> Multisim/ Pspice/Equivalent simulation software tool, Computer Systems with required specifications</p> <p><b>References:</b></p> <ol style="list-style-type: none"><li>1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.</li><li>2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9<sup>th</sup> Edition 2020.</li></ol>					



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Course Code	<b>HEALTH AND WELLNESS, YOGA AND SPORTS (Common to All branches of Engineering)</b>	L	T	P	C
		<b>0</b>	<b>0</b>	<b>1</b>	<b>0.5</b>
<b>I Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"><li>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</li></ul>					
<b>Course Outcomes (CO):</b>					
After completion of the course the student will be able to CO1: Understand the importance of yoga and sports for Physical fitness and sound health. CO2: Demonstrate an understanding of health-related fitness components. CO3: Compare and contrast various activities that help enhance their health. CO4: Assess current personal fitness levels. CO5: Develop Positive Personality					
<b>UNIT I</b>					
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.					
<b>Activities:</b>					
<ol style="list-style-type: none"><li>Organizing health awareness programmes in community</li><li>Preparation of health profile</li><li>Preparation of chart for balance diet for all age groups</li></ol>					
<b>UNIT II</b>					
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.					
<b>Activities:</b>					
Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar					
<b>UNIT III</b>					
Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.					
<b>Activities:</b>					
<ol style="list-style-type: none"><li>Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc. Practicing general and specific warm up, aerobics</li><li>Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.</li></ol>					



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**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. HumanKinetics, 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.



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**Electronics & Communication Engineering**

<b>Sri Krishnadevaraya University College of Engineering &amp; Technology</b>					
<b>Dept. of Electronics and Communication Engineering</b>					
<b>II Year I Semester</b>					
<b>S.No</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.		Probability and Complex Variables	BS&H	3-0-0	3
2.		Universal Human Values– Understanding Harmony and Ethical Human Conduct	ES	3-0-0	3
3.		Signals Systems and Stochastic Process	PC	3-0-0	3
4.		Electronic Devices and Circuits	BS&H	2-1-0	3
5.		Digital Logic Design	PC	3-0-0	3
6.		Electronic Devices and Circuits Lab	PC	0-0-3	1.5
7.		Digital Design & Signal Simulation Lab	PC	0-0-3	1.5
8.		Data Structures	SC	0-1-2	2
<b>Total</b>					<b>20</b>

<b>Category</b>	<b>Credits</b>
Basic Science and Humanities	6
Professional Core	3
Engineering Sciences	11
<b>TOTAL CREDITS</b>	<b>20</b>



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Course Code	PROBABILITY AND COMPLEX VARIABLES	L	T	P	C
		3	0	0	3
<b>II Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To introduce the basic concepts of probability and random variables.</li> <li>• To familiarize the student with functions of random variables and basic operations of probability distributions.</li> <li>• To expose the student to advanced topics in probability, including conditional probability and Bayes' theorem.</li> <li>• To impart knowledge on the concepts of complex variables.</li> <li>• To enable the student to solve engineering problems using contour integrals, residues, and related methods.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• Understand the concepts of Probability, Random Variables and their characteristics</li> <li>• Learn how to deal with multiple random variables, conditional probability, joint distribution and statistical independence.</li> <li>• Formulate and solve engineering problems involving random variables.</li> <li>• Analyze limit, continuity and differentiation of functions of complex variables and Understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions.</li> <li>• Understand Cauchy theorem, Cauchy integral formulas and apply these to evaluate complex contour integrals. Classify singularities and poles; find residues and evaluate complex integrals using the residue theorem.</li> </ul>					
<b>UNIT - I</b>	<b>Probability &amp; Random Variable</b>				
Probability 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, Bayes' Theorem, Independent Events. Random variables (discrete and continuous), probability density functions, properties, mathematical expectation. Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian.					
<b>UNIT II</b>	<b>Operations on Random variable</b>				
Moments-moments about the origin, Central moments, Variance and Skew, Chebyshev's inequality, moment generating function, characteristic function. Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density –Statistical Independence.					
<b>UNIT - III</b>	<b>Operations on Multiple Random variables</b>				
Operations on Multiple Random Variables: Expected Value of a Function of Random Variables, Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case.					
<b>UNIT - IV</b>	<b>Complex Variable – Differentiation</b>				
Introduction to functions of complex variable-concept of Limit & continuity-Differentiation, Cauchy-Riemann equations, analytic functions harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.					
<b>UNIT - V</b>	<b>Complex Variable – Integration</b>				
Line integral-Contour integration, Cauchy's integral theorem (Simple Case), Cauchy Integral formula, Power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.					



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**Textbooks:**

1. Peyton Z. Peebles, “Probability, Random Variables & Random Signal Principles”, 4th Edition, TMH, 2002.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017, 44<sup>th</sup> Edition.

**Reference Books:**

1. Athanasios Papoulis and S. Unnikrishnan Pillai, “Probability, Random Variables and Stochastic Processes”, 4th Edition, PHI, 2002
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India
3. Henry Stark and John W. Woods, “Probability and Random Processes with Application to Signal Processing,” 3rd Edition, Pearson Education, 2002.
4. B.V.Ramana, Higher Engineering Mathematics, Mc Graw Hill publishers.

**Online Learning Resources:**

[https://onlinecourses.nptel.ac.in/noc20\\_ma50/preview](https://onlinecourses.nptel.ac.in/noc20_ma50/preview)

[https://onlinecourses.nptel.ac.in/noc21\\_ma66/preview#:~:text=This%20course%20provides%20random%20variable,and%20simple%20Markovian%20queueing%20models.](https://onlinecourses.nptel.ac.in/noc21_ma66/preview#:~:text=This%20course%20provides%20random%20variable,and%20simple%20Markovian%20queueing%20models.)



Course Code	UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT	L	T	P	C
		2	1	0	3
<b>II Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• 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.</li> <li>• To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.</li> <li>• To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• Define the terms like Natural Acceptance, Happiness and Prosperity</li> <li>• Identify oneself, and one's surroundings (family, society nature)</li> <li>• Apply what they have learnt to their own self in different day-to-day settings in real life</li> <li>• Relate human values with human relationship and human society.</li> <li>• Justify the need for universal human values and harmonious existence</li> <li>• Develop as socially and ecologically responsible engineers</li> </ul>					
<b>Course Topics</b>					
<p>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.</p> <p>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.</p>					
<b>UNIT - I</b>					
<p>Introduction to Value Education (6 lectures and 3 tutorials for practice session)</p> <p>Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)</p> <p>Lecture 2: Understanding Value Education</p> <p>Tutorial 1: Practice Session PS1 Sharing about Oneself</p> <p>Lecture 3: self-exploration as the Process for Value Education</p> <p>Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations</p> <p>Tutorial 2: Practice Session PS2 Exploring Human Consciousness</p> <p>Lecture 5: Happiness and Prosperity – Current Scenario</p> <p>Lecture 6: Method to Fulfill the Basic Human Aspirations</p> <p>Tutorial 3: Practice Session PS3 Exploring Natural Acceptance.</p>					
<b>UNIT II</b>					

**Electronics & Communication Engineering**

Harmony in the Human Being (6 lectures and 3 tutorials for practice session) Lecture 7: Understanding Human being as the Co-existence of the self and the body. Lecture 8: Distinguishing between the Needs of the self and the body Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body. Lecture 9: The body as an Instrument of the self Lecture 10: Understanding Harmony in the self Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self Lecture 11: Harmony of the self with the body Lecture 12: Programme to ensure self-regulation and Health Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body		
<b>UNIT - III</b>		
Harmony in the Family and Society (6 lectures and 3 tutorials for practice session) Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction Lecture 14: 'Trust' – the Foundational Value in Relationship Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust Lecture 15: 'Respect' – as the Right Evaluation Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture 16: Other Feelings, Justice in Human-to-Human Relationship Lecture 17: Understanding Harmony in the Society Lecture 18: Vision for the Universal Human Order Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal		
<b>UNIT - IV</b>		
Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session) Lecture 19: Understanding Harmony in the Nature Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature Lecture 21: Realizing Existence as Co-existence at All Levels Lecture 22: The Holistic Perception of Harmony in Existence Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.		
<b>UNIT - V</b>		
Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session) Lecture 23: Natural Acceptance of Human Values Lecture 24: Definitiveness of (Ethical) Human Conduct Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order Lecture 26: Competence in Professional Ethics Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies Lecture 28: Strategies for Transition towards Value-based Life and Profession Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order		
Practice Sessions for UNIT I – Introduction to Value Education PS1 Sharing about Oneself PS2 Exploring Human Consciousness PS3 Exploring Natural Acceptance Practice Sessions for UNIT II – Harmony in the Human Being PS4 Exploring the difference of Needs of self and body PS5 Exploring Sources of Imagination in the self PS6 Exploring Harmony of self with the body Practice Sessions for UNIT III – Harmony in the Family and Society PS7 Exploring the Feeling		



of Trust  
PS8 Exploring the Feeling of Respect  
PS9 Exploring Systems to fulfil Human Goal  
Practice Sessions for UNIT IV – Harmony in the Nature (Existence) PS10 Exploring the Four Orders of Nature  
PS11 Exploring Co-existence in Existence  
Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics  
PS12 Exploring Ethical Human Conduct  
PS13 Exploring Humanistic Models in Education  
PS14 Exploring Steps of Transition towards Universal Human Order

**Textbook READINGS:**  
**Textbook and Teachers Manual**

- a. The Textbook  
R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
- b. The Teacher's Manual  
R R Gaur, R Asthana, G P Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

**Reference Books:**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

**Mode of Conduct:**

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

Tutorial hours are to be used for practice sessions.

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

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

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

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Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values. It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department. Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

**Online Resources:**

1. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf>
2. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf>
3. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf>
4. <https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf>
5. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf>
6. <https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf>
7. <https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf>
8. <https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385>
9. [https://onlinecourses.swayam2.ac.in/aic22\\_ge23/preview](https://onlinecourses.swayam2.ac.in/aic22_ge23/preview).



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<b>Course Code</b>	<b>SIGNALS, SYSTEMS AND STOCHASTIC PROCESS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**II Year 1<sup>st</sup> Semester**

**Course Objectives:**

- Understanding the basics of signals and systems required for ECE courses.
- To teach concepts of signals and systems and its analysis using different transform techniques.
- To provide basic understanding of random processes which is essential for the random signals and systems encountered in communications and signal Processing areas.

**Course Outcomes (CO):**

- Understand the mathematical description and representation of continuous-time and discrete-time signals and systems, Also, understand the concepts of various transform techniques and Random Processes
- Apply sampling theorem to convert continuous-time signals to discrete-time signals and reconstruct back, different transform techniques to solve signals and system related problems.
- Formulate and solve engineering problems involving random processes.
- Analyze the frequency spectra of various continuous-time signals using different transform methods.
- Classify the systems based on their properties and determine the response of them.

**UNIT I**

**Signals & Systems:** Basic definitions and classification of Signals and Systems (Continuous time and discrete time), operations on signals, Concepts of Convolution and Correlation of signals, Analogy between vectors and signals-Orthogonality, mean square error,  
**Fourier series:** Trigonometric & Exponential forms of Fourier series, Properties, Concept of discrete spectrum, Illustrative Problems.

**UNIT II**

**Fourier Transform:** Definition, Computation and properties of Fourier transform for different types of signals and systems, Inverse Fourier transform. Sampling: Sampling theorem – Graphical and analytical proof for Band Limited Signals, Reconstruction of signal from its samples, Effect of under sampling – Aliasing. Illustrative Problems.  
**Laplace Transform:** Definition, ROC, Properties, Inverse Laplace transforms, the s-plane and BIBO stability, Transfer functions, System Response to standard signals, Solution of differential equations with initial conditions, Illustrative Problems.

**UNIT - III**

**Signal Transmission through Linear Systems:** Linear system, impulse response, Response of a linear system for different input signals, linear time-invariant (LTI) system, 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 characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between bandwidth and rise time, Energy and Power spectral densities, Illustrative Problems.



<b>UNIT IV</b>	
<b>Random Processes – Temporal Characteristics:</b> 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-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. Random Signal, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.	
<b>UNIT V</b>	
<b>Random Processes – Spectral Characteristics:</b> 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. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.	
<b>Textbooks:</b> <ol style="list-style-type: none"><li>1. Peyton Z. Peebles, “Probability, Random Variables &amp; Random Signal Principles”, 4thEdition, TMH, 2002.</li><li>2. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, “Signals and Systems”, 2nd Edition,PHI, 2009.</li></ol>	
<b>Reference Books:</b> <ol style="list-style-type: none"><li>1. Signals, Systems &amp; Communications - B.P. Lathi, 2013, BSP.</li><li>2. Athanasios Papoulis and S. Unnikrishna Pillai, “Probability, Random Variables and Stochastic Processes”, 4th Edition, PHI, 2002</li><li>3. Simon Haykin and Van Veen, “Signals &amp; Systems”, 2nd Edition, Wiley, 2005.</li><li>4. Matthew Sadiku and Warsame H. Ali, “Signals and Systems A primer with MATLAB”, CRC Press, 2016.</li><li>5. Hwei Hsu, “Schaum's Outline of Signals and Systems”, 4thEdition, TMH, 2019.</li></ol>	



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Course Code	ELECTRONIC DEVICES & CIRCUITS	L	T	P	C
		3	0	0	3
<b>II Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• Students will be able understand the basic principles of all semiconductor devices.</li> <li>• Able to analyze diode circuits, various biasing and small signal equivalent circuits of amplifiers, compare the performance of BJTs and MOSFETs</li> <li>• Able to design rectifier circuits and various amplifier circuits using BJTs and MOSFETs.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• Understand principle of operation, characteristics and applications of semiconductor diodes, special diodes, BJTs, JFET and MOSFETs.</li> <li>• Applying the basic principles solving the problems related to Semiconductor diodes, BJTs, and MOSFETs.</li> <li>• Analyze diode circuits for different applications such as rectifiers, clippers and clampers also analyze biasing circuits of BJTs, and MOSFETs.</li> <li>• Design of diode circuits and amplifiers using BJTs, and MOSFETs.</li> <li>• Compare the performance of various semiconductor devices.</li> </ul>					
<b>UNIT - I</b>					
<p><b>PN junction diode:</b> Review, diode current equation, Diode resistance, Transition and Diffusion Capacitance, effect of temperature on PN junction diode, Quantitative analysis of Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Ripple Factor and Regulation Characteristics, Clipping and Clamping circuits, Illustrative problems.</p> <p><b>Special Diodes:</b> Construction, operation and VI characteristics of Tunnel Diode, Varactor Diode, LED, LCD, Photo Diode, SCR and UJT.</p>					
<b>UNIT II</b>					
<p><b>Review of Bipolar Junction Transistors,</b> Characteristics, Transistor as an Amplifier and as a Switch, BJT Configurations, Limits of Operation, BJT Specifications.</p> <p><b>Biasing and Stabilization:</b> Operating Point, DC and AC Load Lines, Importance of Biasing, Fixed Bias, Collector to Base Bias, Self-Bias, Bias Stability, Thermal Runaway, Thermal Stability, Illustrative problems.</p>					
<b>UNIT - III</b>					
<p><b>BJT Small Signal Operation and Models-</b> the transconductance, input resistance at the base, input resistance at the emitter, Voltage gain, separating the Signal and the DC Quantities, The Hybrid <math>\pi</math> Model, the T Model. Single Stage BJT Amplifiers - Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, Problem solving.</p>					
<b>UNIT - IV</b>					
<p><b>Junction Field Effect Transistor (FET):</b> Construction, Principle of Operation, V-I Characteristics, Comparison of BJT and FET, FET as Voltage Variable Resistor. FET biasing.</p> <p><b>MOS Field Effect Transistors:</b> Introduction, Device Structure and Physical Operation, CMOS, V - I Characteristics, MOSFET Circuits at DC, MOSFET as an Amplifier and as a Switch. Biasing in MOS Amplifier circuits - biasing by fixing VGS with and without source resistance, biasing using drain to gate feedback resistor, biasing using constant current source, body effect, Problem solving.</p>					
<b>UNIT - V</b>					
<p><b>MOSFET Small Signal Operation Models</b>– the dc bias, separating the DC analysis and the signal analysis, Small signal equivalent circuit models, the transconductance, the T equivalent circuit model, Single stage MOS Amplifiers – common source (CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, Problem Solving.</p>					



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**Textbooks:**

4. Adel S. Sedra and Kenneth C. Smith, “Microelectronic Circuits – Theory and Applications”, 6<sup>th</sup> Edition, Oxford Press, 2013.
5. J. Milliman and C Halkias, “Integrated electronics”, 2nd Edition, Tata McGraw Hill, 1991.

**Reference Books:**

1. Donald A Neamen, “Electronic Circuits – analysis and design”, 3rd Edition, McGrawHill (India), 2019.
2. Behzad Razavi, “Microelectronics”, Second edition, Wiley, 2013.
3. R.L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuits,” 9th Edition, Pearson, 2006.
4. Jimmie J Cathey, “Electronic Devices and Circuits,” Schaum’s outlines series, 3<sup>rd</sup> edition, McGraw-Hill (India), 2010.



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**Electronics & Communication Engineering**

Course Code	DIGITAL LOGIC DESIGN	L	T	P	C
		3	0	0	3
<b>II Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• Understand the properties of Boolean algebra, logic operations, and minimization of Boolean functions.</li> <li>• Analyze combinational and analyze sequential logic circuits.</li> <li>• Understand the concepts of FSM and compare various Programmable logic devices.</li> <li>• Model combinational and sequential circuits using HDLs.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• Understand the properties of Boolean algebra, logic operations, concepts of FSM</li> <li>• Apply techniques for minimization of Boolean functions</li> <li>• Analyze combinational and Sequential logic circuits.</li> <li>• Design and Model combinational and sequential circuits using HDLs</li> </ul>					
<b>UNIT - I</b>	<b>Boolean algebra, logic operations, and minimization of Boolean functions</b>				
Number systems - binary numbers, octal, hexadecimal, other binary codes; complements, signed binary numbers, digital logic operations and gates, basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, complements of Boolean functions, two-level NAND and NOR Implementation of Boolean functions. The Karnaugh map method (up to five variables), product of sums simplifications, don't care conditions, Tabular method.					
<b>UNIT II</b>	<b>Combinational Logic Circuits</b>				
Combinational circuits, Design with basic logic gates, design procedure, adders, subtractors, 4-bit binary adder/ subtractor circuit, BCD adder, carry look- a-head adder, binary multiplier, magnitude comparator, data selectors, priority encoders, decoders, multiplexers, demultiplexers.					
<b>UNIT - III</b>	<b>Sequential Logic Circuits</b>				
Basic architectural distinction between combinational and sequential circuits, Design procedure, latches, flip-flops, truth tables and excitation tables, timing and triggering consideration, conversion of flip- flops, design of counters, ripple counters, synchronous counters, ring counter, Johnson counter, registers, shift registers, universal shift register.					
<b>UNIT - IV</b>	<b>Finite State Machines and Programmable Logic Devices</b>				
Types of FSM, capabilities and limitations of FSM, state assignment, realization of FSM using flip-flops, Mealy to Moore conversion and vice-versa, reduction of state tables using partition technique, Design of sequence detector. Types of PLD's: PROM, PAL, PLA.					
<b>UNIT - V</b>	<b>Hardware Description Language</b>				
Introduction to Verilog - structural specification of logic circuits, behavioral specification of logic circuits, hierarchical Verilog Code, Verilog for combinational circuits - conditional operator, if-else statement, case statement, for loop using sequential circuits with CAD tools. Verilog constructs for sequential circuits, flip-flop with clear capability, using Verilog constructs for registers and counters.					



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**Textbooks:**

1. M. Morris Mano, “Digital Design”, 3rd Edition, PHI. (Unit I to IV)
2. Stephen Brown and Zvonko Vranesic, “Fundamentals of Digital Logic with Verilog Design”, 3rd Edition, McGraw-Hill (Unit V)

**Reference Books:**

1. Charles H. Roth, Jr, “Fundamentals of Logic Design”, 4th Edition, Jaico Publishers.
2. Zvi Kohavi and Niraj K. Jha, “Switching and Finite Automata Theory, 3rd Edition, Cambridge University Press, 2010.
3. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, 2<sup>nd</sup> Edition, Prentice Hall PTR.
4. D.P. Leach, A.P. Malvino, “Digital Principles and Applications”, TMH, 7th Edition.
5. each, A.P. Malvino, “Digital Principles and Applications”, TMH, 7th Edition.



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Course Code	ELECTRONIC DEVICES & CIRCUITS LAB	L	T	P	C
		0	0	3	1.5
<b>II Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"><li>• Verify the theoretical concepts practically from all the experiments.</li><li>• Analyze the characteristics of Diodes, BJT, MOSFET, UJT.</li><li>• Design the amplifier circuits from the given specifications.</li><li>• Model the electronic circuits using tools such as PSPICE/Multisim</li></ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"><li>• Understand the characteristics and applications of basic electronic devices.</li><li>• Plot the characteristics of electronic devices.</li><li>• Analyze various biasing circuits and electronic circuits as amplifiers</li><li>• Design MOSFET / BJT based amplifiers for the given specifications.</li><li>• Simulate all circuits in PSPICE /Multisim.</li></ul>					
<b>LIST OF EXPERIMENTS: (Implement / Execute any 10 experiments).</b>					
<ol style="list-style-type: none"><li>1. Verify various clipping and clamper circuits using PN junction diode and draw the suitable graphs.</li><li>2. Study and draw the Volt Ampere characteristics of UJT and determine <math>\eta</math>, <math>I_P</math>, <math>I_V</math>, <math>V_P</math>, &amp; <math>V_V</math> from the experiment.</li><li>3. Verification of the input and output characteristics of BJT in Common Emitter configuration experimentally and find required parameters from the graphs.</li><li>4. Study and draw the input and output characteristics of BJT in Common Base configuration experimentally and determine required parameters from the graphs.</li><li>5. Verification of the input and output characteristics of BJT in Common Collector configuration experimentally and find required parameters from the graphs. Study and draw the V- I characteristics of JFET experimentally.</li><li>6. Study and draw the <b>output</b> and <b>transfer</b> characteristics of MOSFET (Enhance mode) in Common Source Configuration experimentally. Find <b>Threshold voltage (<math>V_T</math>)</b>, <b><math>g_m</math></b>, &amp; <b><math>K</math></b> from the graphs.</li><li>7. Study and draw the <b>output</b> and <b>transfer</b> characteristics of MOSFET (Depletion mode) or JFET in Common Source Configuration experimentally. Find <b><math>I_{DSS}</math></b>, <b><math>g_m</math></b>, &amp; <b><math>V_P</math></b> from the graphs.</li><li>8. Design and analysis of voltage- divider bias/self-bias circuit using BJT.</li><li>9. Design and analysis of self-bias circuit using MOSFET.</li><li>10. Design a suitable circuit for switch using MOSFET/BJT.</li><li>11. Design a small signal amplifier using MOSFET (common source) for the given specifications. Draw the frequency response and find the bandwidth.</li><li>12. Design a small signal amplifier using BJT(common emitter) for the given specifications. Draw the frequency response and find the bandwidth.</li></ol>					
<b>Tools / Equipment Required:</b> Software Toollike Multisim/ Pspice or Equivalent, DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.					



Course Code	DIGITAL DESIGN & SIGNAL SIMULATION LAB	L	T	P	C
		0	0	3	1.5
<b>II Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"><li>• Verify the truth tables of various logic circuits.</li><li>• Design sequential/combinational circuit using Hardware Description Language and verify their functionality.</li><li>• Simulate various Signals and Systems through MATLAB</li><li>• Analyze the output of a system when it is excited by different types of deterministic and random signals.</li></ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"><li>• Verify the truth tables of various logic circuits.</li><li>• Understand how to simulate different types of signals and system response.</li><li>• Design sequential and combinational logic circuits and verify their functionality.</li><li>• Analyze the response of different systems when they are excited by different signals and plot power spectral density of signals.</li><li>• Generate different random signals for the given specifications.</li></ul>					
<b>List of Experiments</b>					
<b>PART A</b>					
<ol style="list-style-type: none"><li>1. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.</li><li>2. Verification of functional table of 3 to 8-line Decoder /De-multiplexer</li><li>3. 4 variable logic function verification using 8 to 1 multiplexer.</li><li>4. Design full adder circuit and verify its functional table.</li><li>5. Design a four-bit ring counter using D Flip-Flops/JK Flip Flop and verify output.</li><li>6. Design a four-bit Johnson's counter using D Flip-Flops/JK Flip Flops and verify output</li><li>7. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.</li><li>8. 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.</li><li>9. Design MOD-8 synchronous counter using T Flip-Flop and verify the result and sketch the output waveforms.</li><li>10. (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.</li></ol>					
<b>References:</b>					
<ol style="list-style-type: none"><li>1. M. Morris Mano, "Digital Design", 3rd Edition, PHI</li></ol>					



**PART B**

**List of Experiments:**

1. Write a program to generate various Signals and Sequences: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc function.
2. Perform operations on Signals and Sequences: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
3. Write a program to find the trigonometric & exponential Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings- Plot the discrete spectrum of the signal.
4. Write a program to find Fourier transform of a given signal. Plot its amplitude and phase spectrum.
5. Write a program to convolve two discrete time sequences. Plot all the sequences.
6. Write a program to find autocorrelation and cross correlation of given sequences.
7. Write a program to verify Linearity and Time Invariance properties of a given Continuous System.
8. Write a program to generate discrete time sequence by sampling a continuous time signal. Show that with sampling rates less than Nyquist rate, aliasing occurs while reconstructing the signal.
9. Write a program to find magnitude and phase response of first order low pass and high pass filter. Plot the responses in logarithmic scale.
10. Write a program to generate Complex Gaussian noise and find its mean, variance, Probability Density Function (PDF) and Power Spectral Density (PSD).
11. Generate a Random data (with bipolar) for a given data rate (say 10kbps). Plot the same for a time period of 0.2 sec.
12. To plot pole-zero diagram in S-plane of given signal/sequence and verify its stability.

Note: Any 10 experiments. All the experiments are to be simulated using MATLAB or equivalent software.

**References:**

Stephen J. Chapman, “MATLAB Programming for Engineers”, Cengage, November 2012.



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Course Code	DATA STRUCTURES	L	T	P	C
		0	1	2	2
<b>II Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"><li>• To provide the knowledge of basic data structures and their implementations.</li><li>• To understand importance of data structures in context of writing efficient programs.</li><li>• To develop skills to apply appropriate data structures in problem solving.</li></ul>					
<b>Course Outcomes (CO):</b>					
CO1: Identify the role of data structures in organizing and accessing data. CO2: Design, implement, and apply linked lists for dynamic data storage. CO3: Develop applications using stacks and queues. CO4: Design and implement algorithms for operations on binary trees and binary search trees. CO5: Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.					
<b>UNIT I:</b>					
<b>Introduction to Data Structures:</b> Definition and importance of Data structures, Abstract data types (ADTs) and its specifications, <b>Arrays:</b> Introduction, 1-D, 2-D Arrays, accessing elements of array, Row Major and Column Major storage of Arrays, <b>Searching Techniques:</b> Linear & Binary Search, <b>Sorting Techniques:</b> Bubble sort, Selection sort, Quick sort.					
<b>Sample experiments:</b>					
<ol style="list-style-type: none"><li>1. Program to find min &amp; max element in an array.</li><li>2. Program to implement matrix multiplication.</li><li>3. Find an element in given list of sorted elements in an array using Binary search.</li><li>4. Implement Selection and Quick sort techniques.</li></ol>					
<b>UNIT II</b>					
<b>Linked Lists:</b> Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.					
<b>Sample experiments:</b>					
<ol style="list-style-type: none"><li>1. Write a program to implement the following operations. a. Insert                      b. Deletion                      c. Traversal</li><li>2. Write a program to store name, roll no, and marks of students in a class using circular double linked list.</li><li>3. Write a program to perform addition of given two polynomial expressions using linked list.</li></ol>					
<b>UNIT III</b>					
<b>Stacks:</b> Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.					
<b>Sample experiments:</b>					



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

#### **UNIT IV**

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

**Deque:** Introduction to deque (double-ended queues), Operations on deque and their applications.

**Sample experiments:**

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

#### **UNIT V**

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

**Sample experiments:**

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

**Textbooks:**

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

**Reference Books:**

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



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<b>Sri Krishnadevaraya University College of Engineering &amp; Technology</b>					
<b>Dept. Electronics and Communication Engineering</b>					
<b>II Year II Semester</b>					
<b>S.No</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.		Managerial Economics and Financial Analysis	MG	2-0-0	2
2.		Linear Control Systems	ES	3-0-0	3
3.		Electronic Circuit Analysis	PC	3-0-0	3
4.		EM Waves and Transmission Lines	PC	3-0-0	3
5.		Analog and Digital Communications	PC	3-0-0	3
6.		Electronic Circuit Analysis Lab	PC	0-0-3	1.5
7.		Analog and Digital Communications Lab	PC	0-0-3	1.5
8.		Soft Skills	SC	0-1-2	2
9.		Design Thinking and Innovation	BS& H	0-1-2	2
10.		Environmental Science	MC	2-0-0	-
<b>Total</b>					<b>21</b>
<b>Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation</b>					

<b>Category</b>	<b>CREDITS</b>
Management Course	2
Engineering Science Courses	3
Basic Science Courses	2
Skill Course	2
Professional Core Courses	12
<b>TOTAL CREDITS</b>	<b>21</b>



Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	L	T	P	C
		2	0	0	2
<b>II Year 2nd Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>To inculcate the basic knowledge of microeconomics and financial accounting</li> <li>To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost</li> <li>To Know the Various types of market structure and pricing methods and strategy</li> <li>To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.</li> <li>To provide fundamental skills on accounting and to explain the process of preparing financial statements.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>Define the concepts related to Managerial Economics, financial accounting and management</li> <li>Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets</li> <li>Apply the Concept of Production cost and revenues for effective Business decision</li> <li>Analyze how to invest their capital and maximize returns</li> <li>Evaluate the capital budgeting techniques.</li> <li>Develop the accounting statements and evaluate the financial performance of business entity .</li> </ul>					
<b>UNIT - I</b>	<b>Managerial Economics and Demand analysis</b>				
Introduction- Nature and Scope of Managerial Economics. Demand-Concept- Demand Function- Law of Demand and its Exceptions. Demand Elasticity- Types of Elasticity – Measurement- Significance of elasticity. Demand Forecasting-Factors governing Forecasting- Methods of Demand Forecasting.					
<b>UNIT - II</b>	<b>Production and Cost Analysis</b>				
Introduction –Production Function– Short run and long run Production Function- Isoquants and Isocosts, Least-Cost Combination. Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems) –Significance of BEA.					
<b>UNIT - III</b>	<b>Business Organizations and Markets</b>				
Introduction – Forms of Business Organizations- Sole Proprietorship - 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					
<b>UNIT - IV</b>	<b>Capital and Capital Budgeting</b>				
Introduction – Capital and its Significance- Types of Capital- Estimating Fixed and Working capital requirements- Sources of Short-term and Long-term Capital. Capital Budgeting– Features of capital budgeting Proposals, Methods and Evaluation of Projects – Pay Back Method, Accounting Rate of Return (ARR), Net Present Value (NPV) and Internal Rate Return (IRR) Method (sample problems)					
<b>UNIT-V Financial Accounting and Analysis</b>					
Introduction - Double-Entry Bookkeeping- preparation of Journal- Ledger -Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, Capital structure Ratios and Profitability Ratios					



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**Textbooks:**

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

**Reference Books:**

1. Ahuja HI 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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Course Code	LINEAR CONTROL SYSTEMS	L	T	P	C
		3	0	0	3
<b>II Year 2nd Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• Introduce the basic principles and applications of control systems.</li> <li>• Learn the time response and steady state response of the systems.</li> <li>• Know the time domain analysis and solutions to time invariant systems.</li> <li>• Understand different aspects of stability analysis of systems in frequency domain.</li> <li>• Understand the concept of state space, controllability and observability.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• Summarize the basic principles and applications of control systems.</li> <li>• Understand the time response and steady state response of the systems.</li> <li>• Understand the concept of state space, controllability and observability.</li> <li>• Apply time domain analysis to find solutions to time invariant systems.</li> <li>• Analyze different aspects of stability analysis of systems in frequency domain.</li> </ul>					
<b>UNIT - I</b>					
<b>Control Systems Concepts:</b> Open loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differentialequations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason’s gain formula. Controller components, DC Servomotor and AC Servomotor- their transfer functions, Synchros.					
<b>UNIT - II</b>					
<b>Time Response Analysis:</b> Step Response - Impulse Response - 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, Study of effects and Design of P, PI, PD and PID Controllers on second ordersystem.					
<b>UNIT - III</b>					
<b>Stability Analysis in Time Domain:</b> The concept of stability – Routh’s stability criterion – Stability and conditional stability - limitations of Routh’s stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.					
<b>UNIT - IV</b>					
<b>Frequency Response Analysis:</b> Introduction, Frequency domain specifications-Bode Diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram - Stability Analysis from Bode Plots. Polar Plots- Nyquist Plots- Phase margin and Gain Margin-Stability Analysis. Compensation techniques – Study of Effects and Design of Lag, Lead, Lag-Lead Compensator design in frequency Domain on a second order system.					
<b>UNIT-V</b>					
<b>State Space Analysis of Continuous Systems:</b> Concepts of state, state variables and state model - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, solving the Time invariant state Equations- State Transition Matrix and its Properties. System response through State Space models. The concepts of controllability and observability,					



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**Sri Krishnadevaraya University College of Engineering & Technology**  
**Ananthapuramu – 515 003 (A.P) India**  
**Electronics & Communication Engineering**

**Textbooks:**

1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5<sup>th</sup> edition, 2010.
2. Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P)Limited Publishers, 5<sup>th</sup> edition, 2007.

**References:**

1. Control Systems Principles & Design by M.Gopal, 4<sup>th</sup> Edition, McGraw Hill Education, 2012.
2. Automatic Control Systems by B. C. Kuo and Farid Golnaraghi, John Wiley and Sons, 8<sup>th</sup> edition, 2003.
3. Feedback and Control Systems, Joseph J Distefano III, Allen R Stubberud & Ivan J Williams, 2<sup>nd</sup> Edition, Schaum's outlines, McGraw Hill Education, 2013.
4. Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6<sup>th</sup> Edition, Pearson, 2010.



**Electronics & Communication Engineering**

Course Code	EM WAVES AND TRANSMISSION LINES	L	T	P	C
		3	0	0	3
<b>II Year 2nd Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>To understand and analyze different laws and theorems of electrostatic fields.</li> <li>To study and analyze different laws and theorems of magnetostatic fields.</li> <li>Analyzing Maxwell’s equations in different forms.</li> <li>To learn the concepts of wave theory and its propagation through various mediums.</li> <li>To get exposure to the properties of transmission lines.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>Learn the concepts of wave theory and its propagation through various mediums.</li> <li>Understand the properties of transmission lines and their applications.</li> <li>Apply the laws &amp; theorems of electrostatic fields to solve the related problems</li> <li>Gain proficiency in the analysis and application of magnetostatic laws and theorems.</li> <li>Analyze Maxwell’s equations in different forms.</li> </ul>					
<b>UNIT - I</b>					
Review of Co-ordinate Systems, <b>Electrostatics:</b> Coulomb’s Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell’s Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Poisson’s and Laplace’s Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.					
<b>UNIT - II</b>					
<b>Magnetostatics:</b> Biot-Savart Law, Ampere’s Circuital Law and Applications, Magnetic Flux Density, Maxwell’s Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere’s Force Law, Inductances and Magnetic Energy, Illustrative Problems. <b>Maxwell’s Equations (Time Varying Fields):</b> Faraday’s Law and Transformer EMF, Inconsistency of Ampere’s Law and Displacement Current Density, Maxwell’s Equations in Different Final Forms and Word Statements, Conditions at a Boundary Surface, Illustrative Problems.					
<b>UNIT - III</b>					
<b>EM Wave Characteristics:</b> Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types, Illustrative Problems.  Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem, Illustrative Problems.					
<b>UNIT - IV</b>					
<b>Transmission Lines - I :</b> Types, Parameters, T & $\pi$ Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Illustrative Problems.					
<b>UNIT-V</b>					
<b>Transmission Lines – II:</b> Input Impedance Relations, Reflection Coefficient, VSWR, Average Power, Shorted Lines, Open Circuited Lines, and Matched Lines, Low loss radio frequency and UHF Transmission lines, UHF Lines as Circuit Elements, Smith Chart – Construction and Applications, Quarter wave transformer, Single Stub Matching, Illustrative Problems.					



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**Textbooks:**

1. Elements of Electromagnetics, Matthew N.O. Sadiku, 4<sup>th</sup> Edition, Oxford University Press, 2008.
2. Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balmain, 2<sup>nd</sup> Edition, PHI, 2000.

**References:**

1. Electromagnetic Field Theory and Transmission Lines, G. S. N. Raju, 2<sup>nd</sup> Edition, Pearson Education, 2013.
2. Engineering Electromagnetics, William H. Hayt Jr. and John A. Buck, 7<sup>th</sup> Edition, TataMcGraw Hill, 2006.
3. Electromagnetics, John D. Krauss, 3<sup>rd</sup> Edition, McGraw Hill, 1988.
4. Networks, Lines, and Fields, John D. Ryder, 2<sup>nd</sup> Edition, PHI publications, 2012.



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Course Code	ANALOG AND DIGITAL COMMUNICATIONS	L	T	P	C
		3	0	0	3
<b>II Year 2nd Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• Introduce various modulation and demodulation techniques of analog and digital communication systems.</li> <li>• Analyze different parameters of analog and digital communication techniques.</li> <li>• Understand function of various stages of AM, FM transmitters and Know characteristics of AM &amp; FM receivers.</li> <li>• Analyze the performance of various digital modulation techniques in the presence of AWGN.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• Recognize the basic terminology used in analog and digital communication technique for transmission of information/data.</li> <li>• Explain the basic operation of different analog and digital communication systems at baseband and passband level.</li> <li>• Compute various parameters of baseband and passband transmission schemes by applying basic engineering knowledge.</li> <li>• Analyze the performance of different modulation &amp; demodulation techniques to solve complex problems in the presence of noise.</li> <li>• Evaluate the performance of all analog and digital modulation techniques to know the merits and demerits of each one of them in terms of bandwidth and power efficiency.</li> </ul>					
<b>UNIT - I</b>					
Amplitude Modulation: Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, COSTAS Loop, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, principle of Vestigial side band modulation.					
<b>UNIT - II</b>					
Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Signal- Armstrong Method, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM., Concept of Pre-emphasis and de-emphasis					
<b>UNIT - III</b>					
Transmitters: Classification of Transmitters, AM Transmitters, FM Transmitters Receivers: Radio Receiver - Receiver Types - Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, AGC, Amplitude limiting, FM Receiver, Comparison of AM and FM Receivers.					
<b>UNIT - IV</b>					
Introduction to Noise: Types of Noise, Receiver Model, Noise in AM, DSB, SSB, and FM Receivers. Pulse Modulation: Types of Pulse modulation- PAM, PWM and PPM. Comparison of FDM and TDM. Pulse Code Modulation: PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, Delta Modulation, DPCM, Noise in PCM and DM.					
<b>UNIT-V</b>					
Digital Modulation Techniques: Coherent Digital Modulation Schemes – ASK, BPSK, BFSK, QPSK, Non-coherent BFSK, DPSK. M-ary Modulation Techniques, Power Spectra, Bandwidth Efficiency Baseband Transmission and Optimal Reception of Digital Signal: A Baseband Signal Receiver, Probability of Error, Optimum Receiver, Coherent Reception, ISI, Eye Diagrams					



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**Textbooks:**

1. Simon Haykin, “Communication Systems”, JohnWiley& Sons, 4<sup>th</sup> Edition, 2004.
2. Wayne Tomasi - Electronics Communication Systems-Fundamentals through Advanced, 5<sup>th</sup>Ed., PHI, 2009
3. B. P. Lathi, Zhi Ding “ Modern Digital and Analog Communication Systems”, Oxford press, 2011.

**References:**

1. Sam Shanmugam, “Digital and Analog Communication Systems”, JohnWiley& Sons, 1999.
2. Bernard Sklar, F. J. harris “Digial Communications: Fundamentals andApplications”, Pearson Publications, 2020.
3. Taub and Schilling, “ Principles of Communication Systems”, Tata McGraw Hill, 2007.



Course Code	ANALOG AND DIGITAL COMMUNICATIONS	L	T	P	C
		3	0	0	3
<b>II Year 2nd Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• Introduce various modulation and demodulation techniques of analog and digital communication systems.</li> <li>• Analyze different parameters of analog and digital communication techniques.</li> <li>• Understand function of various stages of AM, FM transmitters and Know characteristics of AM &amp; FM receivers.</li> <li>• Analyze the performance of various digital modulation techniques in the presence of AWGN.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• Recognize the basic terminology used in analog and digital communication technique for transmission of information/data.</li> <li>• Explain the basic operation of different analog and digital communication systems at baseband and passband level.</li> <li>• Compute various parameters of baseband and passband transmission schemes by applying basic engineering knowledge.</li> <li>• Analyze the performance of different modulation &amp; demodulation techniques to solve complex problems in the presence of noise.</li> <li>• Evaluate the performance of all analog and digital modulation techniques to know the merits and demerits of each one of them in terms of bandwidth and power efficiency.</li> </ul>					
<b>UNIT - I</b>					
Multistage & Differential Amplifiers: Introduction, Classification of Amplifiers, Distortion in amplifiers, Coupling Schemes, RC Coupled Amplifier using BJT, Cascaded RC Coupled BJT Amplifiers, Cascode amplifier, Darlington pair, the MOS Differential Pair, Small-Signal Operation of the MOS Differential Pair, The BJT Differential Pair, and other Nonideal Characteristics of the Differential Amplifier.					
<b>UNIT - II</b>					
Frequency Response: Low-Frequency Response of the CS and CE Amplifiers, Internal Capacitive Effects and the High-Frequency Model of the MOSFET and the BJT, High-Frequency Response of the CE, Emitter follower, CS, CD, $f_{\beta}$ , $f_T$ and gain bandwidth product.					
<b>UNIT - III</b>					
Feedback Amplifiers: Introduction, The General Feedback Structure, Some Properties of Negative Feedback, The Four Basic Feedback Topologies, Series—Shunt, Series—Series, Shunt—Shunt, Shunt—Series. Oscillators: General Considerations, Phase Shift Oscillator, Wien-Bridge Oscillator, LC Oscillators, Relaxation Oscillator, Crystal Oscillators, Illustrative Problems.					
<b>UNIT - IV</b>					
Power Amplifiers: Introduction, Class A amplifiers (Series fed, Transformer coupled, Push pull), Second Harmonic distortion, Class B amplifiers (Push pull, Complementary symmetry), Crossover distortion and Class AB operation, Class C amplifiers, Power BJTs, MOS power transistors.					
<b>UNIT-V</b>					
Tuned Amplifiers: Introduction, single Tuned Amplifiers – Q-factor, frequency response, Double Tuned Amplifiers – Q-factor, frequency response, Concept of stagger tuning and synchronous tuning. Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.					



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**Electronics & Communication Engineering**

**Textbooks:**

1. Adel. S. Sedra and Kenneth C. Smith, “Micro Electronic Circuits,” 6th Edition, Oxford University Press, 2011.
2. J. Millman, H. Taub and Mothiki S. PrakashRao - Pulse, Digital and Switching Waveforms –2nd Ed., TMH, 2008.
3. Millman, C Chalkias, “Integrated Electronics”, 4thEdition, McGraw Hill Education(India) Private Ltd., 2015.

**References:**

1. Behzad Razavi, “Fundamentals of Micro Electronics”, Wiley, 2010.
2. Donald A Neamen, “Electronic Circuits – Analysis and Design,” 3rdEdition, McGrawHill (India), 2019.
3. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuits Theory”,9th Edition, Pearson/Prentice Hall, 2006.



Course Code	ELECTRONIC CIRCUITS ANALYSIS LAB	L	T	P	C
		0	0	3	1.5
<b>II Year 2nd Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"><li>Plot the characteristics of Differential amplifiers, feedback and power amplifiers.</li><li>Analyze the response of tuned amplifiers and multivibrators.</li><li>Categorize different oscillator circuits based on the application.</li><li>Design the electronic circuits for the given specifications and for a given application</li></ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"><li>Know about the usage of equipment/components/software tools used to conduct experiments in analog circuits.</li><li>Conduct the experiment based on the knowledge acquired in the theory about various analog circuits using BJT/MOSFETs to find the important parameters of the circuit experimentally.</li><li>Analyze the given analog circuit to find required important metrics of it theoretically.</li><li>Compare the experimental results with that of theoretical ones and infer the conclusions.</li><li>Design the circuit for the given specifications.</li></ul>					
<b>List of Experiments:</b>					
<ol style="list-style-type: none"><li>Design and Analysis of Darlington pair.</li><li>Frequency response of CE – CC multistage Amplifier</li><li>Design and Analysis of Cascode Amplifier.</li><li>Frequency Response of Differential Amplifier</li><li>Design and Analysis of any two topologies of feedback amplifies and find the frequency response of it.</li><li>Design and Analysis of Class A power amplifier.</li><li>Design and Analysis of Class AB amplifier.</li><li>Design and Analysis of RC phase shift oscillator.</li><li>Design and Analysis of LC Oscillator</li><li>Frequency Response of Single Tuned amplifier</li><li>Design a Bistable Multivibrator and analyze the effect of commutating capacitors and draw the wave forms at base and collector of transistors.</li><li>Design an Astable Multivibrator and draw the wave forms at base and collector of transistors.</li><li>Design a Monostable Multivibrator and draw the input and output waveforms.</li><li>Draw the response of Schmitt trigger for gain of greater than and less than one.</li></ol>					
<p>Note: At least 12 experiments shall be performed.</p>					
<p>Faculty members who are handling the laboratory shall see that students are given design specifications for a given circuit appropriately and monitor the design and analysis aspects of the curriculum</p>					



Course Code	ANALOG AND DIGITAL COMMUNICATIONS	L	T	P	C
	LAB	0	0	3	1.5

## II Year 2nd Semester

**Course Objectives:**

- Understand the basics of analog and digital modulation techniques.
- Integrate theory with experiments so that the students appreciate the knowledge gained from the theory course.
- Design and implement different modulation and demodulation techniques and their applications.
- Develop cognitive and behavioral skills for performance analysis of various modulation techniques.

**Course Outcomes (CO):**

- Know about the usage of equipment/components/software tools used to conduct experiments in analog and digital modulation techniques.
- Conduct the experiment based on the knowledge acquired in the theory about modulation and demodulation schemes to find the important metrics of the communication system experimentally.
- Analyze the performance of a given modulation scheme to find the important metrics of the system theoretically.

**List of Experiments:**

Design the circuits and verify the following experiments taking minimum of six from each section shown below.

**Section-A**

1. AM Modulation and Demodulation
2. DSB-SC Modulation and Demodulation
3. Frequency Division Multiplexing
4. FM Modulation and Demodulation
5. Radio receiver measurements
6. PAM Modulation and Demodulation
7. PWM Modulation and Demodulation
8. PPM Modulation and Demodulation

**Section-B**

1. Sampling Theorem.
2. Time Division Multiplexing
3. Delta Modulation and Demodulation
4. PCM Modulation and Demodulation
5. BPSK Modulation and Demodulation
6. BFSK Modulation and Demodulation
7. QPSK Modulation and Demodulation
8. DPSK Modulation and Demodulation

Note: Faculty members (who are handling the laboratory) are requested to instruct the students not to use readymade kits for conducting the experiments. They are advised to make the students work in the laboratory by constructing the circuits and analyzing them during the lab sessions.



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Course Code	SOFT SKILLS	L	T	P	C
		0	1	2	2
<b>II Year 2nd Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To encourage all round development of the students by focusing on soft skills</li> <li>• To make the students aware of critical thinking and problem-solving skills</li> <li>• To enhance healthy relationship and understanding within and outside an organization</li> <li>• To function effectively with heterogeneous teams</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• List out various elements of soft skills</li> <li>• Describe methods for building professional image</li> <li>• Apply critical thinking skills in problem solving</li> <li>• Analyze the needs of an individual and team for well-being</li> <li>• Assess the situation and take necessary decisions</li> <li>• Create a productive workplace atmosphere using social and work-life skills ensuring personal and emotional well-being</li> </ul>					
<b>UNIT - I</b>	<b>Soft Skills &amp; Communication Skills</b>				
<p>Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills -Significance, process, types - Barriers of communication - Improving techniques.</p> <p><b>Activities:</b>            Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity.            (The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)            Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.            Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches-convincing- negotiating- agreeing and disagreeing with professional grace.            Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation.</p>					
<b>UNIT - II</b>	<b>Critical Thinking</b>				
<p>Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking - Reflection</p> <p><b>Activities:</b>            Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis</p>					
<b>UNIT - III</b>	<b>Problem Solving &amp; Decision Making</b>				
<p>Meaning &amp; features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods &amp; Styles</p> <p><b>Activities:</b>            Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.            Case Study &amp; Group Discussion</p>					
<b>UNIT - IV</b>	<b>Emotional Intelligence &amp; Stress Management</b>				
<p>Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips</p> <p><b>Activities:</b>            Providing situations for the participants to express emotions such as happiness, enthusiasm,</p>					

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gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates.

**UNIT-V Corporate Etiquette**

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette - Corporate grooming tips -Overcoming challenges

**Activities**

Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

**NOTE:-**

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear.

**Textbooks:**

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, I K International Publishing House, 2018

**Reference Books**

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand & Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press
6. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher : Vayu Education of India, 2014

**Online Learning Resources:**

1. [https://youtu.be/DUlsNJtg2L8?list=PLLy\\_2iUCG87CQhELCYtvXh0E\\_y-bOO1\\_q](https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCYtvXh0E_y-bOO1_q)
2. [https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel\\_j2PUy0pwjVUgj7KIJ](https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KIJ)
3. <https://youtu.be/-Y-R9hDI7IU>
4. <https://youtu.be/gkLsn4ddmTs>
5. <https://youtu.be/2bf9K2rRWwo>
6. <https://youtu.be/FchfE3c2jzc>
7. <https://www.businesstrainingworks.com/training-resource/five-free-business-etiquette-training-games/>
8. [https://onlinecourses.nptel.ac.in/noc24\\_hs15/preview](https://onlinecourses.nptel.ac.in/noc24_hs15/preview)
9. [https://onlinecourses.nptel.ac.in/noc21\\_hs76/preview](https://onlinecourses.nptel.ac.in/noc21_hs76/preview)



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<b>Course Code</b>	<b>DESIGN THINKING AND INNOVATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>1</b>	<b>2</b>	<b>2</b>

**II Year 2nd Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

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

**UNIT - I Introduction to Design Thinking**

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

**UNIT - II Design Thinking Process**

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

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

**UNIT - III Innovation**

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

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

**UNIT - IV Product Design**

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

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

**UNIT-V Design Thinking in Business Processes**

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

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

**Textbooks:**

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

**Reference Books:**

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



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**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/previ](https://swayam.gov.in/nd1_noc19_mg60/previ)



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<b>Course Code</b>	<b>ENVIRONMENTAL SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**II Year 2nd Semester**

**Course Objectives:**

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

**Course Outcomes (CO):**

- Analyze various energy sources and their environmental impacts.
- Understand ecosystem functions and propose biodiversity conservation strategies.
- Identify causes of pollution and recommend control measures.
- Evaluate climate change impacts and suggest mitigation strategies.
- Apply environmental management systems and sustainability practices.

**UNIT - I**

**NATURAL RESOURCES:**

**Energy resources:** Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources, non-conventional energy sources; Implications of energy use on the environment.

**Forest resources** – Use and over – exploitation, deforestation, **Water resources** – Use and over utilization of surface and ground water–**Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources

**Introduction to sustainable development:** Sustainable Development Goals (SDGs) - targets and indicators, challenges and strategies for SDGs.

**UNIT - II**

**ECOSYSTEMS:** Concept of an ecosystem, Structure and function of an ecosystem, Energy flow in the ecosystem, Ecological succession. Introduction, types, characteristic features, structure and function of Forest, Grassland, Desert and aquatic ecosystems.

**BIODIVERSITY AND ITS CONSERVATION:** genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts

**UNIT - III**

**ENVIRONMENTAL POLLUTION:** Definition, Cause, effects and control measures of Air, Water, Soil, Marine, Noise, Thermal and Nuclear Pollutions.

**SOLID WASTE MANAGEMENT:** Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution.

**UNIT - IV**

**Climate Change:** Impacts, Adaptation and Mitigation:

**Understanding climate change:** Natural variations in climate; Structure of atmosphere; **Anthropogenic climate change from greenhouse gas emissions**– past, present and future; Projections of global climate change

Impacts, vulnerability and adaptation to climate change. Observed impacts of climate change on ocean and land systems.

**Mitigation of climate change:** Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; Energy efficiency measures; Renewable energy sources; Carbon capture and storage.

**UNIT-V**



**Environmental Management**

Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control.

**Environmental management system:** ISO 14001, Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis, Environmental audit and impact assessment; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme.

**TEXTBOOKS:**

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by PalaniSwamy – Pearson education
3. Environmental Studies by Dr.S.AzeemUnnisa, Academic Publishing Company

**REFERENCES:**

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



**Sri Krishnadevaraya University College of Engineering & Technology**  
**Ananthapuramu – 515 003 (A.P) India**  
**Electronics & Communication Engineering**

<b>Course Code</b>	<b>COMMUNITY SERVICE PROJECT</b> .....Experiential learning through community engagement				

**II Year 2nd Semester**

**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 benefit 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 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 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 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 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- 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, housewives, etc
- A logbook must be maintained by each of the students, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- An 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.



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**Electronics & Communication Engineering**

- The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project reports 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, 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
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

**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

**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 project. 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, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should 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
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling lvel- observation.

**Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs**

Programs for School Children

1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant

themes. Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social

Entrepreneurship General Camps



1. General Medical camps
  2. Eye Camps
  3. Dental Camps
  4. Importance of protected drinking water
  5. ODF awareness camp
  6. Swatch Bharath
  7. AIDS awareness camp
  8. Anti Plastic Awareness
  9. Programs on Environment
  10. Health and Hygiene
  11. Hand wash programmes
  12. Commemoration and Celebration of important days
- Programs for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality

Development Common Programs

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –
  - i. Agriculture
  - ii. Health
  - iii. Marketing and Cooperation
  - iv. Animal Husbandry
  - v. Horticulture
  - vi. Fisheries
  - vii. Sericulture
  - viii. Revenue and Survey
  - ix. Natural Disaster Management
  - x. Irrigation
  - xi. Law & Order
  - xii. Excise and Prohibition

**Role of Students:**

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.
- An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

**Timeline for the Community Service Project**

**Activity Duration: 8 weeks**

**1. Preliminary Survey (One Week)**



- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

**2. Community Awareness Campaigns (One Week)**

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

**3. Community Immersion Programme (Three Weeks)**

**Along with the Community Awareness Programmes**, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

**4. Community Exit Report (One Week)**

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University. Throughout the Community Service Project, a daily logbook need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.



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**Electronics & Communication Engineering**

<b>Sri Krishnadevaraya University College of Engineering &amp; Technology</b>					
<b>Dept. Electronics and Communication Engineering</b>					
<b>III Year, I Semester</b>					
S.No.	CourseCode	Course Name	Category	L-T-P	Credits
1.		Analog and Digital IC Applications	PC	3-0-0	3
2.		Antennas & Wave Propagation	PC	3-0-0	3
3.		Microprocessors and Microcontrollers	PC	3-0-0	3
4.		1. Computer Architecture & Organization 2. Fuzzy & Neural Networks 3. Detection and Estimation Theory	PE-1	3-0-0	3
5.		1.Fundamentals of Microprocessors and Microcontrollers 2.Fundamentals of Digital Electronics 3.Basics of Signals and Systems	OE-1	3-0-0	3
6.		Analog & Digital IC Applications Lab	PC	0-0-3	1.5
7.		Microprocessors and Microcontrollers Lab	PC	0-0-3	1.5
8.		PCB Design and Prototype development (SEC – III)	SOC	0-1-2	2
9.		Tinkering Lab	ES	0-0-2	1
10.		Evaluation of Community Service Internship	PR	0-0-0	2
<b>Total</b>					<b>23</b>

Category	CREDITS
Professional Core Courses	12
Professional Elective courses	3
Open Elective Course/Job oriented elective	3
Skill Enhancement course/soft skill course*	2
Engineering Science	1
Community Service Internship	2
<b>TOTAL CREDITS</b>	<b>23</b>



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**Electronics & Communication Engineering**

Course Code	ANALOG AND DIGITAL IC APPLICATIONS		L	T	P	C
			3	0	0	3
<b>III Year 1<sup>st</sup> Semester</b>						
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• To introduce the classification of Integrated Circuits, internal blocks, and characteristics of Operational Amplifiers (Op-Amps).</li> <li>• To analyze the linear and non-linear applications of Op-Amps.</li> <li>• To gain knowledge about active filters, timers, and phase-locked loops (PLLs).</li> <li>• To understand the working principles of voltage regulators and converters.</li> <li>• To study various types of digital ICs and explore their applications.</li> </ul>						
<b>Course Outcomes (CO):</b>						
<b>At the end of the course, the students will be able to</b>						
<ul style="list-style-type: none"> <li>• Understand the classification of Integrated Circuits, internal blocks and characteristics of Op-Amp.</li> <li>• Analyze linear and non-linear applications of Op-Amp.</li> <li>• Gain knowledge on active filters, timers and phased locked loops.</li> <li>• Understand the working of Voltage Regulators and Converters.</li> <li>• Know about different types of Digital ICs and their applications.</li> </ul>						
<b>UNIT - I</b>	<b>ICs and OP-AMPS</b>					
<b>Integrated Circuits and Operational Amplifier:</b> Introduction, Classification of IC 's, ICchip size and circuit complexity, basic information of Op-Amp IC741 and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC, Features of 741 Op-Amp.						
<b>UNIT II</b>	<b>Applications of OP-AMP</b>					
<b>Linear Applications of Op-Amp:</b> Inverting, non-inverting, Differential amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, Integrator and differentiator.						
<b>Non-Linear Applications of Op-Amp:</b> Sample and Hold circuit, Log and Anti log amplifier, multiplier and divider, Comparators, Schmitt trigger, Multi vibrators, Triangular and Square waveform generators, Oscillators.						
<b>UNIT - III</b>	<b>Active Filters and other ICs</b>					
<b>Active Filters:</b> Introduction, Butterworth filters – 1 <sup>st</sup> order, 2 <sup>nd</sup> order low pass and high pass filters, band pass, band reject and all pass filters.						
<b>Timer and Phase Locked Loops:</b> Introduction to IC 555 timer, description of functional diagram, monostable and a stable operations and applications, Schmitt trigger, PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566), low pass filter, monolithic PLL and applications of PLL.						
<b>UNIT - IV</b>	<b>Voltage Regulators and Converters</b>					
<b>Voltage Regulator:</b> Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.						
<b>D to A and A to D Converters:</b> Introduction, basic DAC techniques-weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.						
<b>UNIT - V</b>	<b>Digital ICs</b>					
<b>CMOS Logic:</b> CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic.						
<b>Combinational Logic IC's:</b> Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers,						



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Parallel Binary Adder/ Subtractor, Magnitude Comparators.

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

**Textbooks:**

1. D. Roy Choudhury, Shail B. Jain, *Linear Integrated Circuit*, 4th Edition, 2012, New Age International Pvt. Ltd., New Delhi, India.
2. Floyd, Jain, *Digital Fundamentals*, 8th Edition, 2009, Pearson Education, New Delhi, India.

**Reference Books:**

1. Ramakant A. Gayakwad, *OP-AMP and Linear Integrated Circuits*, 4th Edition, 2012, Prentice Hall / Pearson Education, New Delhi, India.
2. Sergio Franco, *Design with Operational Amplifiers and Analog Integrated Circuits*, 1997, McGraw Hill, New Delhi, India.
3. Gray, Meyer, *Analysis and Design of Analog Integrated Circuits*, 1995, Wiley International, New Delhi, India.



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Course Code	ANTENNAS & WAVE PROPAGATION	L	T	P	C
		3	0	0	3
<b>III Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<p>To learn the antennas basic terminology, radiation mechanism of antennas and dipole antennas.</p> <ul style="list-style-type: none"> <li>• To gain knowledge on HF, VHF &amp; UHF antennas, their operation and applications.</li> <li>• Analyze the working and applications of Microwave antennas.</li> <li>• Understand different techniques involved in the design of antenna arrays and antenna parameter measurements.</li> <li>• To study the various types of radio wave propagation methods.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<b>At the end of the course, the students will be able to</b>					
<ul style="list-style-type: none"> <li>• Understand the antennas basic terminology and radiation mechanism of antennas.</li> <li>• Gain knowledge on VHF and UHF antennas, their operation and applications.</li> <li>• Design and analyze the working and applications of Microwave antennas.</li> <li>• Analyzed different techniques involved in the design of antenna arrays and antenna parameter measurements.</li> <li>• Gain a comprehensive knowledge about the types of radio wave propagation methods.</li> </ul>					
<b>UNIT - I</b>	<b>Antenna Basics &amp; Dipole antennas</b>				
Definition of antenna, Radiation Mechanism – single wire, two wire, dipoles, Antenna Parameters - Radiation Patterns, Main Lobe and Side Lobes, Beam widths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Aperture Efficiency, Effective Height and length, Antenna Theorems. Radiation – Basic Maxwell's equations, Retarded potential-Helmholtz Theorem, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Field Components, Radiated power, Radiation Resistance, Beam width, Natural current distributions, far fields and patterns of Thin Linear Center-fed Antennas of different lengths, Illustrative problems.					
<b>UNIT II</b>	<b>HF, VHF and UHF Antennas:</b>				
Loop Antennas - Introduction, Small Loop, Comparison of far fields of small loop and short dipole, Radiation Resistances and Directives of small and large loops (Qualitative Treatment), Arrays with Parasitic Elements - Yagi - Uda Arrays, Folded Dipoles & their characteristics. Log periodic Antenna, Helical Antennas-Helical Geometry, Helix modes, Practical Design considerations for Monofilar Helical Antenna in Axial and Normal Modes. Horn Antennas- Types, Fermat's Principle, Optimum Horns, Design considerations of Pyramidal Horns, Illustrative Problems					
<b>UNIT - III</b>	<b>Microwave Antennas :</b>				
Micro strip Antennas- Introduction, features, advantages and limitations, Rectangular patch antennas- Geometry and parameters, characteristics of Micro strip antennas, Impact of different parameters on characteristics, reflector antennas - Introduction, Flatsheet and corner reflectors, parabola reflectors- geometry, pattern characteristics, Feed Methods, Reflector Types-Related Features, Lens Antennas –Geometry of Non-metallic Dielectric Lenses, Zoning, Tolerances, Applications, Illustrative Problems					
<b>UNIT - IV</b>	<b>Antenna Arrays:</b>				
Point sources - Definition, Patterns, arrays of 2 Isotropic sources- Different cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, End fire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison, BSAa with Non-uniform Amplitude Distributions - General considerations and Bio nomial Arrays, Illustrative problems.					



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**Antenna Measurements:** Introduction, Sources of errors, Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement, Gain Measurements (by comparison, Absolute and 3-Antenna Methods).

<b>UNIT - V</b>	<b>Wave Propagation</b>
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Introduction, Definitions, Characterizations and general classifications, different modes of wave propagation, Ray/Mode concepts, Ground wave propagation (Qualitative treatment) - Introduction, Plane earth reflections, Space and surface waves, wave tilt, curved earth reflections, Space wave propagation - Introduction, field strength variation with distance and height, effect of earth's curvature, absorption, Super refraction, M-curves and duct propagation, scattering phenomena, troposphere propagation, fading and path loss calculations, Sky wave propagation - Introduction, structure of Ionosphere, refraction and reflection of sky waves by Ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and Skip distance, Relation between MUF and Skip distance, Multi-HOP propagation, Energy loss in Ionosphere, Summary of Wave Characteristics in different frequency ranges, Illustrative problems.

**Text books:**

1. John D. Kraus, Ronald J. Marhefka, and Ahmad S. Khan, *Antennas and Wave Propagation*, 4th Edition, 2010, TMH, New Delhi, India.
2. C. A. Balanis, *Antenna Theory – Analysis and Design*, 2nd Edition, 2001, John Wiley & Sons, New Delhi, India.
3. K. D. Prasad and Satya Prakashan, *Antennas and Wave Propagation*, 2001, Tech. India Publications, New Delhi, India.

**Reference Books:**

1. E. C. Jordan and K. G. Balmain, *Electromagnetic Waves and Radiating Systems*, 2nd Edition, 2000, PHI, New Delhi, India.
2. G. S. N. Raju, *Antenna and Wave Propagation*, 3rd Edition, 2009, Pearson Education India, New Delhi, India.
3. R. K. Shevgaonkar, *Electromagnetic Waves*, 2006, Tata McGraw-Hill, New Delhi, India



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Course Code	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3
<b>III Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To learn the fundamental architectural concepts of microprocessors.</li> <li>• To gain knowledge about assembly language programming concepts.</li> <li>• To get familiar about 8086 interfacing.</li> <li>• To understand the fundamentals of the 8051 Microcontroller.</li> <li>• To learn interfacing with the 8051 Microcontroller.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<b>At the end of the course, the students will be able to</b>					
<ul style="list-style-type: none"> <li>• Learn the fundamental architectural concepts of microprocessors.</li> <li>• Gain knowledge about assembly language programming concepts.</li> <li>• Understand the concepts of 8086 interfacing.</li> <li>• Learn the fundamentals of the 8051 microcontrollers.</li> <li>• Understand interfacing with the 8051 microcontroller.</li> </ul>					
<b>UNIT - I</b>	<b>8086 Architecture:</b>				
Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.					
<b>UNIT II</b>	<b>8086 Programming:</b>				
Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.					
<b>UNIT - III</b>	<b>8086 Interfacing:</b>				
Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDs, interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237A DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.					
<b>UNIT - IV</b>	<b>Microcontroller :</b>				
Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.					
<b>UNIT - V</b>	<b>Interfacing Microcontroller</b>				
Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors					
<b>Text books:</b>					
<ol style="list-style-type: none"> <li>1. Douglas V. Hall, S. S. P. Rao, <i>Microprocessors and Interfacing – Programming and Hardware</i>, 3rd Edition, 1994, Tata McGraw Hill Education Private Limited, New Delhi, India.</li> <li>2. K. M. Bhurchandi, A. K. Ray, <i>Advanced Microprocessors and Peripherals</i>, 3rd Edition, 2017, McGraw Hill Education, New Delhi, India.</li> <li>3. Raj Kamal, <i>Microcontrollers: Architecture, Programming, Interfacing and System Design</i>, 2nd Edition, 2012, Pearson, New Delhi, India.</li> </ol>					
<b>Reference Books:</b>					



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1. Ramesh S. Gaonkar, *Microprocessor Architecture, Programming and Applications with the 8085*, 6th Edition, 2013, Penram International Publishing, New Delhi, India.
2. Kenneth J. Ayala, *The 8051 Microcontroller*, 3rd Edition, 2004, Cengage Learning, New Delhi, India.



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Course Code	COMPUTER ARCHITECTURE & ORGANIZATION (Professional Elective-I)	L	T	P	C
		3	0	0	3
<b>III Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To learn the design of various functional units of digital computers and the performance issues of computer systems.</li> <li>• To understand the basic processing unit and its connections.</li> <li>• To get familiar with different types of data representation and computer arithmetic operations.</li> <li>• To know about different types of memory and their interconnections.</li> <li>• To learn the basics of parallel computing and pipelining.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<p><b>At the end of this course, the students will be able to</b></p> <ul style="list-style-type: none"> <li>• Learn the design of various functional units of digital computers and performance issues of computer systems.</li> <li>• Understand the basic processing unit and their connections.</li> <li>• Know about different types of Data representation and Computer Arithmetic operations.</li> <li>• Learn about different types of memory and their interconnections.</li> <li>• Understand the basics of parallel computing and pipelining.</li> </ul>					
<b>UNIT - I</b>	<b>Digital Computers</b>				
<p>Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.</p> <p><b>Register Transfer Language and Micro operations:</b> Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro-operations, shift micro-operations, Arithmetic logic shift unit.</p> <p><b>Basic Computer Organization and Design:</b> Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.</p>					
<b>UNIT II</b>	<b>Micro programmed Control &amp; Central Processing Unit:</b>				
<p>Control memory, Address sequencing, micro program example, design of control unit. General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.</p>					
<b>UNIT - III</b>	<b>Data Representation &amp; Computer Arithmetic</b>				
<p><b>Data Representation</b> Data types, Complements, Fixed Point Representation, Floating Point Representation.</p> <p><b>Computer Arithmetic</b> Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.</p>					
<b>UNIT - IV</b>	<b>Input-Output Organization &amp; Memory Organization:</b>				
<p><b>Input-Output Organization:</b> Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.</p> <p><b>Memory Organization:</b> Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.</p>					
<b>UNIT - V</b>	<b>Reduced Instruction Set Computer</b>				



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CISC Characteristics, RISC Characteristics. Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor. Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Inter-processor arbitration, Inter-processor communication and synchronization, Cache Coherence.

**Text books:**

1. Computer System Architecture–M. Moris Mano, Third Edition, Pearson/PHI.

**Reference Books:**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, *Computer Organization*, 5th Edition, McGraw Hill, New Delhi, India.
2. William Stallings, *Computer Organization and Architecture*, 6th Edition, Pearson / PHI, New Delhi, India.
3. Andrew S. Tanenbaum, *Structured Computer Organization*, 4th Edition, PHI / Pearson, New Delhi, India.



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Course Code	<b>FUZZY AND NEURAL NETWORKS (Professional Elective-I)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>III Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• Understand the fundamentals and types of neural networks</li> <li>• Explain the learning and adaptation capability of neural networks</li> <li>• Design, Analyze and train the neural network models</li> <li>• Describe the principles of knowledge based neural networks.</li> <li>• Understand engineering applications that can learn using neural networks</li> <li>• Understand the fuzzy sets, and apply the knowledge for representation using fuzzy rules</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• Design and implement fuzzy inference systems for real-world control and decision-making applications.</li> <li>• Model and simulate fuzzy logic controllers for non-linear and imprecise systems using tools like MATLAB/Simulink or Python.</li> <li>• Design membership functions and fuzzy rules to address uncertainty and vagueness in data.</li> <li>• Develop single-layer and multi-layer neural network architectures (e.g., Perceptron, MLP) for classification and regression tasks.</li> <li>• Implement backpropagation algorithms to train feedforward neural networks.</li> <li>• Design hybrid systems by integrating fuzzy logic with neural networks (Neuro-Fuzzy systems).</li> <li>• Apply neural networks to pattern recognition and time-series prediction problems.</li> <li>• Evaluate model performance using training, validation, and testing datasets with accuracy, loss, and convergence criteria.</li> <li>• Build and optimize neural models using tools like TensorFlow, Keras, or MATLAB Neural Network Toolbox.</li> <li>• Analyze and compare fuzzy logic and neural network-based solutions for solving engineering and data-driven problems</li> </ul>					
<b>UNIT - I</b>	<b>BACKGROUND AND HISTORY</b>				
Knowledge-based Information Processing; Neural Information Processing; Hybrid Intelligence. <b>Basic Neural Computational Models</b> Basic concepts of neural networks (such as node properties, network properties, and dynamics); Inference and Learning (data representation and functional classification); Classification Models (Single Layer Perceptron's, Multi-Layer Perceptrons); Association Models (Hopfield Nets, Bi-directional Associative Memories); Self-Organizing Models (Kohonen Networks, Competitive Learning, Hebbian Learning).					
<b>UNIT II</b>	<b>LEARNING</b>				
Supervised and Unsupervised Learning; Statistical Learning; Neural Network Learning (Back Propagation, Radial Basis Function Networks, ART Networks); Genetic Algorithms. <b>Knowledge-Based Neural Networks &amp; Incremental Learning</b> Rule-Based Neural Networks; Network Training; Decision Tree-Based Neural Networks; Principles; Symbolic Methods; Neural Network Approaches (Probabilistic Neural Networks); Incremental RBCN.					
<b>UNIT - III</b>	<b>NN APPLICATIONS</b>				
Signal Processing; Computer Vision; Medical Applications; Automated Inspection and Monitoring; Business and Finance.					



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<b>UNIT - IV</b>	<b>FUZZINESS Vs PROBABILITY</b>	
Fuzzy Sets & Systems; The Geometry of Fuzzy Sets; The Fuzzy Entropy Theorem; The Subsethood Theorem; The Entropy Subsethood Theorem.		
<b>UNIT - V</b>	<b>FUZZY ASSOCIATIVE MEMORIES</b>	
Fuzzy & Neural Function Estimators; Fuzzy Hebbian FAMs; Adaptive FAMs. <b>Comparison of Fuzzy &amp; Neural Systems:</b> Case Studies.		
<b>Textbooks:</b>		
<ol style="list-style-type: none"> <li>1. Limin Fu, <i>Neural Networks in Computer Intelligence</i>, McGraw Hill Co., 1994.</li> <li>2. B. Kosko, <i>Neural Networks &amp; Fuzzy Systems</i>, Prentice Hall (India) Ltd., 1992.</li> <li>3. S. Haykin, <i>Neural Networks – A Comprehensive Foundation</i>, Maxell Macmillan International, 1991.</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. S. Rajasekaran &amp; G. A. Vijayalakshmi Pai, <i>Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications</i>, Prentice Hall of India (PHI).</li> <li>2. Timothy J. Ross, <i>Fuzzy Logic with Engineering Applications</i>, Wiley India.</li> <li>3. Simon Haykin, <i>Neural Networks and Learning Machines</i> (3rd Edition), Pearson Education.</li> </ol>		



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Course Code	DETECTION AND ESTIMATION THEORY (Professional Elective-I)	L	T	P	C
		3	0	0	3
<b>III Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To understand the impact of white Gaussian noise on the detection of signals.</li> <li>• To analyze the detection of deterministic signals and random signals.</li> <li>• To learn about the nonparametric detections.</li> <li>• To analyze estimation signal parameter and apply suitable estimation techniques.</li> <li>• To understand the signal estimation in Discrete-Time techniques.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<p><b>At the end of this course, the students will be able to</b></p> <ul style="list-style-type: none"> <li>• Understand the impact of white Gaussian noise on the detection of signals.</li> <li>• Analyze the detection of deterministic signals and random signals.</li> <li>• Learn about the nonparametric detections.</li> <li>• Analyze estimation signal parameter and apply suitable estimation techniques.</li> <li>• Understand the signal estimation in Discrete-Time techniques</li> </ul>					
<b>UNIT - I</b>	<b>Statistical Decision Theory</b>				
Review of Gaussian variables and processes; problem formulation and objective of signal detection and signal parameter estimation in discrete-time domain. Bayesian, minimax, and Neyman-Pearson decision rules, likelihood ratio, receiver operating characteristics, composite hypothesis testing, locally optimum tests, detector comparison techniques, asymptotic relative efficiency					
<b>UNIT II</b>	<b>Detection of Deterministic Signals &amp; Detection of Random Signals</b>				
<p><b>Detection of Deterministic Signals:</b> Matched filter detector and its performance; generalized matched filter; detection of sinusoid with unknown amplitude, phase, frequency and arrival time, linear model.</p> <p><b>Detection of Random Signals:</b> Estimator-correlator, linear model, general Gaussian detection, detection of Gaussian random signal with unknown parameters, weak signal detection</p>					
<b>UNIT - III</b>	<b>Nonparametric Detection</b>				
Detection in the absence of complete statistical description of observations, sign detector, Wilcoxon detector, detectors based on quantized observations, robustness of detectors.					
<b>UNIT - IV</b>	<b>Estimation of Signal Parameters</b>				
. Minimum variance unbiased estimation, Fisher information matrix, Cramer-Rao bound, sufficient statistics, minimum statistics, complete statistics; linear models; best linear unbiased estimation; maximum likelihood estimation, invariance principle; estimation efficiency; Bayesian estimation: philosophy, nuisance parameters, risk functions, minimum mean square error estimation, maximum a posteriori estimation.					
<b>UNIT - V</b>	<b>Signal Estimation in Discrete-Time</b>				
Linear Bayesian estimation, Weiner filtering, dynamical signal model, discrete Kalman filtering.					
<b>Textbooks:</b>					
<ol style="list-style-type: none"> <li>1. H. L. Van Trees, <i>Detection, Estimation and Modulation Theory: Part I, II, and III</i>, John Wiley, New York, 1968.</li> <li>2. H. V. Poor, <i>An Introduction to Signal Detection and Estimation</i>, 2nd Edition, Springer, 1998.</li> </ol>					
<b>Reference Books:</b>					



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1. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory", Prentice Hall PTR, 1993.
2. S. M. Kay, "Fundamentals of Statistical Signal Processing: Detection Theory", Prentice Hall PTR, 1998.



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Course Code	FUNDAMENTALS OF MICROPROCESSORS AND MICROCONTROLLERS (Open Elective-1)				L	T	P	C
					3	0	0	3
<b>Open Elective for non ECE Students</b>								
<b>Course Objectives:</b>								
<ul style="list-style-type: none"> <li>• To introduce fundamental architectural concepts of Microprocessors and Microcontrollers.</li> <li>• To impart knowledge on addressing modes and instruction set of 8086 and 8051</li> <li>• To introduce assembly language programming concepts</li> <li>• To explain memory and I/O interfacing with 8086 and 8051</li> </ul>								
<b>Course Outcomes (CO):</b>								
<ul style="list-style-type: none"> <li>• Distinguish between microprocessors &amp; microcontrollers</li> <li>• Develop assembly language programming</li> <li>• Describe interfacing of 8086 with peripheral devices</li> <li>• Design applications using microcontrollers.</li> </ul>								
<b>UNIT - I</b>	<b>8086 MICROPROCESSOR:</b>							
Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, minimum mode and maximum mode configuration.								
<b>UNIT II</b>	<b>8086 INSTRUCTIONS ET AND ASSEMBLER DIRECTIVES:</b>							
Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.								
<b>UNIT - III</b>	<b>8086 INTERFACING</b>							
Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDs, Interfacing seven segment displays, software and hardware interrupt applications, stepper motor, A/D and D/A converters, 8259 programmable interrupt controllers.								
<b>UNIT - IV</b>	<b>8051 MICROCONTROLLER:</b>							
Architecture of 8051 microcontroller. Pin Diagram of 8051, and external memories, counters and timers, serial communication, interrupts								
<b>UNIT - V</b>	<b>8051 ASSEMBLY LANGUAGE PROGRAMMING &amp; INTERFACING</b>							
Instruction set of 8051, Addressing modes of 8051, Assembly Language Programming examples using 8051. Interfacing to LCD, Keyboard, ADC & DAC								
<b>Textbooks:</b>								
<ol style="list-style-type: none"> <li>1. A. K. Ray and K. M. Bhurchandi, <i>Advanced Microprocessors and Peripherals</i>, 2nd Edition, 2000, Tata McGraw Hill, New Delhi, India.</li> <li>2. Mazidi and Mazidi, <i>8051 Microcontroller and Embedded Systems</i>, 2000, Pearson Education, New Delhi, India.</li> </ol>								
<b>Reference Books:</b>								
<ol style="list-style-type: none"> <li>1. Douglas V. Hall, <i>Microprocessors Interfacing</i>, Revised 2nd Edition, 2007, Tata McGraw Hill, New Delhi, India.</li> <li>2. Walter A. Triebel, Avtar Singh, <i>The 8088 and 8086 Microprocessors</i>, 4th Edition, 2003, PHI, New Delhi, India.</li> <li>3. Subrata Ghoshal, <i>8051 Microcontroller: Internals, Instructions, Programming and Interfacing</i>, PHI, New Delhi, India.</li> </ol>								



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Course Code	FUNDAMENTALS OF DIGITAL ELECTRONICS (Open Elective-1)	L	T	P	C
		3	0	0	3
<b>Open Elective for non ECE Students</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To familiarize with the concepts of different number systems and Boolean algebra.</li> <li>• To introduce the design techniques of combinational and sequential logic circuits.</li> <li>• To develop problem-solving skills in logic circuit design using modern techniques.</li> <li>• To understand practical applications of digital logic in computer systems and embedded devices.</li> <li>• To gain foundational knowledge for advanced topics in digital systems and computer architecture.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• Understand the properties of Boolean algebra, other logic operations, and minimization of Boolean functions using Karnaugh maps.</li> <li>• Apply the concepts to solve problems related to combinational and sequential logic circuits.</li> <li>• Analyze the design and functioning of combinational and sequential logic circuits.</li> <li>• Design logic circuits for practical applications in computer systems and embedded devices.</li> <li>• Demonstrate foundational knowledge for advanced digital systems and computer architecture topics.</li> </ul>					
<b>UNIT - I</b>	<b>Binary Systems</b>				
Binary logic; logic gates; postulates of Boolean algebra; two-value Boolean algebra; basic theorems of Boolean algebra; De Morgan's theorems; Boolean functions; Boolean forms.					
<b>UNIT II</b>	<b>Binary Logic and Boolean Algebra</b>				
Binary logic; logic gates; postulates of Boolean algebra; two-value Boolean algebra; basic theorems of Boolean algebra; De Morgan's theorems; Boolean functions; Boolean forms.					
<b>UNIT - III</b>	<b>Boolean Function Implementation</b>				
Need for simplification; K-map method: 2-variable K-map, 3-variable K-map, 4-variable K-map; K-map using don't care conditions; universal gates; NAND gate; NOR gate; NAND implementation; NOR implementation.					
<b>UNIT - IV</b>	<b>Basic Combinational Logic</b>				
Design procedure of combinational logic; adder (half adder, full adder); subtractor (half subtractor, full subtractor); code conversion (BCD – Excess-3 conversion); magnitude comparator; decoder; encoder; multiplexer; demultiplexer.					
<b>UNIT - V</b>	<b>Sequential Circuits</b>				
Classification of sequential circuits; basic flip-flops; excitation and characteristic tables; flip-flop conversions.					
<b>Textbooks:</b>					
<ol style="list-style-type: none"> <li>1. Zvi Kohavi, <i>Switching &amp; Finite Automata Theory</i>, 2nd Edition, TMH.</li> <li>2. Morris Mano, <i>Digital Design</i>, 3rd Edition, 2006, PHI.</li> <li>3. A. Anand Kumar, <i>Switching Theory and Logic Design</i>, 2008.</li> </ol>					
<b>Reference Books:</b>					
<ol style="list-style-type: none"> <li>1. Fletcher, <i>An Engineering Approach to Digital Design</i>, PHI.</li> <li>2. Charles H. Roth, <i>Fundamentals of Logic Design</i>, 5th Edition, 2004, Thomson Publications.</li> <li>3. John M. Yarbrough, <i>Digital Logic Applications and Design</i>, 2006, Thomson Publications.</li> </ol>					



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Course Code	BASICS OF SIGNALS AND SYSTEMS (Open Elective-1)	L	T	P
		3	0	0
<b>Open Elective for non ECE Students</b>				
<b>Course Objectives:</b>				
<ul style="list-style-type: none"> <li>• To introduce students to the basic idea of signal and system analysis and its characterization in time and frequency domains.</li> <li>• To present Fourier tools through the analogy between vectors and signals.</li> <li>• To teach the concept of sampling and reconstruction of signals.</li> <li>• To analyze characteristics of linear systems in time and frequency domains.</li> <li>• To understand Laplace and Z-transforms as mathematical tools to analyze continuous and discrete-time signals and systems.</li> </ul>				
<b>Course Outcomes(CO):</b>				
<p>At the end of this course, students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the mathematical description and representation of continuous-time and discrete-time signals and systems, including various transform techniques.</li> <li>• Apply the sampling theorem to convert continuous-time signals to discrete-time signals and reconstruct them, and use different transform techniques to solve signals and system-related problems.</li> <li>• Analyze the frequency spectra of various continuous-time and discrete-time signals using different transform methods.</li> <li>• Classify systems based on their properties and determine their response to different inputs.</li> </ul>				
<b>UNIT-I</b>	<b>Signals and Systems</b>			
<b>Signals &amp; Systems:</b> Basic definitions and classification of signals and systems (continuous-time and discrete-time), operations on signals, concepts of convolution and correlation of signals, analogy between vectors and signals – orthogonality, mean square error.				
<b>UNIT-II</b>	<b>Fourier Series and Fourier Transform</b>			
<b>Fourier Series:</b> Trigonometric & exponential forms, properties of Fourier series, concept of discrete spectrum, illustrative problems. <b>Continuous-Time Fourier Transform:</b> Definition, computation, and properties for different types of signals and systems; inverse Fourier transform. Statement and proof of the sampling theorem for low-pass signals, illustrative problems.				
<b>UNIT-III</b>	<b>Laplace Transform</b>			
<b>Laplace Transform:</b> Definition, region of convergence (ROC), properties, inverse Laplace transform, the S-plane and BIBO stability, transfer functions, system response to standard signals, solution of differential equations with initial conditions.				
<b>UNIT-IV</b>	<b>Signal Transmission through LTI systems</b>			
<b>Signal Transmission through Linear Systems:</b> Linear system, impulse response, response of a linear system for different input signals, linear time-invariant (LTI) system, linear time-variant (LTV) system, transfer function of an LTI system. Filter characteristics of linear systems; distortionless transmission through a system; signal bandwidth; system bandwidth; ideal LPF, HPF, and BPF characteristics; causality and Paley-Wiener criterion for physical realization; relationship between bandwidth and rise time; energy and power spectral densities, illustrative problems.				
<b>UNIT-V</b>	<b>DTFT&amp;Z-Transform</b>			
<b>Discrete-Time Fourier Transform:</b> Definition, computation, and properties for different types of signals and systems.				



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**Z–Transform:** Definition, ROC, properties, poles and zeros in Z-plane, inverse Z-transform, system analysis, transfer function, BIBO stability, system response to standard signals, solution of difference equations with initial conditions, illustrative problems.

**Textbooks:**

1. A. V. Oppenheim, A. S. Willsky, and S. H. Nawab, *Signals and Systems*, 2nd Edition, PHI, 2009.
2. Simon Haykin and Van Veen, *Signals & Systems*, 2nd Edition, Wiley, 2005.

**ReferenceBooks:**

1. B. P. Lathi, *Principles of Linear Systems and Signals*, 2nd Edition, Oxford University Press, 2015.
2. Matthew Sadiku and Warsame H. Ali, *Signals and Systems: A Primer with MATLAB*, CRC Press, 2016.
3. Hwei Hsu, *Schaum's Outline of Signals and Systems*, 4th Edition, TMH, 2019.



Course Code	ANALOG & DIGITAL IC APPLICATIONS LAB	L	T	P	C
		0	0	3	1.5
<b>III Year, 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To design an Inverting and Non-inverting Amplifier using an Op Amp.</li> <li>• To demonstrate the Linear and Non-Linear Applications using IC741.</li> <li>• To design Astable and Monostable Multivibrator using timer ICs.</li> <li>• To analyse the DAC and ADC converter.</li> <li>• To design Counters and Registers using digital ICs.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• Design an Inverting and Non-inverting Amplifier using an Op Amp.</li> <li>• Demonstrate the Linear and Non-Linear Applications using IC741.</li> <li>• Design Astable and Monostable Multivibrator using timer ICs.</li> <li>• Analyse the DAC and ADC converter.</li> <li>• Design Counters and Registers using digital ICs.</li> </ul>					
<b>List of Experiments:</b>					
<i>(At least 8 Linear and 4 Digital IC experiments shall be performed)</i>					
<b>Linear IC Experiments:</b>					
<ol style="list-style-type: none"> <li>1. Design an Inverting and Non-Inverting Amplifier using Op-Amp and calculate and verify the gain.</li> <li>2. Design an Adder and Subtractor using Op-Amp and verify the addition and subtraction process.</li> <li>3. Design a Comparator using Op-Amp; draw and analyze the comparison results for <math>A = B</math>, <math>A &gt; B</math>, and <math>A &lt; B</math>.</li> <li>4. Design Integrator and Differentiator Circuits using IC 741 and derive the required conditions practically.</li> <li>5. Design Active Low-Pass Filter (LPF) and High-Pass Filter (HPF); use a cutoff frequency of 2 kHz and calculate the roll-off.</li> <li>6. Design a Circuit using IC 741 to generate Sine, Square, and Triangular Waves; use a frequency of 1 kHz and draw the output waveforms.</li> <li>7. Construct a Monostable Multivibrator using IC 555 and draw and analyze the output waveform.</li> <li>8. Construct an Astable Multivibrator using IC 555; draw the output waveform and determine the duty cycle.</li> <li>9. Design a Schmitt Trigger Circuit; determine the Lower Threshold Point (LTP) and Upper Threshold Point (UTP).</li> <li>10. Design a Voltage Regulator using IC 723, IC 7805 / 7809 / 7912 and measure the load regulation factor.</li> </ol>					
<b>Digital IC Experiments:</b>					
<ol style="list-style-type: none"> <li>1. Design an R-2R Ladder DAC (Digital to Analog Converter); calculate its resolution and prepare a truth table with corresponding voltages.</li> </ol>					



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2. Design an ADC (Analog to Digital Converter); implement parallel comparator type, counter type, and successive approximation type; evaluate and compare their efficiency.
3. Design an 8×1 Multiplexer using Digital ICs and verify its operation with a truth table.
4. Design a 4-bit Adder/Subtractor using Digital ICs; demonstrate both addition and subtraction operations.
5. Design a Decade Counter; verify its truth table and draw the output waveforms.
6. Design an Up/Down Counter using IC 74163 and draw the read and write waveforms.
7. Design a Universal Shift Register using IC 74194 / 74195 and verify its shifting operations.
8. Design an 8×3 Encoder and a 3×8 Decoder and verify their truth tables and functionality.



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<b>Course Code</b>	<b>MICROPROCESSORS AND MICROCONTROLLERS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>LAB</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

**III Year 1<sup>st</sup> Semester**

**Course Objectives:**

- To become skilled in 8086 Assembly Language programming.
- To understand the detailed software and hardware structure of the microprocessor.
- Train their practical knowledge through laboratory experiments.
- To understand and learn 8051 Microcontroller.
- To acquire knowledge on microprocessor and microcontrollers, interfacing various peripherals, and configuring

**Course Outcomes (CO):**

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

- Formulate a program and implement algorithms using Assembly language.
- Describe an Assembly language program for the 8086 Microprocessor.
- Develop programs for different applications in the 8086 Microprocessor.
- Interface peripheral devices with 8086 and 8051.
- Use an Assembly/Embedded C programming approach for solving real-world problems.

**List of Experiments: (Any TEN of the experiments are to be conducted)**

**8086 Microprocessor-Based Experiments:**

1. **Programs for 16-bit Arithmetic Operations (Using Various Addressing Modes)**
  - a) Write an ALP to perform addition and subtraction of multi-precision numbers.
  - b) Write an ALP to perform multiplication and division of signed and unsigned hexadecimal numbers.
  - c) Write an ALP to find the square, cube, and factorial of a given number.
2. **Programs Involving Bit Manipulation Instructions**
  - a) Write an ALP to determine whether the given data is positive or negative.
  - b) Write an ALP to determine whether the given data is odd or even.
  - c) Write an ALP to find the number of logical 1's and 0's in a given data.
3. **Programs on Arrays for 8086**
  - a) Write an ALP to perform addition/subtraction of N numbers.
  - b) Write an ALP to find the largest/smallest number in an array.
  - c) Write an ALP to sort a given array in ascending/descending order.
4. **Programs on String Manipulations for 8086**
  - a) Write an ALP to find the length of a string.
  - b) Write an ALP to display a given string.
  - c) Write an ALP to compare two strings.
  - d) Write an ALP to reverse a string and check for palindrome.
5. **Programs for Digital Clock Design Using 8086**
  - a) Write an ALP to design a clock using INT 21H interrupt.
  - b) Write an ALP to design a clock using DOS interrupt functions.
  - c) Write an ALP to design a clock by reading the system time.
6. **Interfacing Stepper Motor with 8086**
  - a) Write an ALP to interface a stepper motor and operate it in clockwise direction with a variable step size.



b) Write an ALP to interface a stepper motor and operate it in anti-clockwise direction with a variable step size.

**7. Interfacing ADC/DAC with 8086**

a) Write an ALP to interface an ADC with 8086.

b) Write an ALP to interface a DAC with 8086 and generate square wave, triangular wave, or step signal.

**8. Communication Between Two Microprocessors**

a) Write an ALP for parallel communication between two microprocessors using 8255.

b) Write an ALP for serial communication between two microprocessor kits using 8251.

**8051 Microcontroller-Based Experiments:**

**9. Programs Using Arithmetic and Logical Instructions for 8051**

a) Write an ALP to perform arithmetic operations like addition, subtraction, multiplication, and division.

b) Write an ALP to perform logical operations like AND, OR, and XOR.

c) Write programs related to register banks.

**10. Programs to Verify Timers/Counters of 8051**

a) Create a delay of 25 ms using Timer 0 in Mode 1 and blink all pins of Port 0.

b) Create a delay of 50  $\mu$ s using Timer 1 in Mode 0 and blink all pins of Port 2.

c) Create a delay of 75 ms using Counter 0 in Mode 2 and blink all pins of Port 1.

d) Create a delay of 80  $\mu$ s using Counter 1 in Mode 1 and blink all pins of Port 3.

**11. UART Operation in 8051**

a) Write a program to transfer a character serially at a baud rate of 9600 using UART.

b) Write a program to transfer a character serially at a baud rate of 4800 using UART.

c) Write a program to transfer a character serially at a baud rate of 2400 using UART.

**12. Interfacing LCD with 8051**

a) Develop and execute a program to interface a 16 $\times$ 2 LCD with 8051.

b) Develop and execute a program to interface LCD to 8051 in 4-bit or 8-bit mode.

**Textbooks:**

1. Kenneth J. Ayala, *The 8051 Microcontroller*, 3rd Edition, Cengage Learning, 2010.

2. A. K. Ray and K. M. Bhurchandani, *Advanced Microprocessors and Peripherals*, 2nd Edition, TMH, 2006.

3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, *The 8051 Microcontroller and Embedded Systems: Using Assembly and C*, 2nd Edition, Pearson, 2000.



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Course Code	PCB DESIGN AND PROTOTYPE DEVELOPMENT (Skill Oriented Course)	L	T	P	C
		0	1	2	2
<b>III Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• Students can design the schematic of their circuit.</li> <li>• Students can create the PCB layout for their design.</li> <li>• Gain detailed understanding and hands-on experience in PCB designing.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<b>At the end of this course, the students will be able to</b>					
<ul style="list-style-type: none"> <li>• Students can design a schematic of their circuit.</li> <li>• Students can design a PCB layout for their circuit.</li> <li>• Students will gain detailed theoretical knowledge and practical experience in PCB designing.</li> </ul>					
<b>UNIT - I</b>	<b>Fundamental of basic electronics</b>				
Fundamental of basic electronics: Component identification, Component symbols & their footprints, understand schematic, creating new PCB, Browsing footprints libraries, Setting up the PCB layers, Design rule checking, Track width selection, Component selection, Routing and completion of the design					
<b>UNIT II</b>	<b>Introduction to PCB</b>				
Introduction to PCB: Definition and Need/Relevance of PCB, Background and History of PCB, Type of PCB, Classes of PCB Design, Terminology in PCB Design, Different Electronic design automation (EDA)tools and comparison.					
<b>UNIT - III</b>	<b>Design Process</b>				
Design Process: PCB Design Flow, Placement and routing, Steps involved in layout design, Art work generation Methods - manual and CAD, General design factors for digital and analogue circuits, Layout and Artwork making for Single-side, double-side and Multilayer Boards, Design for manufacturability, Design-specification standards.					
<b>Practice Exercises: Any twelve experiments are to be done</b>					
<p>1. Practice PCB design steps:</p> <ul style="list-style-type: none"> <li>• <b>Schematic Design:</b> Familiarization with the schematic editor, schematic creation, annotation, netlist generation.</li> <li>• <b>Layout Design:</b> Familiarization with footprint editor, mapping of components, creation of PCB layout schematic.</li> <li>• Create new schematic components.</li> <li>• Create new component footprints.</li> </ul> <p>2. Regulator circuit using 7805.</p> <p>3. Inverting Amplifier or Summing Amplifier using op-amp.</p> <p>4. Full-wave Rectifier.</p> <p>5. Astable Multivibrator using IC 555.</p> <p>6. Monostable Multivibrator using IC 555.</p> <p>7. RC Phase-shift Oscillator using transistor.</p> <p>8. Wein-bridge Oscillator using op-amp.</p> <p>9. Full-Adder using half-adders.</p>					



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10. 4-bit binary/MOD N counter using D-Flip flops.
11. One open-ended experiment (analog/digital/mixed) assigned by the teacher; students are expected to solve and execute/simulate independently.
12. Design an 8051 Development board with power section consisting of IC 7805, capacitor, resistor, headers, LED.
13. Design an 8051 Development board with serial communication section consisting of MAX232, capacitors, DB9 connector, jumper, LEDs.
14. Design an 8051 Development board with reset & input/output sections consisting of 89C51 microcontroller, electrolytic capacitor, resistor, jumper, crystal oscillator, capacitors.
15. Fabricate a single-sided PCB, mount the components, and assemble them in a cabinet for any of the above circuits

**Reference Books:**

1. Jon Varteresian, *Fabricating Printed Circuit Boards*, 2002.
2. R. Tummala, *Fundamentals of Microsystems Packaging*, McGraw-Hill, 2001.
3. C. Robertson, *PCB Designer's Reference*, Prentice Hall, 2003.
4. Open-source EDA Tool KiCad Tutorial.



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Course Code	<b>TINKERING LAB</b>			
	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>III Year 1<sup>st</sup> Semester</b>				
<b>Course Objectives:</b>				
<ul style="list-style-type: none"> <li>• Encourage Innovation and Creativity</li> <li>• Provide Hands-on Learning and Impart Skill Development</li> <li>• Foster Collaboration and Teamwork</li> <li>• Enable Interdisciplinary Learning, and Prepare for Industry and Entrepreneurship</li> <li>• Impart a Problem-Solving Mindset</li> </ul>				
<b>Course Outcomes (CO):</b>				
<ul style="list-style-type: none"> <li>• The students will be able to experiment, innovate, and solve real-world challenges.</li> </ul>				
<b>List of experiments:</b>				
<ol style="list-style-type: none"> <li>1. Make your own parallel and series circuits using a breadboard for any application of your choice.</li> <li>2. Demonstrate a traffic light circuit using a breadboard.</li> <li>3. Build and demonstrate an automatic street light using an LDR (Light Dependent Resistor).</li> <li>4. Simulate the Arduino LED blinking activity using Tinkercad.</li> <li>5. Build and demonstrate an Arduino LED blinking activity using the Arduino IDE.</li> <li>6. Interface an IR Sensor and Servo Motor with Arduino.</li> <li>7. Blink an LED using ESP32.</li> <li>8. Interface an LDR with ESP32.</li> <li>9. Control an LED using a mobile app.</li> <li>10. Design and 3D print a walking robot.</li> <li>11. Design and 3D print a rocket.</li> <li>12. Build a live soil moisture monitoring project and monitor soil moisture levels of a remote plant on your computer dashboard.</li> <li>13. Demonstrate all the steps in design thinking to redesign a motorbike.</li> </ol>				



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<b>Sri Krishnadevaraya University College of Engineering &amp; Technology</b>					
<b>Dept. Electronics and Communication Engineering</b>					
<b>III Year II Semester</b>					
S.No.	CourseCode	Course Name	Category	L-T-P	Credits
1.		Digital Signal Processing	PC	3-0-0	3
2.		Microwave Engineering & Optical Communications	PC	3-0-0	3
3.		VLSI Design	PC	3-0-0	3
4.		1. Electronic Measurements and Instrumentation 2. Artificial Intelligence & Machine learning 3. Speech Processing	PE-II	3-0-0	3
5.		1. Embedded systems 2. Information Theory and Coding 3. Satellite communications'	PE-III	3-0-0	3
6.		1. Microcontroller & Applications 2. Principles of Signal Processing 3. Electronic Instrumentation	OE-II	3-0-0	3
7.		Digital Signal Processing Lab	PC	0-0-3	1.5
8.		VLSI Design Lab/ Microwave and Optical Communications Lab	PC	0-0-3	1.5
9.		RF System Design tools/ Industrial IOT & Automation (SEC – V)	SOC	0-1-2	2
10.		Technical Paper Writing & IPR	AC	2-0-0	-
<b>Total</b>					<b>23</b>
Industrial/Research Internship (Mandatory) for 8 weeks duration during summer vacation					

Category	CREDITS
Professional Core Courses	12
Professional Elective courses	6
Open Elective Course/Job oriented elective	3
Skill Enhancement course/soft skill course*	2
Audit Course	0
<b>TOTAL CREDITS</b>	<b>23</b>



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Course Code	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To get familiar with the properties of discrete time signals, systems and z-transform.</li> <li>• To learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations.</li> <li>• To understand the implementations of digital filter structures.</li> <li>• To analyze the FIR filter design using Fourier series and windowing methods.</li> <li>• To gain the knowledge on Programmable DSP Devices.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<b>At the end of the course, the students will be able to</b>					
<ul style="list-style-type: none"> <li>• Familiar with the properties of discrete time signals, systems and z-transform.</li> <li>• Learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations.</li> <li>• Understand the implementations of digital filter structures.</li> <li>• Analyse the FIR filter design using Fourier series and windowing methods.</li> <li>• Gain the knowledge on Programmable DSP Devices.</li> </ul>					
<b>UNIT - I</b>	<b>INTRODUCTION TO DISCRETE TIME SIGNALS AND SYSTEMS</b>				
Introduction to digital signal processing, Review of discrete-time signals and systems, Analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems. analysis of linear time-invariant systems in the z-domain, pole-zero stability.					
<b>UNIT - II</b>	<b>DISCRETE FOURIER TRANSFORM &amp; FAST FOURIER TRANSFORM</b>				
<b>Discrete Fourier Transform</b> : Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT, sampling, Quantization effects.					
<b>Fast Fourier Transform:</b> Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).					
<b>UNIT - III</b>	<b>IIR FILTERS</b>				
<b>IIR Filters:</b> Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Frequency transformations, Basic structures of IIR Filters - Direct form- I, Direct form-II, Cascade form and Parallel form realizations.					
<b>UNIT - IV</b>	<b>FIR FILTERS</b>				
<b>FIR Filters:</b> Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanning, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations					
<b>UNIT-V</b>	<b>MULTIRATE DIGITAL SIGNAL PROCESSING</b>				
Introduction, Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion. Applications of digital signal processing Speech Signal Processing (Enhancement and Reproduction of speech signal), Image Processing (Steps in Digital Image Processing), Radar Signal					



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Processing (Nonlinear and No stationary signal processing).

**Textbooks:**

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2007.
2. A.V.Oppenheim and R.W. Schaffer, Discrete Time Signal Processing ,PHI.

**Reference Books:**

1. S.K.Mitra, Digital Signal Processing – A practical approach , 2nd Edition, Pearson Education, New Delhi, 2004.
2. MH Hayes, Digital Signal Processing, Schaum’s Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007.



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Course Code	MICROWAVE ENGINEERING AND OPTICAL COMMUNICATION	L	T	P	C
		3	0	0	3
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To analyze different modes of operation in rectangular wave guides, circular wave guides and resonators.</li> <li>• To study and analyze various microwave components and microwave sources.</li> <li>• To gain knowledge on different microwave semiconductor devices and microwave measurements procedures.</li> <li>• To analyze different optical fiber modes and to study different types of distortions and losses in optical communication.</li> <li>• To study various optical sources, optical detectors and to analyze various optical links.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<b>At the end of the course, the students will be able to</b>					
<ul style="list-style-type: none"> <li>• Analyze different modes of operation in rectangular wave guides, circular wave guides and resonators.</li> <li>• Understand and analyze various microwave components and microwave sources.</li> <li>• Gain knowledge on different microwave semiconductor devices and microwave measurements procedures.</li> <li>• Analyze different optical fiber modes and to study different types of distortions and losses in optical communication.</li> <li>• Understand study various optical sources, optical detectors and to analyze various optical links.</li> </ul>					
<b>UNIT - I</b>	<b>WAVEGUIDES</b>				
<b>Waveguides:</b> Introduction, Rectangular waveguides, Field expressions for TE and TM modes, Wave propagation in the guide, Phase and group velocities, Power transmission and attenuation, Waveguide current and mode excitation, Circular waveguide – TE and TM modes ( <b>Qualitative treatment only</b> ), Wave propagation, Cavity resonators ( <b>Qualitative treatment only</b> ).					
<b>UNIT - II</b>	<b>PASSIVE MICROWAVE DEVICES &amp; MICROWAVE AMPLIFIERS AND OSCILLATORS</b>				
<b>Passive Microwave Devices:</b> Introduction to scattering parameters and their properties, Terminations, Variable short circuit, Attenuators, Phase shifters, Hybrid Tees (H-plane, E-plane, Magic Tees), Directional Couplers – Bethe hole and Two hole Couplers, Deriving Scattering matrix for Microwave passive devices. Microwave propagation in Ferrites, Gyrator, Isolator, Circulator. <b>Microwave Amplifiers and Oscillators:</b> Microwave Tubes: Linear Beam Tubes – Two cavity Klystron amplifier -velocity modulation, bunching process, output power, Reflex Klystron oscillator, power output and efficiency, Travelling Wave Tube (TWT) – Bunching process and amplification process ( <b>Qualitative treatment only</b> ). Crossed Field Tubes – Magnetron oscillator, pi-mode operation, power output and efficiency, Hartree Condition.					
<b>UNIT - III</b>	<b>MICROWAVE SEMICONDUCTOR DEVICES &amp; MICROWAVE MEASUREMENTS</b>				
<b>Microwave Semiconductor Devices:</b> Gunn Oscillator – Principle of operation, Characteristics, Two valley model, IMPATT, TRAPATT diodes. <b>Microwave Measurements:</b> Description of Microwave bench-different blocks and their features, error and precautions, Microwave power measurements, Measurement of attenuation, frequency, VSWR (low, medium, high), Measurement of $Q$ of a cavity, Impedance measurements.					
<b>UNIT - IV</b>	<b>INTRODUCTION TO OPTICAL FIBERS AND TRANSMISSION</b>				



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<b>CHARACTERISTICS</b>	
<p><b>Introduction to Optical Fibers and Transmission Characteristics</b> - The propagation of light in optical waveguides – Classification of optical fibers – Numerical aperture, Step index and Graded index fiber – Modes in cylindrical fiber – Linearly polarized modes, Attenuation: Absorption, Scattering, Bending losses. Modal dispersion and chromatic dispersion – Single mode fiber - waveguide dispersion– MFD – PMD</p>	
<b>UNIT-V</b>	<b>OPTICAL TRANSMITTERS AND RECEIVERS</b>
<p><b>Optical Transmitters and Receivers:</b> Optical Sources: - Light source materials – LED homo and hetero structures – surface and edge emitters – Quantum efficiency – Injection Laser Diode – Modes and threshold condition – Structures and Radiation Pattern. Optical detectors: – Physical principles – PIN and APD diodes – Photo detector noise</p> <p><b>Optical Link Design:</b> Point- to- point links – System considerations – Link Power budget – Rise time budget.</p>	
<b>Textbooks:</b>	
<ol style="list-style-type: none"> <li>1. David M. Pozar,   Microwave Engineering   John Wiley &amp; Sons, Inc. 4<sup>th</sup> edition, 2012</li> <li>2. Samuel Y. Liao, —Microwave Devices and Circuits  , PHI publications, Third Edition, 1997.</li> <li>3. Gerd Keiser, —Optical Fiber Communications  , McGraw Hill, Third Edition, 2000.</li> </ol>	
<b>Reference Books:</b>	
<ol style="list-style-type: none"> <li>1. R. E. Collin, —Foundations for Microwave Engineering  , Wiley Student Edition, Second Edition, 2009.</li> <li>2. Om. P. Gandhi, —Microwave: Engineering and Applications  , Kai Fa Book Company, 1981.</li> <li>3. Reich H. J., et al, —Microwave Principles  , MIT Press, 1972.</li> <li>4. F E Terman, —Electronic and Radio Engineering  , McGraw Hill, 4th Edition, 1984</li> </ol>	



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Course Code	VLSI DESIGN	L	T	P	C
		3	0	0	3
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To understand the steps involved in fabrication of ICs using MOS transistor technology.</li> <li>• To learn about the VLSI design processes, Stick diagrams and Layouts.</li> <li>• To gain knowledge on the Gate Level Design concepts.</li> <li>• To learn the design of various subsystems with different VLSI Design styles.</li> <li>• To get familiar with CMOS testing techniques.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<b>At the end of the course, the students will be able to</b>					
<ul style="list-style-type: none"> <li>• Understand the steps involved in fabrication of ICs using MOS transistor technology.</li> <li>• Learn about the VLSI design processes, Stick diagrams and Layouts.</li> <li>• Gain knowledge on the Gate Level Design concepts.</li> <li>• Learn the design of various subsystems with different VLSI Design styles.</li> <li>• Familiar with CMOS testing techniques.</li> </ul>					
<b>UNIT - I</b>	<b>Introduction to VLSI</b>				
Introduction: Brief Introduction to IC technology MOS, PMOS, NMOS, CMOS & BiCMOS Technologies. Basic Electrical Properties of MOS and BiCMOS Circuits: $I_{DS} - V_{DS}$ relationships, MOS transistor Threshold Voltage, figure of merit, Transconductance, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.					
<b>UNIT - II</b>	<b>VLSI Circuit Design Processes</b>				
VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda( $\lambda$ )-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.					
<b>UNIT - III</b>	<b>Gate level Design</b>				
Gate level Design: Logic gates and other complex gates, Switch logic, Alternate gate circuits. Basic Circuit Concepts: Sheet Resistance $R_s$ and its concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out.					
<b>UNIT - IV</b>	<b>Subsystem Design</b>				
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, Introduction to Switch logic and Gate logic.					
<b>UNIT-V</b>	<b>CMOS Testing</b>				
Subsystem Design: Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters. VLSI Design styles: Full-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices, parameters influencing low power design.					
<b>Textbooks:</b>					
<ol style="list-style-type: none"> <li>1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, EshraghianDouglas, A. Pucknell, 2005, PHI.</li> <li>2. Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education.</li> </ol>					
<b>Reference Books:</b>					



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1. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.
2. BehzadRazavi , —Design of Analog CMOS Integrated Circuits, McGraw Hill, 2003.
3. Jan M. Rabaey, —Digital Integrated Circuits, AnanthaChandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2<sup>nd</sup> edition, 2009.



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Course Code	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (Professional Elective-II)	L	T	P	C
		3	0	0	3
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To know about the performance characteristics of instruments and measurement of electrical quantities.</li> <li>• To understand the construction, working and applications of different types of CRO's.</li> <li>• To analyze the working of different types of bridges.</li> <li>• To study the working of signal &amp; function generators and analyzers.</li> <li>• To analyze the working of sensors and transducers in measuring physical parameters.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<p><b>At the end of the course, the students will be able to</b></p> <ul style="list-style-type: none"> <li>• Learn about the performance characteristics of instruments and measurement of electrical quantities.</li> <li>• Understand the construction, working and applications of different types of CRO's.</li> <li>• Compare the working of different types of bridges.</li> <li>• Know the working of signal &amp; function generators and analyzers.</li> <li>• Grasp the working of sensors and transducers in measuring physical parameters.</li> </ul>					
<b>UNIT - I</b>	<b>Performance characteristics of Instruments</b>				
<p><b>Performance characteristics of Instruments:</b> Static characteristics, Accuracy, Precision, Resolution, Sensitivity, static and dynamic calibration, Errors in Measurement, and their statistical analysis, dynamic characteristics-speed of Response, fidelity, Lag and dynamic error. DC ammeters, DC voltmeters-multirange, range extension/solid state and differential voltmeters, AC voltmeters–multirange, range extension. Thermocouple type RF ammeter, ohm meters, series type, shunt type, multimeter for voltage, current and resistance measurements.</p>					
<b>UNIT - II</b>	<b>Oscilloscopes</b>				
<p><b>Oscilloscopes:</b> Introduction, Basic Principle, Standard specifications of CRO,CRT features, vertical and horizontal amplifiers, horizontal and vertical deflection systems, sweep trigger pulse, delay line, sync selector circuits, probes for CRO – active, passive, and attenuator type, triggered sweep CRO, and Delayed sweep, dual trace/beam CRO, Measurement of amplitude, frequency and phase (Lissajous method). Principles of sampling oscilloscope, storage oscilloscope, and digital storage oscilloscope, Digital frequency counters, time &amp; Period measurements.</p>					
<b>UNIT - III</b>	<b>Bridges</b>				
<p><b>Bridges:</b> 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.</p>					
<b>UNIT - IV</b>	<b>Signal Generators</b>				
<p><b>Signal Generators:</b> Signal generator-fixed and variable, AF oscillators, function generators, pulse, random noise, sweep, and arbitrary waveform generators, their standards, specifications and principles of working (Block diagram approach).Wave analyzers, Harmonic distortion analyzers, Spectrum analyzers, and Logic analyzers.</p>					
<b>UNIT-V</b>	<b>Sensors and Transducers</b>				
<p><b>Sensors and Transducers</b> - Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.</p>					
<b>Textbooks:</b>					



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1. A.D. Helfrick and W.D. Cooper, —Modern Electronic Instrumentation and Measurement Techniques, 5<sup>th</sup> Edition, PHI, 2002.
2. H.S.Kalsi, —Electronic Instrumentation, 2<sup>nd</sup> edition, Tata McGraw Hill, 2004.

**Reference Books:**

1. David A. Bell, —Electronic Instrumentation & Measurements, 2<sup>nd</sup> Edition, PHI, 2003.
2. K. Lal Kishore, —Electronic Measurements & Instrumentations, Pearson Education, 2009.



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Course Code	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING (Professional Elective-II)	L	T	P	C
		3	0	0	3
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To learn the basics and problems of Artificial Intelligence with rationality and structure of agents.</li> <li>• To describe the search for solutions using various search strategies &amp; algorithms for optimization.</li> <li>• To evaluate the representation of Agents with Propositional Logic in Shopping World.</li> <li>• To understand the concepts of Machine Learning with different Perspectives.</li> <li>• To analyze Decision Tree Representation with different problems&amp; issues.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<p style="text-align: center;"><b>At the end of the course, the students will be able to</b></p> <ul style="list-style-type: none"> <li>• To learn the basics and problems of Artificial Intelligence with rationality and structure of agents.</li> <li>• To describe the search for solutions using various search strategies &amp; algorithms for optimization.</li> <li>• To evaluate the representation of Agents with Propositional Logic in Shopping World.</li> <li>• To understand the concepts of Machine Learning with different Perspectives.</li> <li>• To analyze Decision Tree Representation with different problems&amp; issues.</li> </ul>					
<b>UNIT - I</b>	<b>INTRODUCTION</b>				
<b>Introduction:</b> What Is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.					
<b>UNIT - II</b>	<b>PROBLEM SOLVING</b>				
<b>Problem Solving:</b> Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.					
<b>UNIT - III</b>	<b>KNOWLEDGE REPRESENTATION</b>				
<b>Knowledge Representation:</b> Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World.					
<b>UNIT - IV</b>	<b>INTRODUCTION TO MACHINE LEARNING</b>				
<b>Introduction to Machine Learning:</b> Well-Posed Learning Problem, Designing a Learning system, Perspectives and Issues in Machine Learning. <b>Concept Learning and The General-to-Specific Ordering:</b> Introduction, A Concept Learning Task, Concept Learning as Search, FIND-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Remarks on Version spaces and Candidate-Elimination, Inductive Bias					
<b>UNIT-V</b>	<b>DECISION TREE LEARNING</b>				
<b>Decision Tree Learning:</b> Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.					
<b>Textbooks:</b>					
<ol style="list-style-type: none"> <li>1. Stuart Russell and Peter Norvig, —Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson</li> <li>2. Tom M. Mitchell, <i>Machine Learning</i>, McGraw Hill Edition, 2013</li> </ol>					
<b>Reference Books:</b>					



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1. Saroj Kaushik, —Artificial Intelligence, Cengage Learning India, 2011
2. Elaine Rich and Kevin Knight, —Artificial Intelligence, Tata McGraw Hill
3. David Poole and Alan Mackworth, —Artificial Intelligence: Foundations for Computational Agents, Cambridge University Press 2010.
4. Trivedi, M.C., —A Classical Approach to Artificial Intelligence, Khanna Publishing House, Delhi.



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Course Code	SPEECH PROCESSING (Professional Elective-II)	L	T	P	C
		3	0	0	3
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To impart knowledge on anatomy and physiology of speech organs and the process of Speech Production.</li> <li>• To understand the methods for extracting of speech using Time domain parameters.</li> <li>• To learn the Frequency Domain Methods for Speech Processing.</li> <li>• To interpret and analyze LPC Parameters for Speech Processing.</li> <li>• To introduce the concepts of homomorphic Speech Processing.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<p><b>At the end of the course, the students will be able to</b></p> <ul style="list-style-type: none"> <li>• Gain knowledge on anatomy and physiology of speech organs and the process of Speech Production.</li> <li>• Understand the methods for extracting of speech using Time domain parameters.</li> <li>• Learn the Frequency Domain Methods for Speech Processing.</li> <li>• Interpret and analyze LPC Parameters for Speech Processing.</li> <li>• Grasp the concepts of homomorphic Speech Processing.</li> </ul>					
<b>UNIT - I</b>	<b>FUNDAMENTALS OF DIGITAL SPEECH PROCESSING</b>				
<b>Fundamentals of Digital Speech Processing:</b> Anatomy & Physiology of Speech Organs, The process of Speech Production, The Acoustic Theory of Speech Production – Uniform lossless tube model, effect of losses in vocal tract and radiation at lips, Digital models for speech signals.					
<b>UNIT - II</b>	<b>TIME DOMAIN METHODS FOR SPEECH PROCESSING</b>				
<b>Time Domain Methods for Speech Processing:</b> Time domain parameters of speech, methods for extracting the parameters: Zero crossings, Auto-correlation function, pitch estimation.					
<b>UNIT - III</b>	<b>FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING</b>				
<b>Frequency Domain Methods for Speech Processing:</b> Short time Fourier analysis, Filter bank analysis, Spectrographic analysis, Formant extraction, Pitch extraction.					
<b>UNIT - IV</b>	<b>LINEAR PREDICTIVE CODING (LPC) FOR SPEECH</b>				
<b>Linear predictive Coding (LPC) for Speech:</b> Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains, Method of Solution of the LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.					
<b>UNIT-V</b>	<b>HOMOMORPHIC SPEECH PROCESSING</b>				
<b>Homomorphic Speech Processing:</b> Introduction Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, pitch Detection and Formant Estimation; Applications of speech processing – Speech Enhancement, Speech recognition, Speech synthesis and Speaker Verification.					
<b>Textbooks:</b>					
<ol style="list-style-type: none"> <li>1. L.R. Rabiner and S. W. Schafer, Digital Processing of Speech Signals, Pearson Education.</li> <li>2. Douglas O' Shaughnessy, Speech Communications: Human &amp; Machine, 2nd Ed., Wiley- IEEE Press.</li> </ol>					
<b>Reference Books:</b>					
<ol style="list-style-type: none"> <li>1. Thomas F. Quatieri, Discrete Time Speech Signal Processing: Principles and Practice, 1st Ed., Pearson Education.</li> <li>2. Ben Gold &amp; Nelson Morgan, Speech and Audio Signal Processing: Processing and Perception of Speech and Music ,1st Ed., Wiley.</li> </ol>					



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Course Code	EMBEDDED SYSTEM DESIGN (Professional Elective-III)	L	T	P	C
		3	0	0	3
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
The objectives of the course are to <ul style="list-style-type: none"> <li>• To introduce major components of an embedded system</li> <li>• To expose role of firmware, operating systems in correlation with hardware systems.</li> <li>• To explain interfacing of various communication and I/O devices to an embedded system</li> </ul> To demonstrate implementation of embedded systems for different applications					
<b>Course Outcomes (CO):</b>					
<b>At the end of the course, the students will be able to</b> <ul style="list-style-type: none"> <li>• Identify hardware and software components of an embedded system</li> <li>• Choose appropriate embedded system architecture for the given application</li> <li>• Discuss quality attributes and characteristics of an embedded system</li> <li>• Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment</li> </ul> Design simple embedded system-based applications					
<b>UNIT - I</b>	<b>Introduction to Embedded Systems</b>				
Introduction to Embedded Systems: What is embedded system, embedded systems vs general computing systems, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, Processor and OS trends in embedded system. Embedded hardware units and devices in a system, embedded software in a system and an overview of programming languages, skills required for an embedded system designer, examples of the embedded systems					
<b>UNIT - II</b>	<b>Core of the embedded system</b>				
Core of the embedded system, memory, sensors and actuators, communication interface, embedded firmware, other system components, Characteristics of an embedded system, Quality attributes of embedded systems					
<b>UNIT - III</b>	<b>I/O, Communication devices and Interrupt</b>				
I/O, Communication devices and Interrupt Service Mechanism: I/O types and examples, serial communication devices, parallel device ports, wireless devices, timer and counting devices; Interrupt-driven input and output, interrupt service routine concept, interrupt sources, hardware interrupts, software interrupts, interrupt-servicing mechanism, multiple interrupts, interrupt service threads as second-level interrupt handlers, context and the periods for context switching, interrupt latency, interrupt-service deadline, interrupt service mechanism form context-saving angle, direct memory access driven I/O, Device driver programming					
<b>UNIT - IV</b>	<b>Inter-process Communication (IPC):</b>				
Inter-process Communication (IPC): Multiple processes in an application, multiple threads in an application, tasks, task and thread states, tasks and data, distinction between function, ISR, IST and task by their characteristics, inter-process communication and synchronization, signals, concept of semaphores, disabling and enabling functions, shared data problem, queues and mailboxes, pipe and socket functions, remote procedure call functions.					
<b>UNIT-V</b>	<b>Designing Embedded Systems with 8051 Microcontroller</b>				
Designing Embedded Systems with 8051 Microcontroller: Factors to be considered in selection a controller, why 8051 microcontroller; Design Examples using 8051 Microcontroller: Displaying binary numbers using 8 LEDs, 2 phase 6-wire stepper motor control; Embedded Product Development Life Cycle (EDLC): Concept of EDLC, objectives of EDLC, different phases of EDLC, EDLC approaches.					
<b>Textbooks:</b>					



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1. Shibu K V, Introduction to Embedded Systems, 2<sup>nd</sup> edition, McGraw Hill Education, 2017.
2. Raj Kamal, Embedded Systems: Architecture, Programming and Design, 3<sup>rd</sup> edition, McGraw Hill Education, 2017.

**Reference Books:**

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C, 2<sup>nd</sup> edition, Pearson Education India, 2007



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Course Code	INFORMATION THEORY AND CODING (Professional Elective-III)	L	T	P	C
		3	0	0	3
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To provide an insight into the concept of information in the context of communication theory and communication receivers.</li> <li>• To implement various source coding algorithms and analyze their performance.</li> <li>• To gain knowledge about techniques for error detection and error correction.</li> <li>• To design linear block code and cyclic codes.</li> <li>• To get familiar with various convolution codes.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<p><b>At the end of the course, the students will be able to</b></p> <ul style="list-style-type: none"> <li>• Learn the concept of information in the context of communication theory and communication receivers.</li> <li>• Implement various source coding algorithms and analyze their performance.</li> <li>• Gain knowledge about techniques for error detection and error correction.</li> <li>• Design linear block codes and cyclic codes.</li> <li>• Understand various convolution codes.</li> </ul>					
<b>UNIT - I</b>	<b>Information Theory</b>				
<p><b>Information Theory:</b> Introduction, Definition of Entropy, Conditional Entropy, Relative Entropy, Basic Properties of Entropy, Mutual Information, Information Inequalities, Problem solving.</p> <p><b>Block to Variable length Coding:</b> Prefix-free Code, Coding a single Random Variable, Prefix, Free Code, Kraft Inequality, Bounds on optimal Code length, Coding a Single Random Variable, Rooted Tree with Probabilities, Shannon-Fano Coding, Free fix code, Coding an information Source, Huffman Coding, Example.</p> <p><b>Variable to Block Length Coding:</b> Proper message set, Assigning probabilities to K-ary rooted tree corresponding to a proper message set, Prefix free Coding of a proper message set, Tunstall message set, Tunstall coding.</p>					
<b>UNIT - II</b>	<b>Universal Source Coding:</b>				
<p>Asymptotic Equi-partition Property, Chebyshev inequality, Weak law of large numbers, Typical Sequences, Block to Block Coding of DMS: Consequences of Asymptotic Equipartition Property, Problem solving.</p> <p><b>Universal Source Coding:</b> Lempel-Ziv Algorithm, LZ -77 Encoding and Decoding, Lempel-Ziv Welch (LZW) Algorithm, LZW Encoding, and Decoding.</p> <p>Coding of Sources with memory, Channel Capacity, Noisy Channel Coding Theorem, Differential Entropy, Gaussian Channel, Rate Distortion Theory, Blahut-Arimoto Algorithm, problem solving.</p>					
<b>UNIT - III</b>	<b>Error Control Coding:</b>				
<p><b>Error Control Coding:</b> Introduction to Error Control Codes, Error Probability with Repetition in the Binary Symmetric Channel, Parity Check Bit Coding for Error Detection, Block Coding for Error Detection and Correction, The Hamming Distance, The upper bound of the Probability of Error with Coding, Soft Decision Decoding, Hard Decision Decoding.</p>					
<b>UNIT - IV</b>	<b>Linear Block Codes:</b>				
<p><b>Linear Block Codes:</b> Introduction to Linear Block Codes, Syndrome and Error Detection, Encoding Block Codes, Decoding of Block Codes, Single Parity Check bit Code, Repeated Codes, Hadamard Code, Hamming Code, Cyclic Codes, Generator and Parity-Check Matrices of Cyclic Codes, Encoding and Decoding of Cyclic Codes, BCH codes, Reed-Solomon Code.</p>					
<b>UNIT-V</b>	<b>Convolutional Coding,</b>				



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Convolutional Coding, Code Generation, Decoding Convolutional Code, the Code Tree, Decoding in the presence of Noise, State and Trellis Diagrams, The Viterbi Algorithm, Comparison of Error Rates in Coded and Uncoded Transmission, Turbo Codes, LDPC codes, Hard and Soft Decision Decoding.

**Textbooks:**

1. Thomas M. Cover, Joy A. Thomas, Elements of Information Theory, John Wiley & Sons, 2<sup>nd</sup> Edition, 2006.
2. Herbert Taub, Donald L. Shilling, Goutam Saha, Principles of Communication Systems, 4<sup>th</sup> Edition, McGraw Hill, 2017.

**Reference Books:**

1. ShuLin, Daniel J. Costello Jr., Error Control Coding, Pearson, Second Edition, 2013.
2. Simon Haykin, Communication Systems, John Wiley, 4th Edition, 2010.



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Course Code	SATELLITE COMMUNICATIONS (Professional Elective-III)	L	T	P	C
		3	0	0	3
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To understand the basic concepts of satellite communications, orbital mechanics and launchers, various subsystems of a satellite and earth station, multiple access techniques, low earth orbit and geo-stationary satellite systems.</li> <li>• To apply frequency allocation standards, reliability techniques, multiple access techniques power test methods to satellite systems.</li> <li>• To analyze satellite navigation and global positioning system. To design Uplink and Downlink of a satellite.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<p><b>At the end of the course, the students will be able to</b></p> <ul style="list-style-type: none"> <li>• Understand the orbital and functional principles of satellite communication systems</li> <li>• Architect, interpret, and select appropriate technologies for implementation of specified satellite communication systems</li> <li>• Analyze and evaluate a satellite link and suggest enhancements to improve the link performance. Select an appropriate modulation, multiplexing, coding and multiple access schemes for a given satellite communication link. Specify, design, prototype and test analog and digital satellite communication systems as per given specifications.</li> </ul>					
<b>UNIT - I</b>	<b>Overview of Satellite Communications,</b>				
Introduction: Overview of Satellite Communications, GEO, MEO and LEO satellite systems, frequency bands					
<b>Orbital Mechanics:</b> Orbit Equations, Locating the satellite w.r.t. the earth, Orbital elements, look Angles, Orbital perturbation, Effects of earth's oblateness, moon and sun, Satellite eclipse, sun transit outage, Coverage angle, slant range, satellite launching					
<b>UNIT - II</b>	<b>Satellite subsystems</b>				
Satellite subsystems: Attitude and Orbit Control System (AOCS), Telemetry, Tracking and Command System (TT&C), Power System, Satellite antennas, Communications subsystem, transponders Satellite Link Design: Basic transmission theory, System noise temperature and G/T ratio, CNR, CIR, ACI, IMI, down link design, up link design, System design examples					
<b>UNIT - III</b>	<b>Modulation and Multiplexing</b>				
Modulation and Multiplexing: FM with multiplexed telephone signals, Analog FM SCPC, PSK, QPSK, Multiple Access Schemes: FDM/FM/FDMA, TDMA, Frame structure, frame acquisition, synchronization, TDMA in VSAT network, On-board processing, CDMA, Spread spectrum transmission and reception, DS-SS CDMA capacity.					
<b>UNIT - IV</b>	<b>Error Control for Digital Satellite Links:</b>				
Error Control for Digital Satellite Links: Error control coding, Block codes, Convolution codes, - Implementation of error detection on satellite links.					
<b>UNIT-V</b>	<b>VSAT Systems:</b>				
VSAT Systems: Overview of VSAT systems, Network architectures, Access control, multiple access selection <b>LEO Satellite systems:</b> Orbits, Coverage and frequency bands, off axis scanning, delay and throughput, NGSO constellation design, Problems					
<b>Textbooks:</b>					



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1. TIMOTHY PRATT, CHARLES BOSTIAN JERMEY ALLNUTT, Satellite Communications, John Wiley, Singapore, Second Edition, reprint 2013.

**Reference Books:**

1. M. RICHHARAIA, Satellite Communication Systems, BS Publishers, Second Edition, 2008.
2. TRI.T. HA, Digital Satellite Communications, McGraw-Hill, 2000.  
William K. Pratt, “Digital Image Processing”, John Wiley, 3rd Edition, 2004.



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Course Code	<b>MICROCONTROLLERS &amp; APPLICATIONS</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>(Open Elective-II)</b>				<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>III Year 2<sup>nd</sup> Semester</b>								
<b>Course Objectives:</b>								
<ul style="list-style-type: none"> <li>• Describe the Architecture of 8051 Microcontroller and Interfacing of 8051 to external memory.</li> <li>• Write 8051 Assembly level programs using 8051 instruction set.</li> <li>• Describe the Interrupt system, operation of Timers/Counters and Serial port of 8051.</li> </ul> <p style="margin-left: 20px;">Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051</p>								
<b>Course Outcomes (CO):</b>								
<p style="text-align: center;"><b>At the end of the course, the students will be able to</b></p> <ul style="list-style-type: none"> <li>• Understand the importance of Microcontroller and Acquire the knowledge of Architecture of 8051 Microcontroller.</li> <li>• Apply and Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to using 8051 I/O ports.</li> <li>• Develop the 8051 Assembly level programs using 8051 Instruction set</li> <li>• Design the Interrupt system, operation of Timers/Counters and Serial port of 8051</li> </ul>								
<b>UNIT - I</b>		<b>8051 Microcontroller</b>						
Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture-Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.								
<b>UNIT - II</b>		<b>Addressing Modes</b>						
Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples to use these Instructions.								
<b>UNIT - III</b>		<b>8051 Stack</b>						
8051 Stack, Stack and Subroutine instructions. Simple Assembly language program examples to use subroutine instructions.8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin.								
<b>UNIT - IV</b>		<b>8051 Serial Communication</b>						
8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch								
<b>UNIT-V</b>		<b>8051 C programming</b>						
8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Interfacing with relays and opto isolators, Stepper Motor Interfacing, DC motor interfacing, PWM generation using 8051								
<b>Textbooks:</b>								
<ol style="list-style-type: none"> <li>1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; “The 8051 Microcontroller and Embedded Systems – using assembly and C”, PHI, 2006 / Pearson, 2006.</li> <li>2. Kenneth J. Ayala, “The 8051 Microcontroller”, 3rd Edition, Thomson/Cengage Learning.</li> </ol>								
<b>Reference Books:</b>								



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1. Manish K Patel, “The 8051 Microcontroller Based Embedded Systems”, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. Raj Kamal, “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Pearson Education, 2005.



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Course Code	PRINCIPLES OF SIGNAL PROCESSING (Open Elective-II)	L	T	P	C
		3	0	0	3
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To describe discrete time signals and systems.</li> <li>• To teach importance of FFT algorithm for computation of Discrete Fourier Transform.</li> <li>• To expose various implementations of digital filter structures.</li> <li>• To present FIR and IIR Filter design procedures.</li> <li>• To outline need of Multi-rate Processing</li> </ul>					
<b>Course Outcomes (CO):</b>					
<p style="text-align: center;"><b>At the end of the course, the students will be able to</b></p> <ul style="list-style-type: none"> <li>• Use the FFT algorithm for solving the DFT of a given signal</li> <li>• Design a Digital filter (FIR&amp;IIR) from the given specifications</li> <li>• Realize the FIR and IIR structures from the designed digital filter.</li> <li>• Use the Multirate Processing concepts in various applications</li> <li>• Apply the Adaptive signal processing concepts to various signal</li> </ul>					
<b>UNIT - I</b>	<b>DISCRETE SIGNALS AND SYSTEMS</b>				
Discrete Signals and Systems- A Review – Introduction to DFT – Properties of DFT – Circular Convolution – Filtering methods based on DFT – FFT Algorithms –Decimation in time Algorithms, Decimation in frequency Algorithms – Use of FFT in Linear Filtering.					
<b>UNIT - II</b>	<b>STRUCTURES OF IIR FILTERS</b>				
Structures of IIR filters – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation					
<b>UNIT - III</b>	<b>STRUCTURES OF FIR FILTERS</b>				
Structures of FIR filters – Linear phase FIR filter – Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques					
<b>UNIT - IV</b>	<b>MULTIRATE SIGNAL PROCESSING</b>				
Multirate signal processing: Basic building blocks of multirate DSP, Decimation, Interpolation, Sampling rate conversion by a rational factor, Multistage Sampling Rate Converters.					
<b>UNIT-V</b>	<b>ADAPTIVE FILTERS</b>				
Adaptive Filters: Introduction, LMS and RLS Adaptation Algorithms, Applications of adaptive filtering to equalization, noise cancellation.					
<b>Textbooks:</b>					
<ol style="list-style-type: none"> <li>1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.</li> <li>2. Discrete Time Signal Processing – A.V. Oppenheim and R.W. Schaffer, PHI</li> </ol>					
<b>Reference Books:</b>					
<ol style="list-style-type: none"> <li>1. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris, Thomson, 2007.</li> <li>2. Understanding Digital Signal Processing 2<sup>nd</sup> Edition by Richard G. Lyons</li> </ol>					



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Course Code	ELECTRONIC INSTRUMENTATION (Open Elective-II)	L	T	P	C
		3	0	0	3
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To introduce various measuring instruments and their functionality</li> <li>• To teach various measurement metrics for performance analysis</li> <li>• To explain principles of operation and working of different electronic instruments</li> </ul> <p>To familiarize the characteristics, operations, calibrations and applications of the different oscilloscopes and signal generators.</p>					
<b>Course Outcomes (CO):</b>					
<p style="text-align: center;"><b>At the end of the course, the students will be able to</b></p> <ul style="list-style-type: none"> <li>• Learn different types of errors in measurement, calibration process and standards, various methods for measurement of non-electrical quantities, understand the different methods for measurement of various electrical quantities.</li> <li>• Familiarize the dynamics of instrument systems, various passive, and active transducers</li> <li>• Compare the various measuring techniques for measuring voltage</li> </ul>					
<b>UNIT - I</b>	<b>Measurement and Error</b>				
<p><b>Measurement and Error:</b> Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. (Text 2)</p> <p><b>Ammeters:</b> DC Ammeter, Multi-range Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. (Text 1)</p> <p><b>Voltmeters and Multi-meters:</b> Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multi range Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multi-meter. (Text 1)</p>					
<b>UNIT - II</b>	<b>Digital Voltmeters</b>				
<p><b>Digital Voltmeters:</b> Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, -Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM, (Text 1)</p> <p><b>Digital Instruments:</b> Introduction, Digital Multi-meters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter, (Text 1)</p>					
<b>UNIT - III</b>	<b>Oscilloscopes</b>				
<p><b>Oscilloscopes:</b> Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope. (Text 1)</p> <p><b>Signal Generators:</b> Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator, (Text 1)</p>					
<b>UNIT - IV</b>	<b>Measuring Instruments</b>				
<p><b>Measuring Instruments:</b> Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger. (Text 1)</p> <p><b>Bridges:</b> Introduction, Whetstone's bridge, Kelvin's Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell's bridge, Wien's bridge. (Text 1)</p>					
<b>UNIT-V</b>	<b>Transducers</b>				
<p><b>Transducers:</b> Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive Position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor. (Text 1)</p>					
<b>Textbooks:</b>					



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1. 'H. S. Kalsi, "Electronic Instrumentation", McGraw Hill, 3rd Edition, 2012, ISBN:9780070702066.
2. D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measuring Techniques", Pearson, 1st Edition, 2015, ISBN: 9789332556065

**Reference Books:**

1. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press PHI 2nd Edition, 2006 ISBN 81-203-2360-2.



Course Code	DIGITAL SIGNAL PROCESSING LAB	L	T	P	C
		0	0	3	1.5
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Outcomes (CO):</b>					
<ul style="list-style-type: none"> <li>• Implement various DSP Algorithms using software packages.</li> <li>• Implement DSP algorithms with Digital Signal Processor.</li> <li>• Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital IIR-Butterworth, Chebyshev filters.</li> <li>• Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filters using window techniques.</li> <li>• Analyze digital filters using Software Tools.</li> </ul> <p>The Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/ Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors)</p>					
<b>List of Experiments:</b>					
<ol style="list-style-type: none"> <li>1. Generate the following standard discrete time signals.               <ol style="list-style-type: none"> <li>i) Unit Impulse ii) Unit step iii) Ramp iv) Exponential v) Sawtooth</li> </ol> </li> <li>2. Generate sum of two sinusoidal signals and find the frequency response (magnitude and phase).</li> <li>3. Implement and verify linear and circular convolution between two given signals.</li> <li>4. Implement and verify autocorrelation for the given sequence and cross correlation between two given signals.</li> <li>5. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence.</li> <li>6. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).</li> <li>7. Implement and verify N-point IFFT of a given sequence.</li> <li>8. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)</li> <li>9. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter /High Pass Filter).</li> <li>10. Design FIR filter (Low Pass Filter /High Pass Filter) using windowing technique.               <ol style="list-style-type: none"> <li>i. Using rectangular window</li> <li>ii. Using hamming window</li> <li>iii. Using Kaiser window</li> </ol> </li> <li>11. Design and verify Filter (IIR and FIR) frequency response by using Filter design and Analysis Tool.</li> <li>12. Compute the Decimation and Interpolation for the given signal.</li> <li>13. Real time implementation of an audio signal using a digital signal processor.</li> <li>14. Compute the correlation coefficient for the two given audio signals of same length using a digital signal processor.</li> </ol> <p><b>Note: Any TWELVE of the experiments are to be conducted.</b></p>					



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Course Code	VLSI DESIGN LAB/ ANTENNAS AND MICROWAVE ENGINEERING LAB	L	T	P	C
		0	0	3	1.5

**III Year 2<sup>nd</sup> Semester**

**Course Outcomes (CO):**

- To understand and develop HDL source code for the given problem/experiment
- To analyze the obtained results of the given experiment/problem
- To simulate the given circuit with suitable simulator and verify the results
- To understand how to use FPGA/CPLD hardware tools in the lab  
To design and implement the experiments using FPGA/CPLD hardware tools
- Understand the mode characteristics of Reflex Klystron oscillator and negative resistance characteristics of Gunn Oscillator.
- Determine the Scattering matrix of given passive device experimentally and verify the same theoretically. Also determine numerical aperture and bending losses of a given optical fiber

**List of Experiments:**

**VLSI DESIGN**

1. Design and Implementation of a Universal Gates
2. Design and Implementation of an Inverter
3. Design and Implementation of Full Adder
4. Design and Implementation of Full Subtractor
5. Design and Implementation of 4x16 Decoder
6. Design and Implementation of 8: 1 Multiplexer
7. Design and implementation of 8-bit Comparator
8. Design and Implementation of SR, JK, D and T Flip Flops
9. Design and Implementation asynchronous counter
10. Design and Implementation of static RAM cell
11. Design and Implementation of 8-bit DAC using R-2R ladder network
12. Design and Implementation of 4-bit ALU
13. Mealy machine Design

Moore machine Design

**ANTENNAS AND MICROWAVE ENGINEERING**

1. Set up the Full Microwave bench and know the importance of each block. Identify the pin configuration of Reflex Klystron with the help of its power supply cable connected from the power supply unit. Also identify the Microwave signal coupling from Klystron Oscillator to the waveguide.
2. Make use of the bench setup and conduct the experiment to find mode characteristics of Reflex Klystron: (i)Repeller voltage vs output power(ii)Repeller voltage vs Frequency.
3. Measurement of Frequency and wavelength of generated Microwave signal using Reflex Klystron oscillator.
4. Verify the negative resistance characteristics of Gunn oscillator using the Microwave bench set up with Gunn oscillator set up.
5. Find the Scattering matrix of E-plane, H-plane, and Magic Tees experimentally.
6. Make use of Microwave bench set up to find VSWR and impedance of an unknown load that is connected at the end of the bench set up. Make use of VSWR meter for the measurement of VSWR of a given load.
7. Determine directivity, insertion loss and coupling factor of a given Directional Coupler experimentally.

Making use of Microwave bench set up, find the radiation characteristics in both the planes and determine HPBW and directivity of a pyramidal horn antenna



Course Code	RF SYSTEM DESIGN TOOLS/ INDUSTRIAL IOT & AUTOMATION (Skill Oriented Course – V)	L	T	P	C
		0	1	2	2
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To introduce the fundamentals of Industrial IoT (IIoT), its architecture, and its differences from traditional IoT.</li> <li>• To understand the components of IIoT, including sensors, actuators, and control systems, and their integration with embedded platforms.</li> <li>• To explore communication technologies such as ZigBee, Bluetooth, NFC, RFID, and MQTT for IIoT applications.</li> <li>• To study data visualization techniques, dashboard creation, and web-based connectivity for IIoT systems.</li> <li>• To learn data retrieval techniques, machine-to-machine (M2M) communication, and cloud integration for IIoT applications.</li> </ul>					
<b>Course Outcomes(CO):</b>					
<p>At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Explain the fundamental concepts of IIoT, its architecture, and the challenges associated with industrial automation.</li> <li>• Demonstrate the integration of sensors and actuators with Raspberry Pi/NodeMCU for real-time monitoring and control.</li> <li>• Implement communication protocols such as MQTT, ZigBee, and Bluetooth to enable seamless IIoT connectivity.</li> <li>• Develop web-based dashboards for real-time visualization and remote monitoring of IIoT devices.</li> <li>• Retrieve, analyze, and transmit industrial data using web-based interactions and M2M communication.</li> </ul>					
<b>MODULE 1</b>	<b>Introduction &amp; Architecture</b>				
<p>What is IIoT and connected world? The difference between IoT and IIoT, Architecture of IIoT, IOT node, Challenges of IIOT. Practice</p> <p>1. Introduction to Arduino, Introduction to raspberry Pi.  <a href="https://www.youtube.com/watch?v=AQdLQV6vhbk">https://www.youtube.com/watch?v=AQdLQV6vhbk</a></p>					
<b>MODULE 2</b>	<b>IIOT Components</b>				
<p>Fundamentals of Control System, introductions, components, closed loop &amp; open loop system. Introduction to Sensors (Description and Working principle): What is sensor? Types of sensors, working principle of basic Sensors -Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11).Digital switch, Electro Mechanical switches.</p> <p>Practice</p> <p>1. Measurement of temperature &amp; pressure values of the process using raspberry pi/node mcu.  2. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor) using Raspberry pi/node mcu.  3. Modules and Actuators Interfacing (Relay, Motor, Buzzer) using Raspberry pi/node mcu.</p>					
<b>MODULE 3</b>	<b>Communication Technologies of IIoT</b>				
<p>Communication Protocols: IEEE 802.15.4, ZigBee, Bluetooth, BLE, NFC, RFID Industry standards communication technology (MQTT), wireless network communication.</p> <p>Practice</p> <p>1. Demonstration of MQTT communication.</p>					
<b>MODULE 4</b>	<b>Visualization and Data Types of IIoT</b>				



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Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.

Practice

1. Visualization of diverse sensor data using dashboard (part of IoT's \_control panel')
2. Sending alert message to the user. ways to control and interact with your environment)

<b>MODULE 5</b>	<b>Retrieving Data</b>
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Extraction from Web: Grabbing the content from a web page, Sending data on the web, Troubleshooting basic Arduino issues, Types of IoT interaction, Machine to Machine interaction (M2M).

Practice

1. Device control using mobile Apps or through Web pages.
2. Machine to Machine communication.

<b>MODULE 6</b>	<b>Control &amp; Supervisory Level of Automation</b>
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Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA).

Practice

1. Digital logic gates programming using ladder diagram.
2. Implementation of Boolean expression using ladder diagram.
3. Simulation of PLC to understand the process control concept

**Projects:**

IIoT based smart energy meter  
 Smart Agriculture system  
 Automation using controller via Bluetooth  
 Temperature controlled Fan/cooler using controller  
 Automatic streetlight  
 Smart Baggage Tracker

**Textbooks**

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication)
2. Industrial Internet of Things: Cybermanufacturing System, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer Publication)
3. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)



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Course Code	TECHNICAL PAPER WRITING & IPR	L	T	P	C
	(Audit Course)	3	0	0	3
<b>III Year 2<sup>nd</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To enable the students to practice the basic skills of research paper writing</li> <li>• To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.</li> <li>• To practice the basic skills of performing quality literature review</li> <li>• To help them in knowing the significance of real-life practice and procedure of Patents.</li> <li>• To enable them learn the procedure of obtaining Patents, Copyrights, &amp; Trade Marks</li> </ul>					
<b>Course Outcomes (CO):</b>					
<p style="text-align: center;"><b>At the end of the course, the students will be able to</b></p> <ul style="list-style-type: none"> <li>• Identify key secondary literature related to their proposed technical paper writing.</li> <li>• Explain various principles and styles in technical writing.</li> <li>• Use the acquired knowledge in writing a research/technical paper.</li> <li>• Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark, etc.</li> <li>• Evaluate different forms of IPR available at national and international level.</li> <li>• Develop skill of making search of various forms of IPR by using modern tools and techniques.</li> </ul>					
<b>UNIT - I</b>					
Principles of Technical Writing: styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language –highlighting your findings-discussing your limitations –hedging and criticizing –plagiarism and paraphrasing.					
<b>UNIT - II</b>					
Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature-Problems and Framing Research Questions- Synopsis.					
<b>UNIT - III</b>					
Process of research: publication mechanism: types of journals- indexing-seminars- conferences- proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion-results- citation rules.					
<b>UNIT - IV</b>					
Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights. Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.					
<b>UNIT-V</b>					
Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.					
<b>Textbooks:</b>					
1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013 2. Meenakshi Raman, Sangeeta Sharma. Technical Communication: Principles and practices. Oxford					
<b>Reference Books:</b>					



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- 1.R.Myneni, Law of Intellectual Property, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli,Intellectual Property Rights Tata Mcgraw Hill, 2001
3. P.Naryan,Intellectual Property Law, 3rd Ed ,Eastern Law House, 2007.

**Online Resources**

1. <https://theconceptwriters.com.pk/principles-of-technical-writing/>
2. <https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html>
3. <https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html>
4. <https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper-journal>
5. <https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf>
6. <https://lawbhoomi.com/intellectual-property-rights-notes/>
7. <https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf>



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<b>Sri Krishnadevaraya University College of Engineering &amp; Technology</b>					
<b>Dept. Electronics and Communication Engineering</b>					
<b>IV Year I Semester</b>					
<b>S.No.</b>	<b>CourseCode</b>	<b>Course Name</b>	<b>Category</b>	<b>L-T-P</b>	<b>Credits</b>
1.		Digital Image Processing	PC	3-0-0	3
2.		Entrepreneurship and Incubation Management Science Human Resource Management	MGT	2-0-0	2
3.		1. Real Time Operating Systems 2. DSP Processors & Architectures 3. Cellular & Mobile Communications	PE-IV	3-0-0	3
4.		1. Internet of things 2. Radar Engineering 3. MEMS and Micro Systems	PE-V	3-0-0	3
5.		1. Embedded Systems 2. Consumer Electronics 3. Fundamentals of Communication Systems	OE-III	3-0-0	3
6.		1. Introduction to Image Processing 2. Transducers and Sensors 3. Introduction to Internet of things	OE-IV	3-0-0	3
7.		System Verilog	SOC	0-1-2	2
8.		Gender Sensitization	AC	2-0-0	0
9.		Evaluation of Industry Internship	PR	0-0-0	2
<b>Total</b>					<b>21</b>

<b>Category</b>	<b>CREDITS</b>
Professional Core Courses	3
Management Elective	2
Professional Elective courses	6
Open Elective Course/Job oriented elective	6
Skill Enhancement course/soft skill course*	2
Industrial/Research Internship	2
<b>TOTAL CREDITS</b>	<b>21</b>



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Course Code	<b>DIGITAL IMAGE PROCESSING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>IV Year 1<sup>st</sup>Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To learn the fundamentals of Image Processing with different Transforms.</li> <li>• To understand functions of Intensity Transformations and working fundamentals of Spatial Filters</li> <li>• To implement various models of Restoring and Reconstruction of Images from filtering projections.</li> <li>• To study the concepts of image compression using different coding &amp; Wavelets and Multi resolution Processes.</li> <li>• To design image processing systems using Segmentation techniques for Morphological &amp; Color Images</li> </ul>					
<b>Course Outcomes(CO):</b>					
<p>At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Learn the fundamentals of Image Processing with different Transforms.</li> <li>• Understand functions of Intensity Transformations and working fundamentals of Spatial Filters</li> <li>• Implement various models of Restoring and Reconstruction of Image from filtering projections.</li> <li>• Grasp the concepts of image compression using different coding &amp; Wavelets and Multiresolution Processes.</li> <li>• Design the image processing systems using Segmentation techniques for Morphological &amp; Color Images.</li> </ul>					
<b>UNIT-I</b>	<b>INTRODUCTION DIGITAL IMAGE PROCESSING</b>				
Introduction to image processing, Fundamental steps in Digital Image processing, Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.					
<b>UNITII</b>	<b>IMAGE ENHANCEMENT</b>				
Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters , sharpening spatial filters, Combining spatial enhancement methods Filtering in the Frequency Domain: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering					
<b>UNIT-III</b>	<b>IMAGE SEGMENTATION</b>				
Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.					
<b>UNIT-IV</b>	<b>IMAGE COMPRESSION</b>				
Redundancy, inter-pixel and psycho-visual; Loss less compression –predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.					
<b>UNIT-V</b>	<b>COLOR IMAGE PROCESSING</b>				
Color Image Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.					
<b>Textbooks:</b>					



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1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2007.
2. A.V.Oppenheim and R.W. Schaffer, Discrete Time Signal Processing ,PHI.

**Reference Books:**

1. S.K.Mitra, Digital Signal Processing – A practical approach , 2nd Edition, Pearson Education, New Delhi, 2004.
2. MH Hayes, Digital Signal Processing, Schaum’s Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007.



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Course Code	ENTREPRENEURSHIP & INCUBATION	L	T	P	C
	(Management Elective-I)	3	0	0	3
<b>IV Year 1<sup>st</sup>Semester</b>					
<b>Course Objectives:</b>					
To make the student understand about Entrepreneurship					
<ul style="list-style-type: none"> <li>● To enable the student in knowing various sources of generating new ideas in setting up of New enterprise</li> <li>● To facilitate the student in knowing various sources of finance in starting up of a business</li> <li>● To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs</li> <li>● To encourage the student in creating and designing business plans</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>● Understand the concept of Entrepreneurship and challenges in the world of competition.</li> <li>● Apply the Knowledge in generating ideas for New Ventures.</li> <li>● Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.</li> <li>● Evaluate the role of central government and state government in promoting Entrepreneurship.</li> <li>● Create and design business plan structure through incubations</li> </ul>					
<b>UNIT-I</b>	<b>ENTREPRENEURSHIP</b>				
Entrepreneurship -Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship -Differences between Entrepreneur and Entrepreneur - Understanding individual entrepreneurial mind set and personality-Recent trends in Entrepreneurship					
<b>UNIT-II</b>	<b>STARTING THE NEW VENTURE</b>				
Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas- Opportunity recognition-Feasibility study-Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan – Preparing project report -Presenting business plan to investors					
<b>UNIT-III</b>	<b>SOURCES OF FINANCE</b>				
Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development					
<b>UNIT-IV</b>	<b>WOMEN ENTREPRENEURSHIP</b>				
Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction tovarious incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessionsavailable-Womenentrepreneurship- Roleandimportance-GrowthofwomenentrepreneurshipinIndia- Issues &Challenges -Entrepreneurial motivations					
<b>UNIT-V</b>	<b>FUNDAMENTALS OF BUSINESS INCUBATION</b>				
Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence the Type/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition					
<b>Textbooks:</b>					
1. D F Kuratko and T V Rao, “Entrepreneurship” - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : <a href="http://login.cengage.com">login.cengage.com</a> )					
2. Nandan H, “ Fundamentals of Entrepreneurship”, PHI, 2013					



**Reference Books:**

1. VasantDesai, “SmallScaleIndustriesandEntrepreneurship”,HimalayaPublishing2012.
2. RajeevRoy“Entrepreneurship”,2<sup>nd</sup> Edition,Oxford,2012.
3. B.Janakiramand M.Rizwanal “Entrepreneurship Development: Text &Cases”, Excel Books, 2011.
4. Stuart Read, Effectual“Entrepreneurship”,Routledge,2013.



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Course Code	MANAGEMENT SCIENCE (Management Elective-I)	L	T	P	C
		3	0	0	3
<b>IV Year 1<sup>st</sup>Semester</b>					
<b>Course Objectives:</b>					
The objectives of this course are					
<ul style="list-style-type: none"> <li>• To provide fundamental knowledge on Management, Administration, Organization &amp; its concepts.</li> <li>• To make the students understand the role of management in Production</li> <li>• To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training &amp; Development, job evaluation and Merit rating concepts</li> <li>• To create awareness on identify Strategic Management areas &amp; the PERT/CPM for better Project Management</li> <li>• To make the students aware of the contemporary issues in management</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• Understand the concepts &amp; principles of management and designs of organization in a practical world</li> <li>• Apply the knowledge of Work-study principles &amp; Quality Control techniques in industry</li> <li>• Analyze the concepts of HRM in Recruitment, Selection and Training &amp; Development.</li> <li>• Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time &amp; cost of project &amp; to analyze the business through SWOT.</li> <li>• Create Modern technology in management science.</li> </ul>					
<b>UNIT-I</b>	<b>INTRODUCTION TO MANAGEMENT</b>				
Management - Concept and meaning - Nature-Functions - importance of Management. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles – Abraham Maslow's hierarchy theory of needs - Organizational Designs - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.					
<b>UNITII</b>	<b>OPERATIONS MANAGEMENT</b>				
Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control - Deming's contribution to Quality. Material Management - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - Marketing Management - Functions of Marketing - Marketing Mix - Channels of Distribution - Marketing Strategies based on Product Life Cycle..					
<b>UNIT-III</b>	<b>HUMAN RESOURCES MANAGEMENT (HRM)</b>				
HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment- Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration.					
<b>UNIT-IV</b>	<b>STRATEGIC &amp; PROJECT MANAGEMENT</b>				
Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis -Project Management - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).					
<b>UNIT-V</b>	<b>CONTEMPORARY ISSUES IN MANAGEMENT</b>				



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The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re- engineering and Bench Marking - Balanced Score Card - Knowledge Management.

**Textbooks:**

1. A.R Aryasri, “Management Science”, TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.



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Course Code	HUMAN RESOURCES MANAGEMENT (Management Elective-I)	L	T	P	C
		3	0	0	3
<b>IV Year 1<sup>st</sup>Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To make the student understand about Entrepreneurship</li> <li>• To understand and appreciate the importance of the human resources vis-a-vis other resources of the organisation</li> <li>• To familiarize the students with methods and techniques of HRM</li> <li>• To equip them with the application of the HRM tools in real world business situations.</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• Understand the concept of Entrepreneurship and challenges in the world of competition.</li> <li>• Apply the Knowledge in generating ideas for New Ventures.</li> <li>• Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.</li> <li>• Evaluate the role of central government and state government in promoting Entrepreneurship.</li> <li>• Create and design business plan structure through incubations</li> </ul>					
<b>UNIT-I</b>	<b>HUMAN RESOURCES MANAGEMENT</b>				
Human Resources Management - Context and Concept of People Management in a Systems Perspective - Organisation and Functions of the HR and Personnel Department - HR Structure and Strategy; Role of Government and Personnel Environment including MNCs.					
<b>UNIT-II</b>	<b>RECRUITMENT AND SELECTION</b>				
Recruitment and Selection - Human Resource Information System [HRIS] - Manpower Planning - Selection – Induction & Orientation - Performance and Potential Appraisal - Coaching and Mentoring - HRM issues and practices in the context of Outsourcing as a strategy					
<b>UNIT-III</b>	<b>HUMAN RESOURCES DEVELOPMENT</b>				
Human Resources Development –Training and Development Methods - Design & Evaluation of T&D Programmes - Career Development - Promotions and Transfers - Personnel Empowerment including Delegation - Retirement and Other Separation Processes.					
<b>UNIT-IV</b>	<b>FINANCIAL COMPENSATION</b>				
Financial Compensation- -Productivity and Morale - Principal Compensation Issues & Management - Job Evaluation - Productivity, Employee Morale and Motivation - Stress Management - Quality of Work Life.					
<b>UNIT-V</b>	<b>BUILDING RELATIONSHIPS</b>				
Building Relationships – Facilitating Legislative Framework - Trade Unions - Managing Conflicts - Disciplinary Process - Collective Bargaining - Workers Participation in Management - Concept, Mechanisms and Experiences.					
<b>Textbooks:</b>					
<ol style="list-style-type: none"> <li>1. Venkata Ratnam C. S. &amp; Srivatsava B. K.,Personnel Management And Human Resources, Tata Mc-Graw Hill, Newdelhi,</li> <li>2.Aswhathappa, Human Resource Mangement, Tata Mcgraw Hill, Newdelhi, 2010</li> </ol>					
<b>Reference Books:</b>					
<ol style="list-style-type: none"> <li>1.Garry Dessler &amp;Varkkey, Human Resource Management, Pearson, New Delhi, 2009</li> <li>2.Alan Price, Human Resource Management, Cengage Learning, Newdelhi, 2007</li> <li>3.Pravin Durai, Human Resource Mangement, Pearson, New Delhi,2010</li> <li>4.Snell, Bohlander &amp; Vohra, Human Resources Management, Cengage, Newdelhi, 2010</li> </ol>					



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Course Code	REAL TIME OPERATING SYSTEMS (Professional Elective-IV)	L	T	P	C
		3	0	0	3
<b>IV Year 1<sup>st</sup>Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To introduce general idea, structure and functions of general purpose operating systems.</li> <li>• To describe process &amp; memory management techniques</li> <li>• To impart knowledge about the fundamentals of Real Time Systems and interaction with RTOS</li> <li>• To teach concepts of how process are created and controlled with RTOS.</li> <li>• To introduce about the services rendered by RTOS in an application.</li> <li>• To provide knowledge about the common problems in developing an RTOS.</li> <li>• To discuss application development using RTOS</li> </ul>					
<b>Course Outcomes(CO):</b>					
<p>At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Distinguish between general purpose and real time operating systems</li> <li>• Describe real-time operating system requirements and design issues</li> <li>• Illustrate role of operating systems in memory and I/O devices management</li> <li>• Apply concepts of inter-task communication and synchronization via shared memory, message queues, signals, semaphores</li> </ul>					
<b>UNIT-I</b>	<b>INTRODUCTION RTOS</b>				
Introduction: Operating Systems Objectives and functions, Computer System Architecture, OS Structure, OS Operations, Evolution of Operating Systems - Simple Batch, Multi programmed, time shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, Special - Purpose Systems, Operating System services, user OS Interface, System Calls, Types of System Calls, System Programs, Opening System Design and Implementation, OS Structure, Virtual machines					
<b>UNIT-II</b>	<b>PROCESS CONCEPT</b>				
Process Concept, Process Scheduling, Operations on Processes, Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, Monitors, Memory Management and Virtual Memory and File System Interface					
<b>UNIT-III</b>	<b>RTOS</b>				
RTOS: Differences between General Purpose OS & RTOS, Real-time concepts, Hard Real time and Soft Real-time systems, Basic architecture of an RTOS, components in RTOS, kernel, objects, scheduler, Multitasking, context switch, Scheduling types, Task states, Task management. Kernel Objects, Semaphores, Synchronization between two tasks and multiple tasks, Single shared-resource-access synchronization, Recursive shared- resource- access synchronization, message queue, Common pipe, pipe operation, Select operation on multiple pipes, Pipes for inter-task Synchronization, Event register, control block, Signals.					
<b>UNIT-IV</b>	<b>RTOS SERVICES OVERVIEW</b>				
RTOS Services Overview- TCP/IP protocol- Stack- File system- Remote procedure calls- RTOS command shell Exceptions and Interrupts- Programmable interrupt controller-Priority scheme- Task and stack Interrupt nesting- Interrupt processing in two contexts. Timer and Timer Services - Real-time clock Soft-timer- Servicing the timer interrupt in the task context- Timeout event handlers. I/O Subsystem and Memory Management Port-mapped I/O- Memory-mapped I/O-					
<b>UNIT-V</b>	<b>TYPICAL RTOS</b>				
Typical RTOS Introduction to RT Linux, Real-Time Linux Applications in Embedded system, Common Design Problems - Deadlock, priority inversion problem, Embedded RTOS for fault-Tolerant applications					



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**Textbooks:**

1. Operating System Principles, Abraham Silberchatz, Peter B. Galvin, Greg Gagne 8th Edition, Wiley Student Edition.
2. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011

**Reference Books:**

1. Operating systems - Internals and Design Principles, W. Stallings, 6th Edition, Pearson.
2. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH.



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Course Code	DSP PROCESSORS & ARCHITECTURES (Professional Elective-IV)	L	T	P	C
		3	0	0	3
<b>IV Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To describe the unique features and significance of Digital Signal Processing (DSP).</li> <li>• To demonstrate various computational parameters and accuracy considerations in DSP systems.</li> <li>• To introduce architectural improvements in programmable DSP devices and their execution models.</li> <li>• To expose students to basic DSP algorithms, including filtering, FFT, and adaptive processing.</li> <li>• To outline DSP processor applications and their interfacing with memory and I/O peripherals.</li> </ul>					
<b>Course Outcomes(CO):</b>					
<p>At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Summarize the fundamental features and role of Digital Signal Processing in real-world applications.</li> <li>• Evaluate dynamic range, precision, and error sources in DSP implementations.</li> <li>• Explain the architectural features of DSP processors and their computational efficiency.</li> <li>• Analyze the performance of DSP algorithms on programmable DSP platforms for specific applications.</li> <li>• Select and implement DSP processors for real-time applications, including memory and peripheral interfacing.</li> </ul>					
<b>UNIT-I</b>	<b>INTRODUCTION TO DIGITAL SIGNAL PROCESSING</b>				
<p>Introduction, a Digital signal-processing system, the sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), linear time-invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB. <b>Computational Accuracy in DSP Implementations:</b> Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.</p>					
<b>UNITII</b>	<b>ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES</b>				
<p>Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing. <b>Execution Control and Pipelining:</b> Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models.</p>					
<b>UNIT-III</b>	<b>MTI AND PULSE DOPPLER RADAR PROGRAMMABLE DIGITAL SIGNAL PROCESSORS</b>				
<p>Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On- Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.</p>					
<b>UNIT-IV</b>	<b>IMPLEMENTATIONS OF BASIC DSP ALGORITHMS</b>				
<p>The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing. <b>Implementation of FFT Algorithms:</b> An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum.</p>					
<b>UNIT-V</b>	<b>INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES</b>				



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Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

**Textbooks:**

1. Avtar Singh and S. Srinivasan, —Digital Signal Processing Implementation, 1st Edition, Cengage Learning, 2004.
2. Lapsley et al. S. Chand and Co, —DSP Processor Fundamentals, Architectures & Features, 2000.

**Reference Books:**

1. B. Venkata Ramani and M. Bhaskar, —Digital Signal Processors, Architecture, Programming and Applications, TMH, 2004.
2. Jonatham Stein, —Digital Signal Processing: A Computer Science Perspective, John Wiley, 2000.



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Course Code	CELLULAR & MOBILE COMMUNICATIONS (Professional Elective-IV)	L	T	P	C
		3	0	0	3
<b>IV Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To explain the basic cellular system and its working.</li> <li>• To understand the impact of multipath fading channels and techniques to mitigate fading effects in cellular communication.</li> <li>• To explore frequency management, channel assignment strategies, and different types of handoffs in cellular networks.</li> <li>• To analyze the performance of mobile antennas, interference issues, and cellular system design principles.</li> <li>• To evaluate system performance metrics such as dropped call rates, handoff strategies, and spectrum efficiency.</li> </ul>					
<b>Course Outcomes(CO):</b>					
<p>At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the basic cellular system and its working.</li> <li>• Explain the impairments caused by multipath fading and methods to mitigate fading effects in mobile communication.</li> <li>• Apply concepts of cellular communication to solve problems related to mobile antennas and system design.</li> <li>• Analyze co-channel and non-co-channel interferences, different types of handoffs, and dropped call rates.</li> <li>• Evaluate the performance of cellular systems, including signal reception, handoff efficiency, and spectrum utilization</li> </ul>					
<b>UNIT-I</b>	<b>CELLULAR MOBILE RADIO SYSTEMS</b>				
Introduction to Cellular Mobile system, basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems					
<b>UNITII</b>	<b>ELEMENTS OF CELLULAR RADIO SYSTEM DESIGN</b>				
General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a Omni directional Antenna system, Cell splitting, consideration of the components of cellular system <b>Interference:</b> Introduction to Co-channel interference, real time co-channel interference, Co-channel measurement, design of Antenna system, Antenna parameters and their effects, diversity receiver, non-co-channel interference-different types.					
<b>UNIT-III</b>	<b>CELL COVERAGE FOR SIGNAL AND TRAFFIC</b>				
Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation antenna height gain.					
<b>UNIT-IV</b>	<b>CELL SITE AND MOBILE ANTENNAS</b>				
Sum and difference patterns, Omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas. <b>Frequency Management and Channel Assignment:</b> Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment.					
<b>UNIT-V</b>	<b>HANDOFF</b>				



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Handoff, dropped calls and cell splitting, types of handoffs, handoff invitation, delaying handoff, forced handoff, mobile assigned handoff. Intersystem handoff, cell splitting, microcells, vehicle locating methods, dropped call rates and their evaluation.

**System Evaluations:** Performance evaluation, Signal evaluation, Measurement of average received level and level crossings

**Textbooks:**

1. 1. W .C. Y. Lee, —Mobile cellular telecommunications, Tata Mc-Graw Hill, 2<sup>nd</sup> Edition, 2006.
2. Theodore. S. Rapport, —Wireless communications, Pearson Education, 2<sup>nd</sup>Edn., 2002.

**Reference Books:**

1. Gordon L. Stuber, —Principles of Mobile communications, Springer International 2<sup>nd</sup> Edition, 2007.
2. Lee , —Wireless and Mobile Communications, Mc Graw Hills, 3<sup>rd</sup> Edition, 2006.
3. Jon W.Mark and WeihuaZhqung, —Wireless communications and Networking, PHI, 2005.
- R.Blake, —Wireless communication Technology, Thompson Asia Pvt.Ltd., 2004



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Course Code	INTERNET OF THINGS (Professional Elective-V)	L	T	P	C
		3	0	0	3
<b>IV Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• Understand the basics of Internet of Things and protocols.</li> <li>• Discuss the requirement of IoT technology</li> <li>• Introduce some of the application areas where IoT can be applied.</li> <li>• Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• Understand general concepts of Internet of Things.</li> <li>• Apply design concept to IoT solutions</li> <li>• Analyze various M2M and IoT architectures</li> <li>• Evaluate design issues in IoT applications</li> </ul>					
<b>UNIT-I</b>	<b>INTRODUCTION TO IOT</b>				
Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates					
<b>UNITII</b>	<b>PROTOTYPING IOT OBJECTS USING MICROPROCESSOR/MICROCONTROLLER</b>				
Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.					
<b>UNIT-III</b>	<b>IoT ARCHITECTURE AND PROTOCOLS</b>				
Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.					
<b>UNIT-IV</b>	<b>DEVICE DISCOVERY AND CLOUD SERVICES FOR IoT</b>				
Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.					
<b>UNIT-V</b>	<b>UAV IoT</b>				
Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.					
<b>Textbooks:</b>					
1 Vijay Madiseti and ArshdeepBahga, — Internet of Things ( A Hands-on-Approach)ll, 1 <sup>st</sup> Edition, VPT, 2014.					
2 Handbook of unmanned aerial vehicles, KV alavanis; <a href="#">GeorgeJ Vachtsevanos</a> ,New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.					
<b>Reference Books:</b>					
1 Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, —From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligencell, 1 <sup>st</sup> Edition, Academic Press, 2014.					
2 ArshdeepBahga, Vijay Madiseti - Internet of Things: A Hands-On Approach, Universities Press, 2014.					



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Course Code	<b>RADAR ENGINEERING</b> <b>(Professional Elective-V)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>IV Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To understand the basic working principle of Radar and target detection procedure.</li> <li>• To learn about the working and applications of CW and Frequency modulated Radar.</li> <li>• To comprehend the working and applications of MTI and Pulse Doppler Radar</li> <li>• To understand different methods of tracking a target and their limitations.</li> <li>• To analyze the effect of noise at the receiver and uses of phased array antennas and navigational aids.</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• Learn the basic working principle of Radar and target detection procedure.</li> <li>• Know the working and applications of CW and Frequency modulated Radar.</li> <li>• Gain the knowledge of about MTI and Pulse Doppler Radar.</li> <li>• Understand different methods of tracking a target and their limitations.</li> <li>• Analyze the effect of noise at the receiver and uses of phased array antennas and navigational aids.</li> </ul>					
<b>UNIT-I</b>	<b>BASICS OF RADAR</b>				
Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Illustrative Problems. Radar Equation: SNR, Envelope Detector, False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Display types, Illustrative Problems.					
<b>UNIT II</b>	<b>CW AND FREQUENCY MODULATED RADAR</b>				
Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Illustrative Problems. FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.					
<b>UNIT-III</b>	<b>MTI AND PULSE DOPPLER RADAR</b>				
Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, And Staggered PRFs. Range Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler radar.					
<b>UNIT-IV</b>	<b>TRACKING RADAR</b>				
Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two-coordinates), Phase Comparison Monopulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.					
<b>UNIT-V</b>	<b>DETECTION OF RADAR SIGNALS IN NOISE</b>				
<b>Detection of Radar Signals in Noise:</b> Introduction, Noise Figure and Noise Temperature, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection, Detection criteria, Detector Characteristics, Automatic Detection, Constant False Alarm Rate Receiver. Introduction to Software Defined Radio, Introduction to Stealth technology. <b>Radar Receivers:</b> Introduction to Phased Array Antennas- Basic Concepts, Electronically Steered Phased Array Antennas, Phase Shifters, Frequency – scan Arrays, Radiation for Phased Array, Architecture for Phased Arrays. Radiation Pattern. Beam Steering and Beam Width changes. Navigational Aids : Direction Finder, VOR, ILS and Loran.					
<b>Textbooks:</b>					



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1. Merrill I. Skolnik, —Introduction to Radar Systems, 2nd Edition, TMH Special Indian Edition, 2007.
2. Byron Edde, —Radar Principles, Technology, Applications, Pearson Education, 1992.

**Reference Books:**

1. Peebles, —Radar Principles, Wiley, New York, 1998.
2. G.S.N.Raju, —Radar Engineering and Fundamentals of Navigational Aids, I. K. International Pvt. Ltd.
3. G. SasiBhushan Rao, — Microwave and Radar Engineering, Pearson Education, 2014



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Course Code	MEMS AND MICROSYSTEMS (Professional Elective-V)	L	T	P	C
		3	0	0	3
<b>IV Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To introduce major components of an embedded system</li> <li>• To expose role of firmware, operating systems in correlation with hardware systems.</li> <li>• To explain interfacing of various communication and I/O devices to an embedded system</li> <li>• To demonstrate implementation of embedded systems for different applications</li> </ul>					
<b>Course Outcomes (CO):</b>					
After studying this course, students will be able to:					
<ul style="list-style-type: none"> <li>• Appreciate the technologies related to Micro Electromechanical Systems.</li> <li>• Understand design and fabrication processes involved with MEMS De- vices.</li> <li>• Analyze the MEMS devices and develop suitable mathematical models.</li> <li>• Know various application areas for MEMS device.</li> <li>• Describe the Micro manufacturing</li> </ul>					
<b>UNIT - I</b>	<b>OVERVIEW OF MEMS AND MICROSYSTEMS</b>				
MEMS and Micro system, Typical MEMS and Microsystems Products, Evolution of Micro fabrication, Microsystems and Microelectronics, Multidisciplinary Nature of Microsystems, Miniaturization. Applications and Markets					
<b>UNIT - II</b>	<b>WORKING PRINCIPLES OF MICROSYSTEMS</b>				
Introduction, Micro sensors, Micro actuation, MEMS with Micro actuators, Micro accelerometers, Micro fluidics.					
<b>Engineering Science for Microsystems Design and Fabrication:</b>					
Introduction, Molecular Theory of Matter and Inter-molecular Forces, Plasma Physics, Electrochemistry.					
<b>UNIT - III</b>	<b>ENGINEERING MECHANICS FOR MICROSYSTEMS DESIGN</b>				
Introduction, Static Bending of Thin Plates, Mechanical Vibration, Thermo mechanics, Fracture Mechanics, Thin Film Mechanics, Overview on Finite Element Stress Analysis.					
<b>UNIT - IV</b>	<b>SCALING LAWS IN MINIATURIZATION</b>				
Introduction, Scaling in Geometry, Scaling in Rigid-Body Dynamics, Scaling in Electrostatic Forces, Scaling in Fluid Mechanics, Scaling in Heat Transfer.					
<b>UNIT - V</b>	<b>OVERVIEW OF MICROMANUFACTURING</b>				
Introduction, Bulk Micro manufacturing, Surface Micromachining, The LIGA Process, Summary on Micro manufacturing.					
<b>Textbooks:</b>					
1. Tai-Ran Hsu, MEMS and Micro systems: Design, Manufacture and Nanoscale Engineering, 2nd Ed, Wiley.					
<b>Reference Books:</b>					
1. Hans H. Gatzert, Volker Saile, Jurg Leuthold, Micro and Nano Fabrication: Tools and Processes, Springer, 2015.					
2. Dilip Kumar Bhattacharya, Brajesh Kumar Kaushik, Microelectromechanical Systems (MEMS), Cengage Learning					



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Course Code	EMBEDDED SYSTEMS (Open Elective-III)	L	T	P	C
		3	0	0	3
<b>IV Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To introduce major components of an embedded system</li> <li>• To expose role of firmware, operating systems in correlation with hardware systems.</li> <li>• To explain interfacing of various communication and I/O devices to an embedded system</li> <li>• To demonstrate implementation of embedded systems for different applications</li> </ul>					
<b>Course Outcomes(CO):</b>					
<ul style="list-style-type: none"> <li>• Identify hardware and software components of an embedded system</li> <li>• Choose appropriate embedded system architecture for the given application</li> <li>• Discuss quality attributes and characteristics of an embedded system</li> <li>• Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment</li> </ul>					
<b>UNIT - I</b>	<b>INTRODUCTION TO EMBEDDED SYSTEMS</b>				
Introduction to Embedded Systems: What is embedded system, embedded systems vs general computing systems, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, Processor and OS trends in embedded system. Embedded hardware units and devices in a system, embedded software in a system and an overview of programming languages, skills required for an embedded system designer, examples of the embedded systems.					
<b>UNIT - II</b>	<b>CORE OF THE EMBEDDED SYSTEM</b>				
Core of the embedded system, memory, sensor sand actuators, communication interface, embedded firmware, other system components, Characteristics of an embedded system, Quality attributes of embedded systems.					
<b>UNIT - III</b>	<b>I/O, COMMUNICATION DEVICES AND INTERRUPT</b>				
I/O, Communication devices and Interrupt Service Mechanism: I/O types and examples, serial communication devices, parallel device ports, wireless devices, timer and counting devices; Interrupt-driven input and output, interrupt service routine concept, interrupt sources, hardware interrupts, software interrupts, interrupt-servicing mechanism, multiple interrupts, interrupt service threads as second-level interrupt handlers, context and the periods for context switching, interrupt latency, interrupt-service deadline, interrupt service mechanism from context-saving angle, direct memory access driven I/O, Device driver programming.					
<b>UNIT - IV</b>	<b>INTER-PROCESS COMMUNICATION(IPC)</b>				
Inter-process Communication (IPC): Multiple processes in an application, multiple threads in an application, tasks, task and thread states, tasks and data, distinction between function, ISR, IST and task by their characteristics, inter-process communication and synchronization, signals, concept of semaphores, disabling and enabling functions, shared data problem, queues and mailboxes, pipe and socket functions, remote procedure call functions.					
<b>UNIT - V</b>	<b>DESIGNING EMBEDDED SYSTEMS WITH 8051 MICROCONTROLLER</b>				
Designing Embedded Systems with 8051 Microcontroller: Factors to be considered in selecting a controller, why 8051 microcontrollers; Design Examples using 8051 Microcontroller: Displaying binary numbers using 8 LEDs, 2-phase 6-wire stepper motor control; Embedded Product Development Life Cycle (EDLC): Concept of EDLC, objectives of EDLC, different phases of EDLC, EDLC approaches.					
<b>Textbooks:</b>					
<ol style="list-style-type: none"> <li>1. Shibu K.V., <i>Introduction to Embedded Systems</i>, 2nd edition, McGraw Hill Education, 2017.</li> <li>2. Raj Kamal, <i>Embedded Systems: Architecture, Programming and Design</i>, 3rd edition, McGraw Hill Education, 2017</li> </ol>					
<b>Reference Books:</b>					



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1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, *The 8051 Microcontroller and Embedded Systems Using Assembly and C*, 2nd edition, Pearson Education India, 2007.
2. Jonathan W. Valvano, *Embedded Microcomputer Systems: Real Time Interfacing*, 3rd Edition, Cengage Learning, 2012.
3. David E. Simon, *An Embedded Software Primer*, 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.



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Course Code	CONSUMER ELECTRONICS (Open Elective-III)		L	T	P	C
			3	0	0	3
<b>IV Year 1<sup>st</sup> Semester</b>						
<b>Course Outcomes(CO):</b>						
<ul style="list-style-type: none"> <li>• Understand the various type of microphones and loudspeakers.</li> <li>• To identify the various digital and analog signal.</li> <li>• Describe the basis of television and composite video signal.</li> <li>• Describe the various kind of color TV standards and system.</li> <li>• Compare the various types of digital TV system.</li> </ul>						
<b>UNIT - I</b>	<b>AUDIO SYSTEMS</b>					
<b>Audio Systems:</b> Microphones and Loudspeakers: Carbon, moving coil, cordless microphone, Direct radiating and horn loudspeaker, multi-speaker system, Hi-Fi stereo and dolby system. Concept to fidelity, Noise and different types of distortion in audio system.						
<b>UNIT - II</b>	<b>DIGITAL AUDIO FUNDAMENTALS</b>					
<b>Digital Audio Fundamentals:</b> Audio as Data and Signal, Digital Audio Processes Outlined, Time Compression and Expansion						
<b>UNIT - III</b>	<b>TELEVISION</b>					
<b>Television:</b> Basics of Television: Elements of TV communication system, Scanning and its need, Need of synchronizing and blanking pulses, VSB, Composite Video Signal, Colour Television: Primary, secondary colours, Concept of Mixing, Colour Triangle, Camera tube, PAL TV Receiver, NTSC, PAL, SECAM						
<b>UNIT - IV</b>	<b>DIGITAL TRANSMISSION AND RECEPTION</b>					
<b>Digital Transmission and Reception:</b> Digital satellite television, Direct-To-Home(DTH) satellite television, Introduction to :Video on demand, CCTV, High Definition(HD)-TV. Introduction to Liquid Crystal and LED Screen Televisions Basic block diagram of LCD and LED Television and their comparison						
<b>UNIT - V</b>	<b>INTRODUCTION TO DIFFERENT TYPE OF DOMESTIC/COMMERCIAL APPLIANCES</b>					
Introduction to different type of domestic/commercial appliances: Operation of Micro-wave oven, Food Processors, Digital Electronic Lock, Vacuum cleaner, Xerox Machine, Scanner						
<b>Textbooks:</b>						
<ol style="list-style-type: none"> <li>1. Modern Television Practice by R. R. Gulai; New Age International Publishers.</li> <li>2. Audio Video Systems by R. G. Gupta; McGraw Hill Education System.</li> <li>3. Audio Video Systems Principles Practices and Troubleshooting by Bali &amp; Bali; Khanna Publishing Company</li> <li>4. Consumer Electronics by S. P. Bali; Pearson Education, New Delhi</li> </ol>						



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Course Code	FUNDAMENTALS OF COMMUNICATION SYSTEMS (Open Elective-III)	L	T	P	C
		3	0	0	3
<b>IV Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>To understand the fundamentals of communication systems and amplitude modulation techniques.</li> <li>To learn about the angle modulation techniques and bandwidth considerations in communication systems.</li> <li>To gain knowledge on pulse analog modulation and multiple access techniques used in digital communication systems.</li> <li>To examine pulse modulation and digital modulation techniques used in modern communication systems.</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>Understand the fundamentals of communication systems and amplitude modulation techniques.</li> <li>Learn about the angle modulation techniques and bandwidth considerations in communication systems.</li> <li>Gain knowledge on pulse analog modulation and multiple access techniques used in digital communication systems.</li> <li>Get familiar with pulse modulation and digital modulation techniques used in modern communication systems.</li> </ul>					
<b>UNIT-I</b>	<b>ANALOG COMMUNICATION-I</b>				
Elements of communication systems, need for Modulation, Modulation Methods, Baseband and carrier communication Amplitude Modulation(AM),Generation of AM signals, Rectifier detector, Envelope detector, sideband and carrier power of AM, Double side band suppressed carrier(DSB-SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Single sideband(SSB) transmission, VSB Modulation.					
<b>UNITII</b>	<b>ANALOG COMMUNICATION-II</b>				
<b>Angle Modulation &amp; Demodulation:</b> Concept of instantaneous frequency Generalized concept of angle modulation, Bandwidth of angle modulated waves- Narrow band frequency modulation (NBFM); and Wide band FM (WBFM),Phase modulation, Pre-emphasis & De-emphasis, Illustrative Problems					
<b>UNIT-III</b>	<b>DIGITAL COMMUNICATIONS-I</b>				
<b>Pulse Analog Modulation Techniques :</b> Pulse analog modulation techniques, Generation and detection of Pulse amplitude modulation, Pulse width modulation, Pulse position modulation <b>Multiple Access Techniques:</b> Introduction to multiple access techniques, FDMA, TDMA, CDMA, SDMA: Advantages and applications					
<b>UNIT-IV</b>	<b>DIGITAL COMMUNICATIONS-II</b>				
Pulse Code Modulation, DPCM, Delta modulation, Adaptive delta modulation, Overview of ASK, PSK, QPSK, BPSK and M-PSK techniques.					
<b>UNIT-V</b>	<b>WIRELESS COMMUNICATIONS</b>				
Introduction to wireless communication systems, Examples of wireless communication systems, comparison of 2G and 3G cellular networks, Introduction to wireless networks, Differences between wireless and fixed telephone networks, Introduction to Global system for mobile(GSM),GSM services and features.					
<b>Textbooks:</b>					



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1. H Taub, D. Schilling and Gautam Sahe, —Principles of Communication Systems, TMH, 2007, 3rd Edition.
2. George Kennedy and Bernard Davis, —Electronics & Communication System, 4th Edition, TMH 2009.
3. Wayne Tomasi, —Electronic Communication System: Fundamentals Through Advanced, 2nd edition, PHI, 2001.

**Reference Books:**

1. Simon Haykin, —Principles of Communication Systems, John Wiley, 2nd Edition.
2. Sham Shanmugam, —Digital and Analog communication Systems, Wiley-India edition, 2006.
3. Theodore. S. Rappaport, —Wireless Communications, Pearson Education, 2nd Edition, 2002



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Course Code	INTRODUCTION TO IMAGE PROCESSING (Open Elective-IV)	L	T	P	C
		3	0	0	3
<b>Open Elective for non ECE Students</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To learn the fundamentals of Image Processing with different Transforms.</li> <li>• To understand functions of Intensity Transformations and working fundamentals of Spatial Filters</li> <li>• To implement various models of Restoring and Reconstruction of Images from filtering projections.</li> <li>• To study the concepts of image compression using different coding &amp; Wavelets and Multi resolution Processes.</li> <li>• To design image processing systems using Segmentation techniques for Morphological &amp; Color Images</li> </ul>					
<b>Course Outcomes(CO):</b>					
<p>At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Learn the fundamentals of Image Processing with different Transforms.</li> <li>• Understand functions of Intensity Transformations and working fundamentals of Spatial Filters</li> <li>• Implement various models of Restoring and Reconstruction of Image from filtering projections.</li> <li>• Grasp the concepts of image compression using different coding &amp; Wavelets and Multi resolution Processes.</li> <li>• Design the image processing systems using Segmentation techniques for Morphological &amp; Color Images.</li> </ul>					
<b>UNIT-I</b>	<b>INTRODUCTION DIGITAL IMAGE PROCESSING</b>				
<b>Introduction:</b> Digital image representation, Fundamental steps in image processing, Elements of digital image processing, Elements of visual perception, Simple image model, Sampling and Quantization, Basic Relationships between pixels, Image transformations.					
<b>Applications:</b> Medical imaging, Robot vision, Character recognition, Remote sensing.					
<b>UNITII</b>	<b>IMAGE ENHANCEMENT</b>				
Need for image enhancement, Point processing, Histogram processing, Spatial filtering- Smoothing and Sharpening.					
<b>UNIT-III</b>	<b>COLOR IMAGE PROCESSING</b>				
Colour fundamentals, Colour models, Color transformations, Pseudo colour image processing, Full colour image processing.					
<b>UNIT-IV</b>	<b>IMAGE COMPRESSION</b>				
Redundancies, Fidelity criteria, Image compression model, Lossless compression: Huffman coding, Arithmetic coding. Lossy compression: Lossy Predictive Coding, JPEG Compression Standard.					
<b>UNIT-V</b>	<b>IMAGE SEGMENTATION</b>				
Detection of discontinuities: point, line and edge detection, Edge linking and Boundary detections: Local Processing, Global processing via Hough transform, Thresholding, Region oriented segmentation: Region growing, Region splitting and merging.					
<b>Textbooks:</b>					
<ol style="list-style-type: none"> <li>1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2007.</li> <li>2. A.V.Oppenheim and R.W. Schaffer, Discrete Time Signal Processing ,PHI</li> <li>3. S Jayaraman, S Esakkirajan and T Veerakumar, “Digital Image Processing”, TMH, 2011.</li> </ol>					
<b>Reference Books:</b>					



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1. S.K.Mitra, Digital Signal Processing – A practical approach , 2nd Edition, Pearson Education, New Delhi, 2004.
2. MH Hayes, Digital Signal Processing, Schaum’s Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007.



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Course Code	TRANSDUCERS AND SENSORS (Open Elective-IV)	L	T	P	C
		3	0	0	3
<b>Open Elective for non ECE Students</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To understand characteristics of Instrumentation System and the operating principle of motion transducers.</li> <li>• To explore working principles, and applications of different temperature transducers and Piezo-electric sensors.</li> <li>• To provide knowledge on flow transducers and their applications.</li> <li>• To study the working principles of pressure transducers.</li> <li>• To introduce working principle and applications of force and sound transducers.</li> </ul>					
<b>Course Outcomes(CO):</b>					
<p>At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand characteristics of Instrumentation System and the operating principle of motion transducers.</li> <li>• Explore working principles, and applications of different temperature transducers and Piezo-electric sensors.</li> <li>• Gain knowledge on flow transducers and their applications.</li> <li>• Learn the working principles of pressure transducers.</li> <li>• Understand the working principle and applications of force and sound transducers.</li> </ul>					
<b>UNIT-I</b>	<b>INTRODUCTION</b>				
<p><b>Introduction:</b> General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification. <b>Motion Transducers:</b> Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers</p>					
<b>UNITII</b>	<b>TEMPERATURE TRANSDUCERS</b>				
<p><b>Temperature Transducers:</b> Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics. Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.</p>					
<b>UNIT-III</b>	<b>FLOW TRANSDUCERS</b>				
<p><b>Flow Transducers:</b> Bernoulli's principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.</p>					
<b>UNIT-IV</b>	<b>PRESSURE TRANSDUCERS</b>				
<p><b>Pressure Transducers:</b> Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high- and low-pressure measurement.</p>					
<b>UNIT-V</b>	<b>FORCE AND SOUND TRANSDUCERS</b>				
<p><b>Force and Sound Transducers:</b> Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.</p>					
<b>Textbooks:</b>					
<p>1. A.K. Sawhney, —A course in Electrical and Electronics Measurements and Instrumentation, Dhanpat Rai &amp; Co. 3rd edition Delhi, 2010.</p>					



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2. Rangan C.S, Sarma G.R and Mani V S V, —Instrumentation Devices and Systems, TATA McGraw Hill publications, 2007.

**Reference Books:**

1. Doebelin. E.O, —Measurement Systems Application and Design, McGraw Hill International, New York, 2004.
2. Nakra B.C and Chaudhary K.K, —Instrumentation Measurement and Analysis, Second Edition, Tata McGraw-Hill Publication Ltd. 2006.



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Course Code	INTRODUCTION TO INTERNET OF THINGS			L	T	P	C
	(Open Elective-IV)			3	0	0	3
<b>Open Elective for non ECE Students</b>							
<b>Course Objectives:</b>							
<ul style="list-style-type: none"> <li>• Students will be explored to the interconnection and integration of the physical world and they cyber space.</li> <li>They are also able to design &amp; develop IOT Devices.</li> </ul>							
<b>Course Outcomes(CO):</b>							
At the end of the course, the students will be able to:							
<ul style="list-style-type: none"> <li>• Understand the application areas of IOT</li> <li>• Understand building blocks of Internet of Things and characteristics.</li> <li>• Realize the revolution of Internet in Mobile Devices, Cloud &amp; Sensor Networks</li> </ul>							
<b>UNIT-I</b>	<b>OVERVIEW: INTERNET OF THINGS</b>						
<b>Overview:</b> Internet of Things Definition Evolution, IoT Architectures, Resource Management, IoT data management and Analytics, Communication Protocols, Applications, Security, Identity Management and Authentication, Privacy, Standardization and Regulatory Limitations.							
<b>UNITII</b>	<b>DOMAIN SPECIFIC IOTS</b>						
<b>Domain Specific IOTs:</b> Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle.							
<b>UNIT-III</b>	<b>INTRODUCTION TO SENSOR INTERFACING, MICROCONTROLLERS</b>						
<b>Introduction to Sensor Interfacing, Microcontrollers, and Their Interfacing:</b> Introduction to Sensor Interfacing, Types of Sensors, Controlling Sensors through Webpages, Microcontrollers: A Quick Walkthrough, Advanced RISC Machine, Introduction Arduino, Setting up the Arduino development Environment.							
<b>UNIT-IV</b>	<b>PROTOCOLS FOR IOT</b>						
<b>Protocols for IoT – Messaging and Transport Protocols:</b> Introduction, Messaging Protocols, XMPP and DDS Protocols, Transport Protocols							
<b>Addressing and Identification:</b> Introduction, Internet Protocol Version 4, Internet Protocol Version 6 (IPv6), Uniform Resource Identifier (URI) Packages.							
<b>UNIT-V</b>	<b>APPLICATION BUILDING WITH IOT</b>						
<b>Application Building with IoT:</b> Introduction, Smart Perishable Tracking with IoT and Sensors, IoT–Based Application to Monitor Water Quality, Smart Warehouse Monitoring, Smart Retail – IoT Possibilities in the Retail Sector, Prevention of Drowsiness of Drivers by IoT-Based Smart Driver Assistance Systems, System to Measure Collision Impact in an Accident with IoT, Integrated Vehicle Health Management							
<b>Textbooks:</b>							
<ol style="list-style-type: none"> <li>1. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, 2nd Edition, Wiley Publications.</li> <li>2. Vijay Madiseti, Arshdeep Bahga, Internet of Things A Hands-On- Approach, 2014.</li> </ol>							
<b>Reference Books:</b>							
<ol style="list-style-type: none"> <li>1. Adrian McEwen, —Designing the Internet of Things, Wiley Publishers, 2013.</li> <li>2. Daniel Kellmerein, —The Silent Intelligence: The Internet of Things, 2013.</li> </ol>							



Course Code	<b>SYSTEM VERILOG</b> (Skill Oriented Course)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>1</b>	<b>2</b>	<b>2</b>
<b>IV Year 1<sup>st</sup> Semester</b>					
<b>Course Outcomes (CO):</b>					
Outcome 1: Ability to justify the need of verification and verification language System Verilog					
Outcome 2: Ability to describe design and test bench concepts					
Outcome 3: Ability to write your System Verilog code					
Outcome 4: Ability to implement Various System Verilog Data Types including User Defined Data Types					
Outcome 5: Ability to use interface concepts of System Verilog					
Outcome 6: Ability to simulate System Verilog code with simulation tool and interpret simulation log					
<b>UNIT - I</b>					
<b>Module 1</b>					
. Verification Methodology Overview Introduction to Verification Methodology, Verification Process, Reusable TB, Verification Environment Architecture, Constraint Random Coverage Driven Verification ,Verification Methodologies & Summary					
<b>Module 2</b>					
System Verilog Language Concepts System Verilog Concepts Agenda, System Verilog Overview, System Verilog Transactions System Verilog Interface, System Verilog Virtual Interface System Verilog OOP , System Verilog Randomization & Functional Coverage System Verilog TB Architecture					
<b>Module 3</b>					
System Verilog Data types System Verilog Introduction & Logic Data Type, System Verilog Data Types - 2 State, Struct & Enum, System Verilog Data Types - Strings, Packages & Summary					
<b>Module 4</b>					
System Verilog Memories System Verilog Memories - Introduction, Packed and Multi-Dimensional Arrays, System Verilog Memories - Dynamic Arrays & Queues, System Verilog Memories - Associative Arrays, Array Methods & Summary					
<b>Module 5</b>					
System Verilog Tasks & Functions System Verilog Tasks & Functions - Introduction, Void Functions, Fun return & Automatic Task SV Tasks & Functions -Pass by value & ref and Summary					
<b>Module 6</b>					
System Verilog Interfaces System Verilog Interfaces - Introduction & Verilog ports Vs SV Interface, System Verilog Interfaces – Mod ports & Clocking Block System Verilog Interfaces - Examples & Summary					
<b>Module 7</b>					
System Verilog Object Oriented Programming - Basics System Verilog - Introduction, Class Data Type & Objects, System Verilog OOP - Constructor, Null Object, Object assignments and copy, System Verilog OOP – Shallow Vs Deep Copy & Summary					

**Module 8**

System Verilog Object Oriented Programming - Advanced

System Verilog OOP - Introduction, Inheritance & Super, System Verilog OOP - Static properties & methods and Pass by ref, System Verilog OOP - Polymorphism, \$cast, Virtual & Parameterized classes,

**Module 9**

SystemVerilog Randomization

System Verilog Randomization - Introduction, rand and randc

System Verilog Randomization - Randomize(), Pre and Post randomize & Constraints System

Verilog Randomization - Set Membership, Constraints & Summary

**Module 10**

: System Verilog Threads

System Verilog Threads , Events, Mailbox and Semaphores, System Verilog Virtual Interface Module 11

: System Verilog Virtual Interface - Introduction, Implementation & Examples

**Module 12**

: System Verilog Functional Coverage

System Verilog Functional Coverage - Introduction & CRCDV

System Verilog Functional Coverage – Cover group, Cover point, Bins, Cross, Methods & Summary

**Module 13**

System Verilog Case Studies, System Verilog Case Studies

**Module 14**

Universal Verification Methodology Overview

Introduction to UVM, UVM Concepts, UVM SoC TB, UVM AHB UVC, UVM SoC TB Examples

**TEXTBOOKS**

1. Chris Spear, “System Verilog for Verification: A guide to learning the testbench language features”, Springer, 2nd Edition.

**References**

1. Stuart Sutherland, Simon Davidmann, and Peter Flake, “System Verilog for Design: A guide to using system verilog for hardware design and modeling”, Springer, 2nd Edition.

2. Ben Cohen, Srinivasan Venkataramanan, Ajeetha Kumari and Lisa Piper, “SystemVerilog Assertions Handbook”, VhdlCohen Publishing, 3rd edition

3. System Verilog Language Reference manual



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Course Code	GENDER SENSITIZATION (Audit Course)	L	T	P	C
		2	0	0	0
<b>IV Year 1<sup>st</sup> Semester</b>					
<b>Course Objectives:</b>					
To enable students to understand the gender related issues, vulnerability of women and men					
<ul style="list-style-type: none"> <li>• To familiarize them about constitutional safeguard for gender equality</li> <li>• To expose the students to debates on the politics and economics of work</li> <li>• To help students reflect critically on gender violence</li> <li>• To make them understand that gender identities and gender relations are part of culture as they shape the way daily life is lived in the family as well as wider community and the workplace.</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• Understand the basic concepts of gender and its related terminology</li> <li>• Identify the biological , sociological, psychological and legal aspects of gender</li> </ul>					
<b>UNIT-I</b>	<b>UNDERSTANDING GENDER</b>				
Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.					
<b>UNITII</b>	<b>GENDER ROLES AND RELATIONS</b>				
Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences- Declining Sex Ratio-Demographic Consequences-Gender Spectrum -					
<b>UNIT-III</b>	<b>GENDER AND LABOUR</b>				
Division and Valuation of Labour-Housework: The Invisible Labor- —My Mother doesn't Work. —Share the Load. —Work: Its Politics and Economics -Fact and Fiction- Unrecognized and Unaccounted work - Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming					
<b>UNIT-IV</b>	<b>GENDER-BASED VIOLENCE</b>				
The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence					
<b>UNIT-V</b>	<b>GENDER AND CULTURE</b>				
Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature-Gender Development Issues-Gender Issues-Gender Sensitive Language- Just Relationships					
<b>Textbooks:</b>					
1. A.Suneetha, Uma Bhrugubanda, et al. <i>Towards a World of Equals: A Bilingual Textbook on Gender</i> , Telugu Akademi, Telangana, 2015.					
2. Butler, Judith. <i>Gender Trouble: Feminism and the Subversion of Identity</i> . UK Paperback Edn. March 1990					
<b>Reference Books:</b>					
1. Wtatt, Robin and Massood, Nazia, <i>Broken Mirrors: The dowry Problems in India</i> , London : Sage Publications, 2011					
2. Datt, R. and Kornberg, J.(eds), <i>Women in Developing Countries, Assessing Strategies for Empowerment</i> , London: Lynne Rienner Publishers, 2002					
3. Brush, Lisa D., <i>Gender and Governance</i> , New Delhi, Rawat Publication, 2007					



Online Resources:

### 1. Understanding Gender

chrome-

extension://kdpelmjpfafjppnhbloffcjpeomlnpah/https://www.arvindguptatoys.com/arvindgupta/kamla-gender1.pdf

[https://onlinecourses.swayam2.ac.in/nou24\\_hs53/preview](https://onlinecourses.swayam2.ac.in/nou24_hs53/preview)

### 2. Gender Roles and Relations

<https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and-stereotypes>

<https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408>

[https://onlinecourses.swayam2.ac.in/cec23\\_hs29/preview](https://onlinecourses.swayam2.ac.in/cec23_hs29/preview)

### 3. Gender and Labour

<https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be-redressed> [https://onlinecourses.nptel.ac.in/noc23\\_mg67/preview](https://onlinecourses.nptel.ac.in/noc23_mg67/preview)

### 4. GENDER-BASED VIOLENCE

[https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language\\_content\\_entity=en](https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language_content_entity=en)

<https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-and-girls>

[https://onlinecourses.swayam2.ac.in/nou25\\_ge38/preview](https://onlinecourses.swayam2.ac.in/nou25_ge38/preview)

### 5. GENDER AND CULTURE

<https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/>

<https://sociology.iresearchnet.com/sociology-of-culture/gender-and-culture/>

<https://archive.nptel.ac.in/courses/109/106/109106136/>

Abdulali Sohaila. —I Fought For My Life...and Won. Available online (at:

<http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdul/>



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**Electronics & Communication Engineering**  
**B.Tech. IV Year - II Semester**

S. No.	Category	Title	L	T	P	C
1	PR	Internship	-	-	-	4
2	PR	Project work	-	-	-	8

Category	CREDITS
Internship	4
Project work	8
<b>TOTAL CREDITS</b>	<b>12</b>



# **HONOURS WITH VLSI SPECIALIZATION**

**(For ECE students)**



**Sri Krishnadevaraya University**  
**College of Engineering & Technology, Ananthapuramu – 515 003 (A.P) India**  
**Electronics & Communication Engineering**

<b>Sri Krishnadevaraya University College of Engineering &amp; Technology</b>					
<b>Dept. Electronics and Communication Engineering</b>					
<b>Honors in VLSI</b>					
S.No.	CourseCode	Course Name	Category	L-T-P	Credits
1.		Analog IC Design.	PC	3-0-0	3
2.		Digital IC Design	PC	3-0-0	3
3.		Low power VLSI	PC	3-0-0	3
4.		Testing and Verification	PC	3-0-0	3
5.		FPGA architectures	PC	3-0-0	3
6.		Analog and Digital IC Design Lab	PC	0-0-3	1.5
7.		Physical Design Automation Lab	PC	0-0-3	1.5
<b>Total</b>					<b>18</b>



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Course Code	ANALOG IC DESIGN	L	T	P	C
		3	0	0	3
<b>Honors</b>					
<b>Course Objectives:</b>					
<p>To enable students to understand the gender related issues, vulnerability of women and men</p> <ul style="list-style-type: none"> <li>• To explore MOSFET characteristics, biasing techniques and current mirrors for analog circuit design.</li> <li>• To design and analyze single-stage amplifiers and their performance with feedback and cascode configurations.</li> <li>• To analyze the design and performance of differential amplifiers in analog circuits.</li> <li>• To examine the characteristics and compensation techniques of operational amplifiers.</li> <li>• To understand the design principles of bandgap reference circuits.</li> </ul>					
<b>Course Outcomes (CO):</b>					
<p>At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the MOSFET characteristics, biasing techniques and current mirrors for analog circuit design.</li> <li>• Design and analyze single-stage amplifiers and their performance with feedback and cascode configurations.</li> <li>• Analyze the design and performance of differential amplifiers in analog circuits.</li> <li>• Learn the characteristics and compensation techniques of operational amplifiers.</li> <li>• Understand the design principles of bandgap reference circuits.</li> </ul>					
<b>UNIT-I</b>	<b>Review of MOSFET device characteristics:</b>				
<p>Second order effects, MOS small signal Model, Capacitances, body bias effect, Current biasing, voltage biasing, Technology biasing, Relative comparison and limitations. Basic building blocks and basic cells - Switches, active resistors, Current sources and sinks, Current mirrors: Basic current mirror, cascode current mirror, low voltage current mirror, Wilson and Widlar current mirrors, voltage and current references, Mismatch inaccuracies, Design solutions to minimize mismatch inaccuracies.</p>					
<b>UNIT-II</b>	<b>Single stage amplifier</b>				
<p><b>Single stage amplifier:</b> Analytical justification of operating region suitable for amplification/switching, Design of CS amplifier with different loads, Limitations of diode connected load, Improving output impedance of CS amplifier through feedback, small signal analyses of common gate and common drain topologies and their frequency response with parasitic effects, significance of cascode, design of cascode amplifier and with ideal current source load and practical cascode load, Limitations of cascode, folded cascode amplifier and design with parasitics.</p>					
<b>UNIT-III</b>	<b>Differential amplifier</b>				
<p><b>Differential amplifier:</b> Significance of differential signaling, Limitations of quasi differential amplifier, Design of differential amplifier with current source load and diode connected load and small signal analyses, errors due to mismatch, replication principle, qualitative analysis, common mode response, gilbert cell, Common centroid layout.</p>					
<b>UNIT-IV</b>	<b>Operational amplifier</b>				
<p><b>Operational amplifier:</b> Characterization, two stage OP amp, small signal analysis, Miller compensation, effect of RHP zero on stability, Lead compensation, constant gm biasing, design of biasing circuit independent of process and temperature variations.</p>					
<b>UNIT-V</b>	<b>Band Gap Reference</b>				
<p><b>Band Gap Reference:</b> General considerations, Supply independent biasing, temperature-independent references, negative-TC voltage, positive TC voltage, Bandgap reference, PTAT generation, curvature correction, Design of BGR under low voltage conditions.</p>					
<b>Textbooks:</b>					



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1. Behzad Razavi, Design of Analog CMOS Integrated Circuit, McGraw Hill Education, 2017, 2nd Edition.
2. Paul J. Hurst, Paul R. Gray, Robert G Meyer and Stephen H. Lewis, Analysis and Design of Analog Integrated Circuits, Wiley, 2024, 6th Edition.
3. Mohammed Ismail and Terri Fiez, Analog VLSI: Signal and Information Processing, McGraw Hill, 1994.

**Reference Books:**

1. Randall L. Geiger, Phillip E. Allen and Noel R. Strader, VLSI Design Techniques for Analog and Digital Circuits, Tata McGraw-Hill Education, 1989.
2. David Johns, Tony Chan Carusone and Kenneth Martin, Analog Integrated Circuit Design, Wiley, 2011, 2nd Edition.
3. Paul G. A. Jespers and Boris Murmann, Systematic Design of Analog CMOS Circuits, Cambridge University Press, 2017.



Course Code	DIGITAL IC DESIGN	L	T	P	C
		3	0	0	3
<b>Honors</b>					
<b>Course Objectives:</b>					
To enable students to					
<ul style="list-style-type: none"> <li>• To understand MOSFET and CMOS inverter operation along with constraints.</li> <li>• To explore CMOS design techniques for combinational and sequential logic circuits.</li> <li>• To gain knowledge on the timing issues in digital circuits.</li> <li>• To design and analyze various arithmetic building blocks.</li> <li>• To learn about the design and functionality of semiconductor memories.</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• To understand MOSFET and CMOS inverter operation along with constraints.</li> <li>• To explore CMOS design techniques for combinational and sequential logic circuits.</li> <li>• To gain knowledge on the timing issues in digital circuits.</li> <li>• To design and analyze various arithmetic building blocks.</li> <li>• To learn about the design and functionality of semiconductor memories.</li> </ul>					
<b>UNIT-I</b>	<b>MOS Inverters:</b>				
<b>MOS Inverters:</b> Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effect, MOSFET Capacitances, CMOS Inverter- Static and switching characteristics, Delay-Time Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitic, Power Consumption in CMOS Gates.					
<b>UNIT-II</b>	<b>Designing Combinational &amp; Sequential Logic Gates in CMOS</b>				
<b>Designing Combinational &amp; Sequential Logic Gates in CMOS:</b> Static CMOS design- ratioed logic, pass transistor logic, transmission gate logic, Dynamic CMOS Design, Static Latches and Registers, Dynamic Latches and Registers, Alternative Register Styles, Nonbistable Sequential Circuits, Logic Style for Pipelined Structures.					
<b>UNIT-III</b>	<b>Timing Issues in Digital Circuits:</b>				
<b>Timing Issues in Digital Circuits:</b> Introduction, Synchronous Timing basics, Clock Skew and Jitter, Clock distribution techniques, Clock Generation and Synchronization					
<b>UNIT-IV</b>	<b>Designing Arithmetic Building Blocks</b>				
<b>Introduction, The Adder:</b> Circuit and Logic Design, Multipliers: Shifters, Power Considerations in Datapath Structures.					
<b>UNIT-V</b>	<b>Designing Memory:</b>				
<b>Designing Memory:</b> Introduction, Semiconductor Memories - An Introduction, The Memory Core: RAM, ROM, Memory Peripheral Circuitry.					
<b>Textbooks:</b>					
<ol style="list-style-type: none"> <li>1. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, <i>Digital Integrated Circuits: A Design Perspective</i>, Pearson, 2003, 2nd Edition.</li> <li>2. John P. Uyemura, <i>CMOS Logic Circuit Design</i>, Springer, 2001.</li> <li>3. John P. Uyemura, <i>Introduction to VLSI Circuits and Systems</i>, Wiley, 2002.</li> </ol>					
<b>Reference Books:</b>					



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1. Sung-Mo Kang and Yusuf Leblebici, *CMOS Digital Integrated Circuits*, McGraw-Hill, 2003, 3rd Edition.
2. Charles Hawkins, Jaume Segura and Payman Zarkesh-Ha, *CMOS Integrated Digital Electronics: A First Course*, IET, 2012.



Course Code	LOW POWER VLSI DESIGN	L	T	P	C
		3	0	0	3
<b>Honors</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To impart knowledge on different abstraction levels in VLSI Design and the impact of power reduction methods at higher levels</li> <li>• To describe leakage control mechanisms to reduce static power consumption in DSM VLSI regime</li> <li>• To explain technology independent and technology-dependent techniques for Dynamic power reduction in CMOS circuits</li> <li>• To introduce various software power estimation and optimization techniques for low power VLSI system design</li> <li>• To demonstrate low power circuit and architectural techniques for reducing power consumption in SRAM designs.</li> </ul>					
<b>Course Outcomes(CO):</b>					
<p>At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Distinguish impact of various power reduction techniques at different levels of VLSI Design</li> <li>• Identify sources of power dissipation and apply leakage reduction techniques to reduce static power consumption in CMOS circuits</li> <li>• Analyze different power reduction techniques for VLSI systems at Design time, Run-time and Stand-by modes</li> <li>• Apply simple software power estimation and optimization techniques for low power VLSI system design</li> <li>• Apply low power circuit and architectural techniques such as capacitance reduction, gated clocking, VDD and <math>V_{th}</math> scaling, DVS etc in digital systems and SRAM designs</li> </ul>					
<b>UNIT - I</b>	<b>Introduction to Low Power design</b>				
<p><b>Introduction to Low Power design:</b> Why worry about power – at global and SOC levels, Emerging zero-power applications (WSN), 20 nm scenario, Design-productivity challenge, Impact of implementation choices, Motivation for LPD, Basic VLSI Design Flow, Optimization examples at various levels (System, Sub-system, RTL, Gate, Circuit and Device levels)</p> <p>Sources of power dissipation, MOS transistor leakage components, Static Power dissipation, Active Power dissipation, Circuit Techniques for Low Power Design – Standby leakage control using transistor stacks, Multiple VTH and dynamic VTH techniques, Supply voltage scaling technique.</p>					
<b>UNIT - II</b>	<b>Power Optimization Techniques – I:</b>				
<p>Power Optimization Techniques – I: Dynamic Power Reduction Approaches, Circuit Parallelization, Voltage Scaling Based Circuit Techniques, Circuit Technology – Independent Power Reduction, Circuit Technology Dependent Power Reduction; Leakage Power Reduction – Leakage Components, Design Time Reduction Techniques, Run-time Stand-by Reduction Techniques, Run-time Active Reduction Techniques Reduction in Cache Memories, LVLP Logic Styles, Current-Mode CMOS Adders using multiple-valued logic</p>					
<b>UNIT - III</b>	<b>Power Optimization Techniques – II</b>				
<p><b>Power Optimization Techniques – II:</b> Low Power Very Fast Dynamic Logic Circuits, Low Power Arithmetic Operators, Energy Recovery Circuit Design, Adiabatic – Charging Principle and its implementation issues (Ref-2)</p> <p><b>Software Design for Low Power:</b> Sources of Software Power Dissipation, Software Power Estimation, Software Power Optimizations, Automated Low-Power Code Generation, Co-design for Low Power</p>					
<b>UNIT - IV</b>	<b>Low Voltage Low Power Static Random Access memories:</b>				



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**Low Voltage Low Power Static Random Access memories:** Basics, Race between 6T and 4T memory cells, LVLP SRAM Cell designs- Shared bit-line SRAM cell configuration, Power efficient 7T SRAM cell with current mode read and write, Loadless CMOS 4T SRAM cell, The 1T SRAM cell, Pre-charge and Equalization Circuit, Dynamic and static decoders, Voltage Sense amplifier, Output Latch, Low Power SRAM Techniques: Sources of SRAM Power, Low Power Circuit techniques such as capacitance reduction, Leakage current reduction.

**UNIT - V    Large LP VLSI System design and Applications:**

**Large LP VLSI System design and Applications:** Architecture-driven Voltage Scaling, Power optimization using operation reduction and operation substitution, Pre-computation based optimization, Multiple and Dynamic supply voltage design, Choice of supply voltages, Varying the clock speed, varying the VDD of RAM structures, Gated Clocking. Leakage current reduction in medical devices.

**Textbooks:**

1. Kiat-Seng Yeo and Kaushik Roy, “Low-Voltage, Low-Power VLSI Subsystems, Tata McGrawhill Edition, 2005.
2. Christian Piguet, “Low Power CMOS Circuits Technology, Logic Design and CAD Tools”, 1<sup>st</sup> Indian Reprint, CRC Press, 2010.

**Reference Books:**

1. Kaushik Roy and Sharat Prasad, “ Low-Power CMOS VLSI Circuit Design” , Wiley Pub., 2000.
2. Dimitrios Soudris, Christian Piguet and Coastas Goutis, “Designing CMOS Circuits for Low Power”, Kluwer Academic Pub, 2002
3. J. Rabaey, Low Power Design Essentials, 1<sup>st</sup> Edition, Springer Publications, 2010.



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Course Code	TESTING AND VERIFICATION	L	T	P	C
		3	0	0	3
<b>Honors</b>					
<b>Course Objectives:</b>					
To enable students to					
<ul style="list-style-type: none"> <li>• To analyze VLSI testing concepts, fault modeling, and defect analysis for ensuring chip reliability.</li> <li>• To explore fault simulation techniques and algorithms for efficient fault detection in digital circuits.</li> <li>• To examine test generation techniques for combinational and sequential circuits, fault modeling, and scan chain-based testing.</li> <li>• To study and apply test generation algorithms for digital circuits and understand design-for-testability techniques.</li> <li>• To apply Design for Testability (DFT) techniques, including BIST architectures and test algorithms for embedded memory.</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• Identify faults, model defects, and analyze testing methods for improving VLSI chip quality and yield.</li> <li>• Utilize serial, parallel, and deductive fault simulation algorithms for testing and diagnosing faults in digital systems.</li> <li>• Implement ATPG and path sensitization methods for fault detection in combinational and sequential circuits and implement scan chain-based testing.</li> <li>• Apply D, FAN, and PODEM algorithms for fault detection and implement design-for-testability techniques in digital circuits.</li> </ul>					
<b>UNIT-I</b>	<b>VLSI Design flow</b>				
Role of testing in VLSI Design flow, Testing at different levels of abstraction, Fault, error, defect, diagnosis, yield, Types of testing, Rule of Ten, Defects in VLSI chip. Modelling basic concepts, Functional modelling at logic level and register level, structure models, logic simulation, delay models. Various types of faults, Fault equivalence and Fault dominance in combinational sequential circuits.					
<b>UNIT II</b>	<b>Fault simulation applications</b>				
Fault simulation applications, General fault simulation algorithms- Serial, and parallel, Deductive fault simulation algorithms.					
<b>UNIT-III</b>	<b>Combinational circuit test generation</b>				
Combinational circuit test generation, Structural Vs Functional test, ATPG, Path sensitization methods. Difference between combinational and sequential circuit testing, five and eight valued algebra, and Scan chain-based testing method.					
<b>UNIT-IV</b>	<b>D-algorithm procedure</b>				
D-algorithm procedure, Problems, PODEM Algorithm. Problems on PODEM Algorithm. FAN Algorithm. Problems on FAN algorithm, Comparison of D, FAN and PODEM Algorithms. Design for Testability, Ad-hoc design, Generic scan-based design.					
<b>UNIT-V</b>	<b>Classical Scan-Based Design</b>				
Classical scan-based design, System level DFT approaches, Test pattern generation for BIST, Circular BIST, BIST Architectures, Testable memory design, Test algorithms, Test generation for Embedded RAMs.					
<b>Textbooks:</b>					
<ol style="list-style-type: none"> <li>1. M. Abramovici, M. Breuer, and A. Friedman, <i>Digital Systems Testing and Testable Design</i>, IEEE Press, 1990.</li> <li>2. M. Bushnell and V. Agrawal, <i>Essentials of Electronic Testing for Digital, Memory &amp; Mixed-Signal VLSI Circuits</i>, Kluwer Academic Publishers, 2000.</li> </ol>					



**Reference Books:**

1. Stroud, *A Designer's Guide to Built-in Self-Test*, Kluwer Academic Publishers, 2002.
2. V. Agrawal and S. C. Seth, *Test Generation for VLSI Chips*, Computer Society Press, 1989.



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Course Code	FPGA ARCHITECTURES	L	T	P	C
		3	0	0	3
<b>Honors</b>					
<b>Course Objectives:</b>					
To enable students to					
<ul style="list-style-type: none"> <li>• To explore the evolution, design flow, and applications of FPGAs in modern digital systems.</li> <li>• To design and implement digital systems using Programmable Logic Devices (PLDs) for complex operations.</li> <li>• To study FPGA/CPLD architectures, programming technologies, and commercially available FPGA families.</li> <li>• To analyze the architecture, functionality, and performance impact of FPGAs and CPLDs.</li> <li>• To understand FPGA routing architectures, routing strategies, and their implementation in modern FPGA families like Kintex-7, Virtex-7, and Artix-7.</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• Explain FPGA architecture, design process, and real-world applications in digital circuit implementation.</li> <li>• Develop efficient digital circuits such as universal blocks, memory units, floating-point multipliers, and barrel shifters using PLDs.</li> <li>• Analyze FPGA/CPLD programming technologies and compare commercially available FPGA architectures like Xilinx, Actel, and Altera.</li> <li>• Evaluate FPGA/CPLD building blocks, routing structures, and delay models for efficient digital design.</li> <li>• Understand FPGA routing structures, analyze routing strategies, and apply them in real-world FPGA applications using Kintex-7, Virtex-7, and Artix-7.</li> </ul>					
<b>UNIT-I</b>	<b>Introduction to FPGAs</b>				
Introduction to FPGAs: Evolution of programmable devices, FPGA Design flow, Applications of FPGA					
<b>UNIT-II</b>	<b>Design Examples using PLDs</b>				
Design Examples using PLDs: Design of Universal block, Memory, Floating point multiplier, Barrel shifter.					
<b>UNIT-III</b>	<b>FPGAs/CPLDs</b>				
FPGAs/CPLDs: Programming Technologies, Commercially available FPGAs, Xilinx's Vertex and Spartan, Actel's FPGA, Altera's FPGA/CPLD.					
<b>UNIT-IV</b>	<b>Building blocks of FPGAs/CPLDs</b>				
Building blocks of FPGAs/CPLDs: Configurable Logic block functionality, Routing structures, Input/output Block, Impact of logic block functionality on FPGA performance, Model for measuring delay.					
<b>UNIT-V</b>	<b>Routing Architectures</b>				
Routing Architectures: Routing terminology, general strategy for routing in FPGAs, routing for row-based FPGAs, introduction to segmented channel routing, routing for symmetrical FPGAs, example of routing in a symmetrical FPGA, general approach to routing in symmetrical FPGAs, independence from FPGA routing architectures, FPGA routing structures, FPGA architectural assumptions, the logic block, the connection block, connection block topology, the switch block, switch block topology, architectural assumptions for the FPGA CASE STUDY – Applications using Kintex-7, Virtex-7, Artix-7.					



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**Textbooks:**

1. John V. Oldfield and Richard C. Dorf, *Field Programmable Gate Arrays: Reconfigurable Logic for Rapid Prototyping and Implementation of Digital Systems*, Wiley-Interscience, 1995, 1st Edition.
2. Frank Bruno, *FPGA Programming for Beginners*, Packt, 2021.
3. Frank Bruno and Guy Eschemann, *The FPGA Programming Handbook*, Packt, 2024, 2nd Edition.
4. Stephen D. Brown, Robert J. Francis, Jonathan Rose and Zvonko G. Vranesic, *Field Programmable Gate Arrays*, Springer Science+Business Media, LLC, 1992, 1st Edition.

**Reference Books:**

1. Clive Maxfield, *The Design Warrior's Guide to FPGAs: Devices, Tools and Flows*, Elsevier-Newnes, 2004.
2. Datasheets of Artix-7, Kintex-7, Virtex-7.



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Course Code	ANALOG AND DIGITAL IC DESIGN LAB	L	T	P	C
		0	0	3	1.5
<b>Honors</b>					
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To gain proficiency in designing and analyzing MOSFET-based analog circuits, including amplifiers and current mirrors.</li> <li>• To explore the implementation of feedback topologies and differential amplifiers to enhance circuit performance.</li> <li>• To enhance proficiency in simulating and optimizing two-stage operational amplifiers from schematic to post-layout.</li> <li>• To acquire proficiency in designing and simulating CMOS inverters and logic gates using EDA tools.</li> <li>• To explore various architectures for arithmetic circuits such as adders, shift registers, and multipliers.</li> <li>• To gain hands-on experience in functional simulation, timing analysis, and RTL-to-GDS-II</li> </ul>					
<b>Course Outcomes(CO):</b>					
<p>At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Construct and evaluate single-stage and multi-stage amplifiers with various loads and feedback techniques.</li> <li>• Apply the principles of current sources, sinks, and mirrors for effective circuit biasing.</li> <li>• Implement and refine CMOS differential and two-stage operational amplifiers through post-layout simulations.</li> <li>• Construct and analyze CMOS inverters and logic gates with different design constraints and logic styles.</li> <li>• Implement and compare parallel adders, shift registers, and multipliers for performance optimization.</li> <li>• Develop and verify digital systems through functional simulation, static timing analysis, and post-synthesis verification.</li> </ul>					
<b>Analog IC Design Lab</b>					
<i>List of Experiments: Any five experiments from each group (All circuits still post layout)</i>					
<ol style="list-style-type: none"> <li>1. Lambda calculation for PMOS &amp; NMOS, Transconductance plots</li> <li>2. Single transistor amplifier with different loads</li> <li>3. CS amplifier with source degeneration</li> <li>4. Cascode amplifier</li> <li>5. Basic current sink, Cascode current sink</li> <li>6. Basic current source, Cascode current source</li> <li>7. Basic current mirror, Wilson current mirror</li> <li>8. Cascode current mirror</li> <li>9. Feedback topologies</li> <li>10. CMOS differential amplifier with current mirror load</li> <li>11. Two stage Operational amplifier</li> </ol>					
<b>Digital IC Design Lab</b>					
<ol style="list-style-type: none"> <li>1. Design and Simulation of CMOS Inverter to study the transfer Characteristics by varying the design constraints using EDA Tools</li> <li>2. Design and Simulation of logic gates using various logic styles and compare the performance</li> <li>3. 32-bit Parallel adder using 8-bit adder module</li> <li>4. 32-bit Shift register using 8-bit Shift register module</li> <li>5. Combinational and sequential multipliers: 8 x 8 multiplier</li> <li>6. Combinational and sequential multipliers: 16 x 16 multipliers</li> </ol>					



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7. Perform the functional simulation, Static Timing Analysis and post-synthesis timing verification

**Textbooks:**

1. Behzad Razavi, *Design of Analog CMOS Integrated Circuit*, McGraw Hill Education, 2017, 2nd Edition.
2. Paul J. Hurst, Paul R. Gray, Robert G Meyer and Stephen H. Lewis, *Analysis and Design of Analog Integrated Circuits*, Wiley, 2024, 6th Edition.
3. Samir Palnitkar, *Verilog HDL*, Pearson Education, 2003, 2nd Edition.
4. Erik Brunv, *Digital VLSI Chip Design with Cadence and Synopsys CAD Tools*, Pearson, 2011.

**Reference Books:**

1. Randall L. Geiger, Phillip E. Allen and Noel R. Strader, *VLSI Design Techniques for Analog and Digital Circuits*, Tata McGraw-Hill Education, 1989.
2. David Johns, Tony Chan Carusone and Kenneth Martin, *Analog Integrated Circuit Design*, Wiley, 2011, 2nd Edition.
3. Joseph Cavanagh, *Verilog HDL Design Examples*, CRC Press, 2018.
4. Blaine Readler, *Verilog by Example: A Concise Introduction for FPGA Design*, Full ARC Press, 2011.



Course Code	PHYSICAL DESIGN AUTOMATION LAB	L	T	P	C
		0	0	3	1.5
<b>Honors</b>					
<b>Course Objectives:</b>					
<ol style="list-style-type: none"> <li>1. To implement and analyze graph algorithms used in physical design automation for VLSI.</li> <li>2. To study and apply line sweep algorithms for solving computational geometry problems efficiently.</li> <li>3. To explore partitioning algorithms for efficient circuit design, including group migration, simulated annealing, and metric allocation methods.</li> <li>4. To analyze various floor planning algorithms for VLSI design, focusing on constraint-based, hierarchical, and optimization techniques.</li> <li>5. To study and apply routing algorithms for efficient pathfinding in VLSI design and network communication.</li> </ol>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ol style="list-style-type: none"> <li>1. Apply graph-based algorithms to solve problems like spanning trees, shortest paths, and Steiner trees in VLSI design.</li> <li>2. Implement and analyze line sweep and extended line sweep methods for geometric problem-solving.</li> <li>3. Apply partitioning techniques to optimize circuit design using algorithms like Kernighan-Lin, simulated annealing, and metric allocation.</li> <li>4. Utilize floor planning algorithms to optimize area, performance, and layout efficiency in VLSI design.</li> <li>5. Implement and analyze two-terminal and multi-terminal routing algorithms for efficient VLSI interconnections.</li> </ol>					
List of Experiments: <i>(Any ten experiments are to be conducted, minimum one from each group)</i>					
<b>I. Graph Algorithms</b> <ol style="list-style-type: none"> <li>1. Graph search algorithms <ul style="list-style-type: none"> <li>o Depth first search</li> <li>o Breadth first search</li> </ul> </li> <li>2. Spanning tree algorithm <ul style="list-style-type: none"> <li>o Kruskal's algorithm</li> </ul> </li> <li>3. Shortest path algorithm <ul style="list-style-type: none"> <li>o Dijkstra algorithm</li> <li>o Floyd-Warshall algorithm</li> </ul> </li> <li>4. Steiner tree algorithm</li> </ol>					
<b>II. Computational Geometry Algorithm</b> <ol style="list-style-type: none"> <li>1. Line sweep method</li> <li>2. Extended line sweep method</li> </ol>					
<b>III. Partitioning Algorithms</b> <ol style="list-style-type: none"> <li>1. Group migration algorithms <ul style="list-style-type: none"> <li>o Kernighan –Lin algorithm</li> <li>o Extensions of Kernighan-Lin algorithm <ul style="list-style-type: none"> <li>▪ Fiduccias –Mattheyses algorithm</li> <li>▪ Goldberg and Burstein algorithm</li> </ul> </li> </ul> </li> <li>2. Simulated annealing and evolution algorithms <ul style="list-style-type: none"> <li>o Simulated annealing algorithm</li> <li>o Simulated evolution algorithm</li> </ul> </li> <li>3. Metric allocation method</li> </ol>					
<b>IV. Floor Planning Algorithms</b>					



1. Constraint based methods
  2. Integer programming based methods
  3. Rectangular dualization based methods
  4. Hierarchical tree based methods
  5. Simulated evolution algorithms
  6. Time driven Floorplanning algorithms
- V. Routing Algorithms
1. Two-terminal algorithms
    - Maze routing algorithms
      - Lee's algorithm
      - Soukup's algorithm
      - Hadlock algorithm
    - Line-Probe algorithm
    - Shortest path based algorithm
  2. Multi-terminal algorithm
    - Steiner tree based algorithm
      - SMST algorithm
      - Z-RST algorithm



# **Minors in Embedded Systems & IoT**

## **(Offered by ECE to other departments)**



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<b>Sri Krishnadevaraya University College of Engineering &amp; Technology</b>				
<b>Dept. Electronics and Communication Engineering</b>				
<b>List of Minors Offered by ECE</b>				
S.No.	CourseCode	Course Name	L-T-P	Credits
1.		Embedded Systems Technology	3-0-0	3
2.		Real Time Embedded systems design and Analysis	3-0-0	3
3.		Principles of IoT	3-0-0	3
4.		Wireless Sensor Networks	3-0-0	3
5.		Industrial Internet of things	3-0-0	3
6.		Principles of IoT Lab	0-0-3	1.5
7.		Industrial Internet of things Lab	0-0-3	1.5



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Course Code	EMBEDDED SYSTEMS TECHNOLOGY	L	T	P	C
		3	0	0	3
<b>Minors</b>					
<b>Course Objectives:</b>					
To enable students to understand the gender related issues, vulnerability of women and men					
<ul style="list-style-type: none"> <li>• To introduce the fundamental concepts and classifications of embedded systems.</li> <li>• To explore the architecture and processor models used in embedded system design.</li> <li>• To study different communication interfaces and protocols in embedded systems.</li> <li>• To understand rapid prototyping using platforms like Arduino and sensor modules.</li> <li>• To develop embedded GUI interfacing and analyze case studies of real-world embedded applications.</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• Understand the basics of embedded systems, including their history, classification, and processor selection.</li> <li>• Analyze different embedded processor architectures, including ARM, RISC, and application-specific processors.</li> <li>• Evaluate various communication interfaces and protocols, such as UART, USB, SPI, I2C, and Zigbee.</li> <li>• Implement rapid prototyping techniques using Arduino, sensors, and wearable system modules.</li> <li>• Develop and interface embedded GUI systems, including LCDs, touchscreens, and VGA cameras, for real-world applications.</li> </ul>					
<b>UNIT-I</b>	<b>Introduction to Embedded system</b>				
<b>Introduction to Embedded system:</b> Introduction to Embedded Systems, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Embedded Processor Requirements, Features, Types, RISC Processors, Harvard Architecture, Super Harvard Architecture, Selection of Processors & Microcontrollers.					
<b>UNIT II</b>	<b>Architecture of Embedded System Processor</b>				
<b>Architecture of Embedded System Processor:</b> Embedded processor models, ARM core processor, Application specific processor like network processors, multimedia processors, industrial processors, superscalar processor, Advanced RISC processors. Architecture of Embedded OS, Categories of Embedded OS, Application Software, Communication Software, Development and Testing Tools					
<b>UNIT-III</b>	<b>Communication Interfaces</b>				
<b>Communication Interfaces:</b> Need for Communication Interfaces, OSI Reference Model, Basic of Networks, Network Topology, RS232/UART, RS422/RS485, USB, Infrared, Ethernet, IEEE 802.11, Bluetooth, SPI, I2C, CAN, Wifi, Flex Ray, LIN Bus, Zigbee.					
<b>UNIT-IV</b>	<b>Rapid prototyping</b>				
<b>Rapid prototyping:</b> Arduino platform, hardware and software, Sensor's modules, Robo Control modules, 3D printing module, ADC module, wearable systems. etc.					
<b>UNIT-V</b>	<b>Embedded GUI interfacing</b>				
<b>Embedded GUI interfacing:</b> Arduino based graphic LCD, Touch screen, joy stick, VGA camera interfacing and programming in Python. Creative applications of Arduino					
<b>Design Examples &amp; Case Studies of Embedded System:</b> Digital Thermometer, Navigation Systems, Smart Card, RF Tag.					
<b>Textbooks:</b>					
1. David Simon, —An embedded Software Primer   PearsonPublication,2021.					
2. Frank Vahid, —Embedded system — A unified Hardware Software Introduction   John Wiley and Sons,2005.					



**Reference Books:**

1. Tammy Noergaard,|| Embedded System Architecture||, Elsevier publication,2014.



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Course Code	REAL TIME EMBEDDED SYSTEMS DESIGN AND ANALYSIS			L	T	P	C
				3	0	0	3
<b>Minors</b>							
<b>Course Objectives:</b>							
To enable students to							
<ul style="list-style-type: none"> <li>• To understand the fundamental concepts of Real-Time Operating Systems (RTOS), kernel architecture, and synchronization mechanisms.</li> <li>• To study real-time embedded software development using Linux, RT Linux, and RTOS programming techniques.</li> <li>• To explore real-time task scheduling techniques, including table-driven, cyclic, EDF, and RMA scheduling.</li> <li>• To analyze real-time hardware architectures, software stacks, and best practices for embedded system programming.</li> <li>• To examine real-time communication protocols, database systems, and validation techniques for embedded systems.</li> </ul>							
<b>Course Outcomes(CO):</b>							
At the end of the course, the students will be able to:							
<ul style="list-style-type: none"> <li>• Explain the architecture of RTOS, task scheduling, and synchronization mechanisms such as semaphores, mutexes, and message queues.</li> <li>• Demonstrate proficiency in real-time embedded software development using Linux, RT Linux, and various RTOS platforms.</li> <li>• Apply real-time scheduling algorithms to optimize task execution and system performance.</li> <li>• Analyze real-time embedded hardware architectures and software stacks for efficient system integration.</li> <li>• Implement real-time communication protocols and perform validation and verification of embedded systems using case studies.</li> </ul>							
<b>UNIT-I</b>	<b>Introduction to RTOS</b>						
<b>Introduction to RTOS:</b> Overview Of RTOS, Architecture of Kernel, Task & Task Scheduler, ISR, Semaphore, Mutex, Mailbox, Message Queues, Event Registers, Pipes, Signals, Timers, Memory Management, Priority Inversion Problem.							
<b>UNIT-II</b>	<b>Real Time Embedded Software</b>						
<b>Real Time Embedded Software:</b> Linux, RT Linux, multiprocessor software developments, data flow graph, Study and programming of RTOS like RTX51, Free RTOS etc. timing diagram analysis for fixed and dynamic priority software services.							
<b>UNIT-III</b>	<b>Real time Scheduling</b>						
<b>Real time Scheduling:</b> Scheduling Real-Time Tasks: Types of Schedulers Table-driven scheduling Cyclic schedulers EDF RMA, Priority Pre-emptive Scheduler State Machine for Linux and VxWorks, Comparison of Cyclic Executive, Introduction to Worst Case Analysis, Example of scheduling, Real-Time Scheduling and Rate Monotonic Least Upper Bound.							
<b>UNIT-IV</b>	<b>Overview of Real-time Hardware Architectures and Software Stacks</b>						
<b>Overview of Real-time Hardware Architectures and Software Stacks:</b> Embedded Linux on the Raspberry Pi ARM A-Series System-on-Chip processors, Tracing Linux kernel and network stack events. Best Practices for RTES Programming, System Integration Testing (Hardware, Firmware, and Software),							
<b>UNIT-V</b>	<b>Real Time Communication</b>						
<b>Real Time Communication:</b> RT Services Communication and Synchronization, Performance of two Real-Time communication Protocols, Real time communication over network, Real Time database. <b>Verification and Validation of RTES project:</b> Using Point-to-point Serial and TCP/IP for Embedded Systems, Case							



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Study of Coding for Sending Application Layer Byte Streams on A TCP/IP Network Using RTOS. Building a simple Linux multi-service system using POSIX real-time extensions on Raspberry Pi 3b using sequencing and methods to log and verify agreement between theory and practice.

**Textbooks:**

1. Embedded Realtime systems, Prasad Dreamtech Wiley Publication, 2003.
2. "Real-Time Systems: Theory and Practice," Rajib Mall Pearson, 2008.

**Reference Books:**

1. Real-Time Systems Design and Analysis, Philip Laplante, 2nd Edition, Prentice Hall, 2013.



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Course Code	PRINCIPLES OF IOT	L	T	P	C
		3	0	0	3
<b>Minors</b>					
<b>Course Objectives:</b>					
To enable students to					
<ul style="list-style-type: none"> <li>• To introduce the fundamental concepts, characteristics, and design principles of the Internet of Things (IoT).</li> <li>• To explore IoT components, communication protocols, and networking techniques.</li> <li>• To understand IoT system management, including platform design and application development.</li> <li>• To study networking and computing in IoT, including Python-based IoT programming and cloud integration.</li> <li>• To analyze IoT cloud platforms.</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• Understand the fundamentals of IoT, including its architecture, characteristics, and challenges.</li> <li>• Analyze IoT communication protocols and networking techniques used in wireless sensor networks and M2M communication.</li> <li>• Design and manage IoT platforms, including device integration, service models, and application development.</li> <li>• Implement IoT networking and computing techniques, including cloud storage, APIs, and Python-based IoT programming.</li> <li>• Develop and evaluate IoT applications in real-world domains such as smart cities, connected vehicles, and industrial automation.</li> </ul>					
<b>UNIT-I</b>	<b>Introduction &amp; Basic of IoT</b>				
. <b>Introduction &amp; Basic of IoT</b> :Definition, Characteristics, Physical and Logical Designs, challenges, Technological trends in IOT, IoT Examples, M2M.					
<b>UNIT-II</b>	<b>IoT: Components, Communication and Networking:</b>				
<b>IoT: Components, Communication and Networking:</b> Introduction to Sensing and Networking: Sensing & actuation, Wireless Sensor network, Sensor nodes, Communication Protocols,M2M Communication, Networking Hardware, Networking Protocols					
<b>UNIT-III</b>	<b>IoT System Management:</b>				
<b>IoT System Management:</b> Network Operator Requirements, IoT Platform Design Specification – Requirements, Process, Domain Model, Service, IoT Level, Function, Operational view, Device and Component Integration, Application development.					
<b>UNIT-IV</b>	<b>Networking and Computing</b>				
<b>Networking and Computing:</b> File Handling, Python Packages for IoT, IoT Physical Servers – Cloud Storage Models, Communication APIs.					
<b>UNIT-V</b>	<b>IoT Clouds and Data Analytics</b>				
<b>IoT Clouds and Data Analytics:</b> RESTful Web API, Amazon Web Services for IoT, Apache Hadoop, Batch Data Analysis, Chef, Chef Case Studies, Puppet, NETCONF-YANG <b>IoT Applications:</b> Casestudies:smartcities,smarthome,connectedvehicles,IndustrialIOT.					
<b>Textbooks:</b>					
1.Kamal, R., Internet of Things – Architecture and Design Principles,  1st Edition, Mcgraw Hill,2017. 2.Simone Cirani, Internet of Things-Architectures, Protocols and Standards , WILEY,2018.					
<b>Reference Books:</b>					



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1. Alessandro Bassi,|| Enabling Things to Talk- Designing IoT solutions with the IoT Architectural Reference Modell, Springer,2013.



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Course Code	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3
<b>Minors</b>					
<b>Course Objectives:</b>					
To enable students to					
<ul style="list-style-type: none"> <li>• To introduce the fundamental concepts and architecture of wireless sensor networks.</li> <li>• To explore various network architectures, optimization techniques, and design principles for wireless sensor networks.</li> <li>• To study MAC protocols, routing techniques, and addressing mechanisms for efficient sensor network communication.</li> <li>• To understand the infrastructure establishment of sensor networks, including topology control and synchronization.</li> <li>• To provide knowledge on sensor network platforms, programming challenges, and simulation tools.</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• Learn the fundamental concepts and architecture of wireless sensor networks.</li> <li>• Explore various network architectures, optimization techniques, and design principles for wireless sensor networks.</li> <li>• Gain knowledge of MAC protocols, routing techniques, and addressing mechanisms for efficient sensor network communication.</li> <li>• Understand the infrastructure establishment of sensor networks, including topology control and synchronization.</li> <li>• Grasp the knowledge on sensor network platforms, programming challenges, and simulation tools.</li> </ul>					
<b>UNIT-I</b>	<b>Overview of Wireless Sensor Networks</b>				
. <b>Overview of Wireless Sensor Networks:</b> Single-Node Architecture - Hardware Components- Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks-Types of wireless sensor networks.					
<b>UNIT-II</b>	<b>Architectures:</b>				
<b>Architectures:</b> Network Architecture- Sensor Networks-Scenarios- Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts					
<b>UNIT-III</b>	<b>Networking Sensors:</b>				
. <b>Networking Sensors:</b> MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols Energy-Efficient Routing, Geographic Routing.					
<b>UNIT-IV</b>	<b>Infrastructure Establishment:</b>				
<b>Infrastructure Establishment:</b> Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control					
<b>UNIT-V</b>	<b>Sensor Network Platforms and Tools</b>				
<b>Sensor Network Platforms and Tools :</b> Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming					
<b>Textbooks:</b>					
1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.					
2. Feng Zhao & Leonidas J.Guibas, —Wireless Sensor Networks-An Information Processing Approach", Elsevier, 2007					



**Reference Books:**

1. WalteneusDargie , Christian Poellabauer, —Fundamentals Of Wireless Sensor Networks Theory And Practicell, By John Wiley & Sons Publications, 2011
2. KazemSohraby, Daniel Minoli, &TaiebZnati, —Wireless Sensor Networks-Technology, Protocols, and Applicationsll, John Wiley, 2007.
3. Anna Hac, —Wireless Sensor Network Designsl, John Wiley, 2003



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Course Code	INDUSTRIAL INTERNET OF THINGS		L	T	P	C
			3	0	0	3
<b>Minors</b>						
<b>Course Objectives:</b>						
To enable students to						
<ul style="list-style-type: none"> <li>• To understand the fundamental concepts of the Industrial Internet of Things (IIoT), its market potential, and applications in various industries.</li> <li>• To study the methodologies, networking protocols, and wireless communication technologies used in IIoT deployments.</li> <li>• To explore data-driven analytics in IIoT, including big data processing, machine learning algorithms, and neural networks.</li> <li>• To analyze IP and non-IP protocols used in IIoT, such as WPAN, Bluetooth, Zigbee, and MQTT.</li> <li>• To examine IoT cloud platforms, data analytics techniques, and their applications in industrial robotics and asset monitoring.</li> </ul>						
<b>Course Outcomes(CO):</b>						
At the end of the course, the students will be able to:						
<ul style="list-style-type: none"> <li>• Explain the key differences between IoT and IIoT, sensor calibration, placement, and the role of communication systems in IIoT applications.</li> <li>• Demonstrate knowledge of IIoT methodologies, including operating systems, networking protocols, and wireless sensor networks.</li> <li>• Apply data analytics techniques, including big data processing and machine learning, to industrial IoT applications.</li> <li>• Analyze and implement IP and non-IP communication protocols for efficient IIoT connectivity and data exchange.</li> <li>• Utilize IoT cloud platforms for device localization, tracking, and robotics applications in industrial environments.</li> </ul>						
<b>UNIT-I</b>	<b>Introduction IIoT; Market Size and Potential:</b>					
. <b>Introduction IIoT; Market Size and Potential:</b> Definition, IoT v IIoT, Next Generation Sensors, Sensor's calibration and validate sensor measurements, placement of IoT devices, sensors, low-cost communication system design, Top application areas include manufacturing, oil & gas, Embedded systems in the Automotive and Transportation market segment..						
<b>UNIT-II</b>	<b>IIoT Methodology</b>					
<b>IIoT Methodology:</b> Top operating systems used in IIoT deployments, Networking and wireless communication protocols used in IIoT deployments. Smart Remote Monitoring Unit, components of monitoring system, control and management, Wireless Sensor Networ(WSN)						
<b>UNIT-III</b>	<b>Data driven Analytics of IIoT</b>					
. <b>Data driven Analytics of IIoT:</b> Implementing of industrial IoT Data flow, big data and how to prepare data for machine learning algorithms, Machine Learning algorithms, supervised learning & Un-supervised learning algorithms, Basics of neural network, activation functions, back-propagation.						
<b>UNIT-IV</b>	<b>IP and Non-IP Protocols for IoT:</b>					
<b>IP and Non-IP Protocols for IoT:</b> WPAN, IEEE 802.15.4, Bluetooth, NFC, 6LoWPAN; RFID, Zigbee Wireless HART Protocol, MQTT, IP and Non-IP Protocols, REST, CoAP						
<b>UNIT-V</b>	<b>IoT Clouds and Data Analytics</b>					
<b>IoT Clouds and Data Analytics:</b> Develops a physics-based and data-driven digital equipment model to monitor assets and systems, Introduction to device localization and tracking; different types of localization						



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techniques, Radio-Frequency Identification (RFID) and fingerprinting, Device diversity/heterogeneity issue in IIoT networks **Internet of Robotic Things (IoRT)**: Introduction to stationary and mobile robots, Brief introduction to localization, mapping, planning, and control of robotic systems; Introduction to cloud-enabled robotics; Applications of IIoT in robotics; Architectures for IoRT, Examples and case studies: Open issues and challenges.

**Textbooks:**

1. Industry4.0: The Industrial Internet of Things, Alasdair Gilchrist, Apress, 2016.

**Reference Books:**

1 Hands on Industrial Internet of Things, Giacomo Veneri, Antonio Capasso, Pack Press, 2018.



Course Code	PRINCIPLES OF IOT LAB	L	T	P	C
		0	0	3	1.5
<b>Minors</b>					
<b>Course Objectives:</b>					
To enable students to					
<ul style="list-style-type: none"> <li>• To understand the fundamentals of IoT through hands-on experiments with sensors, actuators, and microcontrollers.</li> <li>• To develop skills in interfacing various sensors and actuators with microcontrollers like Arduino, ESP32, and Raspberry Pi.</li> <li>• To explore IoT communication frameworks such as HTTP, MQTT, and cloud-based data logging platforms like ThingSpeak.</li> <li>• To gain experience in remote monitoring and control of IoT devices using mobile and web applications.</li> <li>• To learn UAV/Drone integration with IoT through flight controller programming and GPS-based navigation.</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• Demonstrate the ability to control and monitor sensors and actuators using microcontrollers and IoT platforms.</li> <li>• Implement IoT-based applications using cloud services like ThingSpeak and mobile applications like Blynk.</li> <li>• Develop web-based IoT applications using HTTP and MQTT protocols for remote device management.</li> <li>• Apply IoT principles in real-world applications such as home automation, security systems, and industrial monitoring.</li> <li>• Integrate UAV/Drone technologies with IoT for automated navigation and data acquisition.</li> </ul>					
<b>List of Experiments: (Any 10 Experiments are to be conducted)</b>					
<b>1. Serial Monitor, LED, Servo Motor - Controlling</b>					
<input type="checkbox"/> Controlling actuators through Serial Monitor. Creating different led patterns and controlling them using push button switches. Controlling servo motor with the help of joystick.					
<b>2. Distance Measurement of an object</b>					
<input type="checkbox"/> Calculate the distance to an object with the help of an ultrasonic sensor and display it on an LCD.					
<b>3. LDR Sensor, Alarm and temperature, humidity measurement</b>					
<input type="checkbox"/> Controlling relay state based on ambient light levels using LDR sensor.					
<input type="checkbox"/> Basic Burglar alarm security system with the help of PIR sensor and buzzer.					
<input type="checkbox"/> Displaying humidity and temperature values on LCD					
<b>4. Experiments using Raspberry Pi</b>					
<input type="checkbox"/> Controlling relay state based on input from IR sensors					
<input type="checkbox"/> Interfacing stepper motor with R-Pi					
<input type="checkbox"/> Advanced burglar alarm security system with the help of PIR sensor, buzzer and keypad. (Alarm gets disabled if correct keypad password is entered)					
<input type="checkbox"/> Automated LED light control based on input from PIR (to detect if people are present) and LDR(ambient light level)					
<b>5. IOT Framework</b>					



Upload humidity & temperature data to ThingSpeak, periodically logging ambient light level to ThingSpeak

**6.** Controlling LEDs, relay & buzzer using Blynk app

**7. HTTP Based**

Introduction to HTTP. Hosting a basic server from the ESP32 to control various digital based actuators (led, buzzer, relay) from a simple web page.

**8.** Displaying various sensor readings on a simple web page hosted on the ESP32.

**9. MQTT Based**

Controlling LEDs/Motors from an Android/Web app, Controlling AC Appliances from an android/web app with the help of relay.

**10.** Displaying humidity and temperature data on a web-based application

**11. UAV/Drone:**

Demonstration of UAV elements, Flight Controller

Mission Planner flight planning design

11. Python program to read GPS coordinates from Flight Controller

**Reference:**

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012.

2. Alexander Osterwalder, and Yves Pigneur – Business Model Generation – Wiley, 2011

3. ArshdeepBahga, Vijay Madiseti - Internet of Things: A Hands-On Approach, Universities Press, 2014.

4. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.

**Online Learning Resources/Virtual Labs:**

<https://www.arduino.cc/>

<https://www.raspberrypi.org/>



Course Code	INDUSTRIAL INTERNET OF THINGS LAB	L	T	P	C
		0	0	3	1.5
<b>Minors</b>					
<b>Course Objectives:</b>					
To enable students to					
<ul style="list-style-type: none"> <li>• To understand the fundamental concepts of IIoT, including its architecture, challenges, and differences from IoT.</li> <li>• To explore IIoT components such as sensors, actuators, and control systems for industrial applications.</li> <li>• To study various communication technologies and protocols like IEEE 802.15.4, ZigBee, BLE, and MQTT for IIoT applications.</li> <li>• To learn data visualization techniques and methods for connecting IIoT devices to the web.</li> <li>• To analyze data retrieval techniques and machine-to-machine (M2M) interactions for IIoT-based automation.</li> <li>• To gain hands-on experience with PLCs, SCADA, and real-time control systems used in industrial automation.</li> </ul>					
<b>Course Outcomes(CO):</b>					
At the end of the course, the students will be able to:					
<ul style="list-style-type: none"> <li>• Explain the architecture, challenges, and fundamental concepts of IIoT and differentiate it from IoT.</li> <li>• Demonstrate the interfacing of sensors and actuators with microcontrollers like Raspberry Pi and NodeMCU for industrial automation.</li> <li>• Implement communication protocols such as MQTT, ZigBee, and Bluetooth to enable seamless IIoT connectivity.</li> <li>• Develop web-based dashboards for real-time visualization and control of IIoT devices.</li> <li>• Retrieve, analyze, and transmit industrial data using web-based interactions and M2M communication.</li> <li>• Implement PLC-based automation, Boolean logic programming, and process control using SCADA for industrial applications.</li> </ul>					
<b>(All the modules need to be conducted and minimum one project to be done)</b>					
<p><b>MODULE 1: Introduction &amp; Architecture</b> What is IIoT and connected world? The difference between IoT and IIoT, Architecture of IIoT, IOT node, Challenges of IIOT.</p> <p><b>Practice</b> 1. Introduction to Arduino, Introduction to raspberry Pi.</p> <p><b>MODULE 2: IIOT Components</b> Fundamentals of Control System, introductions, components, closed loop &amp; open loop system. Introduction to Sensors (Description and Working principle): What is sensor? Types of sensors, working principle of basicSensors -Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11).Digital switch, Electro Mechanical switches.</p> <p><b>Practice</b> 1. Measurement of temperature &amp; pressure values of the process using raspberry pi/node mcu. 2. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor) using Raspberry pi/node mcu. 3. Modules and Actuators Interfacing (Relay, Motor, Buzzer) using Raspberry pi/node mcu.</p> <p><b>MODULE 3: Communication Technologies of IIoT</b> Communication Protocols: IEEE 802.15.4, ZigBee, Bluetooth, BLE, NFC, RFIDIndustry standards communication technology (MQTT), wireless network communication. <b>Practice</b> 1. Demonstration of MQTT communication</p> <p><b>MODULE 4: Visualization and Data Types of IIoT</b> Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.</p>					



**Practice** 1. Visualization of diverse sensor data using dashboard (part of IoT's 'control panel')  
2. Sending alert message to the user. ways to control and interact with your environment)

**MODULE 5: Retrieving Data** Extraction from Web: Grabbing the content from a web page, Sending data on the web, Troubleshooting basic Arduino issues, Types of IoT interaction, Machine to Machine interaction (M2M).

**Practice** 1. Device control using mobile Apps or through Web pages.  
2. Machine to Machine communication.

**MODULE 6: Control & Supervisory Level of Automation**

Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA).

**Practice** 1. Digital logic gates programming using ladder diagram.  
2. Implementation of Boolean expression using ladder diagram.  
3. Simulation of PLC to understand the process control concept.

**Projects:**

IIoT based smart energy meter

Smart Agriculture system Automation using controller via Bluetooth

Temperature controlled Fan/cooler using controller

Automatic streetlight

Smart Baggage Tracker

**Text books:**

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication)
2. Industrial Internet of Things: Cybermanufacturing System, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer Publication)
3. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)