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

Electronics & Communication Engineering

SRI KRISHNADEVARAYA UNIVERSITY: ANANTAPUR
College of Engineering & Technology
Academic Regulations 2020 (R20) for
B. Tech (Regular-Full time)

(With effect from the Academic Year 2021-22 for the students admitted into I year I semester)

1. Award of the Degree:

A student will be declared eligible for the award of B. Tech. degree if he/she fulfills the following:

i. Pursues a course of study in not less than four and not more than eight academic years.
ii. After eight academic years from the year of their admission, he/she shall forfeit their seat in B. Tech. course and their admission stands cancelled.
iii. Registers for 163 credits and must secure all the 163 credits.
iv. A student shall be eligible for the award of B.Tech degree with Honors or Minor if he/she earns 20 credits in addition to the 163 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

2. Programs offered by the College:

The following programs are offered at present as specializations for the B. Tech. course from 2020-2021.

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

and any other course as approved by the authorities of the University from time to time.
The entire course of study is of four academic years in semester pattern (for regular students)and of three academic years in semester pattern (for lateral entry students).

3. Medium of Instructions:

The medium of instruction is **English** for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course structure, in accordance with the prescribed syllabi.

4. Minimum Qualification for Admission:

A candidate seeking admission to the first semester of the eight semester B. Tech. Degree Program should have passed the Intermediate Examination of the Board of Intermediate Education of Andhra Pradesh with Mathematics and Physical Sciences (Physics and Chemistry) as optional courses or any other equivalent examination there to recognized by Govt. of Andhra Pradesh, as per AICTE guidelines. For admissions into the third semester of B. Tech Degree Program under lateral entry scheme a candidate should have passed diploma in the respective branch of study as per AICTE guidelines.

5. Structure of the Program:

Every course of B. Tech. Program shall be placed in one of the nine categories as listed in table below:

Table 2: Category wise distribution of credits

S.No.	Category	Code	Suggested breakup of Credits (APSCHE)	Suggested breakup of Credits (AICTE)
1	Humanities and social science including Management courses	HSMC	13.5*	15
2	Basic Science Courses	BSC	21*	25
3	Engineering science courses	ESC	24*	24
4	Professional Core Courses	PCC	51*	48
5	Open Elective Courses	OEC	12*	18
6	Professional Elective Courses	PEC	15*	18
7	Internship, Project Work Seminar	PROJ	16.5*	15
8	Mandatory courses	NCMC	NC	NC
9	Skill Oriented Courses	SOC	10	-
Total Credits			163	163

Minor variation is allowed as per need of the respective disciplines.

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

6. Scheme of Instruction

The scheme of instruction shall be for duration of four academic years for regular students and three academic years for lateral entry students. Each academic year consists of two consecutive semesters (one odd + one even). There shall be 90 working days in each semester, excluding the days allotted for internal examinations, preparation holidays and university examinations. Each working day shall be for duration of six hours of instruction and or seminar/ tutorial work.
Note: Under unavoidable circumstances, the 90 working days can be inclusive of internal examinations.
The details of syllabi and the list of text books and reference books for each branch of study shall be prescribed by the university from time to time on the recommendation of the Board of Studies.

7. Credit Assignment:

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Program related terms:

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

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

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

iv. **Massive Open Online Course (MOOC):** The MOOC course is a Discipline Centric Elective Course and the student shall register for the course offered by authorized Institutions/Agencies, through online with the approval of Head of the Department.

v. Each course is assigned certain number of credits based on following criterion:

	Semester	
	Hours / Week	Credits
Theory (Lecture/Tutorial)	02	02
	03	03
	04	04
Practical	02	01
	03	1.5
	04	02
Summer Internship**	2 Months (or 8 weeks)	1.5
Industrial/Research**	2 Months (or 8 weeks)	3
Non-Credit Mandatory Courses	02 / week	00
Project	6 Months (or 24 weeks)	12

Note:

1. Summer Internship for 2 months (Mandatory) after second year (to be evaluated during V semester).
2. The concerned Board of studies can assign tutorial hours to such courses wherever it is necessary, but without change in the total number of credits already assigned for semester.
3. Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester.
4. During Project period the student is supposed to report the Internal Departmental Committee periodically.

8. Weights for Course Evaluation:

8.1 **Course Pattern:**

i. The entire course of study is for four academic years. Semester pattern shall be followed in all the academic years.

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

iii. 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 fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

8.2 **Evaluation Process:**

The performance of a student in each semester for academic year I,II,III,IV shall be evaluated subject wise with a maximum of 100 marks for theory and 75 marks for practical subject. Project stage-I, Socially relevant project and Internship shall be evaluated for 50 marks each & Project stage-II shall be evaluated for 200 marks whereas mandatory courses with no credits shall be evaluated for 30 internal marks.

1. For theory subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.
2. For practical subjects the distribution shall be 25 marks for Internal Evaluation and 50 marks for the End-Examination.

8.3 **Internal Examination Evaluation:**

For theory subjects, during the semester there shall be 2 midterm examinations. Each midterm examination consists of subjective paper for 25 marks with duration of 1hour 30 minutes.

First midterm examination shall be conducted for the first half of the syllabus in the middle of the semester and second midterm examination shall be conducted for the second half of the syllabus towards the end of the semester. A weightage of 0.75 for better score and 0.25 for the other score will be considered for awarding the sessional marks in both the midterm examinations. There shall be two assignments in each semester for award of 05marks so that midterm component will be 30marks (25 for midterm examinations + 05 marks for assignments).

***Note 1:** The subjective paper shall contain Section A with 2 questions of equal weightage of 10 marks and student shall answer any one.Section B shall contain 4 questions equal weightage of 5 marks and student shall answer any three .Any fraction (0.5 & above) shall be rounded off to the next higher mark.

***Note 2:** The assignment shall contains 5 questions of equal weightage of 1 mark each. Which are essay type questions/numerical problems/software development.

If the student is absent for the internal examination, no re-exam shall be conducted and internal marks for that examination shall be considered as zero.

Final Internal marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 75% weightage given to the better mid exam and 25% to the other.

For Example:

Marks obtained in first mid : 24
Marks obtained in second mid : 20
Final Internal Marks: (24x0.75) + (20x0.25) = 23

If the student is absent for any one midterm examination, the final internal marks shall be arrived at by considering 75% 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 : 24
Final Internal Marks: (24x0.75)+ (0x0.25) =18

8.4 **End Examination Evaluation:**

End examination of theory subjects shall have the following pattern:

a. There shall be 8 questions and each question carries 14 marks and Student shall answer any five of them.

8.5 For practical subjects there shall be a continuous evaluation during the semester for 25 sessional marks and 50 end examination marks. Day-to-day work in the laboratory shall be evaluated for 25 marks by the concerned laboratory teacher based on the regularity/record/viva/Internal test. The end examination shall be conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.

8.6 There shall be mandatory courses with zero credits. There shall be no external examination. However, attendance in the audit course 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 every six months/semester at a mutually convenient date of college/student satisfying the conditions mentioned in item 1 & 2 of the regulations.

8.7 The Engineering Drawing/Graphics course, offered is to be treated as a Theory Course. Evaluation method adopted shall be same as for any other Theory Course. The Internal evaluation for sessionals will be 15 marks for day-to-day work in the class that shall be evaluated by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm exams in a semester for a duration of 2 hrs each, evenly distributed over the syllabi, for 15 marks giving a weightage of 0.75 for the better score and 0.25 for the other score will be considered. The sum of day to day evaluation and the internal tests will be the final sessionals for the subject

.

8.8 The laboratory records and internal test papers shall be preserved for a minimum of 2 years in the respective departments as per the Institution norms and shall be produced to the Committees as and when the same are asked for.

8.9. There shall be 05 Professional Elective courses and 04 Open Elective courses. All the Professional & Open Elective courses shall be offered for 03 credits, wherever lab component is involved it shall be (2-0-2) and without lab component it shall be (3-0- 0). If a course comes with a lab component, that component has to be cleared separately. The concerned BOS shall explore the possibility of introducing virtual labs for such courses with lab component.

8.10 All Open Electives are offered to students of all branches in general. However, a student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during the Programme.

8.11 A student shall be permitted to pursue up to a maximum of TWO Open Elective courses under MOOCs during the Programme. (See the possibility of Min 1 and Max under MOOCs; avoid paid courses; Coursera, NPTEL, TCS ION to be explored). Each of the courses must be of minimum 12 weeks in duration. Attendance will not be monitored for MOOCs. Student has to pursue and acquire a certificate for a MOOC only from the organizations/agencies approved by the BoS in order to earn the 3 credits. The Head of the Department shall notify the list of such courses at the beginning of the semester.

8.12 The college shall invite registration forms from the students at the beginning of the semester for offering professional and open elective courses. There shall be a limit on the minimum and maximum number of registrations based on class/section strength.

8.13 **Internships:**

Students shall undergo mandatory summer internships for a minimum of 2 months duration at the end of second and third year of the Programme. There shall also be mandatory full internship for 6 months in the final semester of the Programme along with the project work.

8.14 S**kill Oriented Courses:**

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 courses and the remaining one shall be a soft skills course.

8.15.**Honors/Minors:**

Under graduate Degree with Honors/Minor shall be issued by the University to the students who fulfill all the academic eligibility requirements for the B. Tech program and Honors/Minor program. The objective is to provide additional learning opportunities to academically motivated students.

9. Attendance Requirements in Academics:

i. A student shall be eligible to appear for University examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.
ii. 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.
iii. Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.
iv. A stipulated fee shall be payable towards condonation of shortage of attendance to the Institution.
v. 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.
vi. 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 when offered next.
vii. The aggregate percentage of attendance can be rounded to next integer for the purpose of considering for condonation/detention.

For example:

A candidate getting ≥64.5 may be condoned, may be rounded to 65. No attendance shall be added but for condoning purpose can only be considered.

10. Minimum Academic Requirements and Award of the Degree:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in section 9.

10.1 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 internal and end examination marks taken together.

10.2 A student shall be promoted from II Year 2nd to III Year 1st Semester only if he/she fulfils the academic requirement of securing **24 credits** in the subjects that have been studied up to II Year 1st Semester.

10.3 A student shall be promoted from III Year 2nd semester to IV Year 1st semester only if he/she fulfils the academic requirements of securing **42 credits** in the subjects that have been studied up to III Year 1st semester And in case a student is detained for want of credits for particular academic year by sections 10.2 and 10.3 above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the III Year 1st semester or IV Year 1st semester as the case may be.

10.4 A student shall register and put up minimum attendance in all 160 credits and earn all the 160 credits.

105 Students who fail to earn 160 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

11. 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 or candidate or student, the result of the candidate shall be withheld and the candidate will not be allowed/promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

12. Award of Grades:

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

Structure of Grading of Academic Performance

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

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

ii. For mandatory courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

12.1. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

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

$$SGPA = \Sigma (C_i \times G_i)/\Sigma C_i$$

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

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

$$CGPA = \Sigma (C_i \times S_i)/ \Sigma C_i$$

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

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

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

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

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

13. Award of Class:

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

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 4.5 < 5.5

14. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The Principal of the college shall take the decision on proposals submitted by the students. An evaluation committee constituted by the Principal of the College 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.

15. Transitory Regulations:

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfillment 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 rejoining 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.

16. Curricular Framework for Mandatory Internships

i. It is mandatory to undergo Community Service Project during II Year Summer Vacation with a minimum of 2 months duration.

ii. It is mandatory to undergo Internship during III Year Summer Vacation with a minimum of 2 months duration. The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs.

iii. 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. The report and the oral presentation shall carry 40% and 60% weightages respectively.

iv. In the final semester, the student should mandatorily undergo internship for 6 Months and parallelly he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner.

v. 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.

17. Curricular Framework for Skill oriented

i For skill oriented/skill advanced course, one theory and 2 practical hours or two theory hours may be allotted as per the decision of concerned BOS.

ii Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be completed in second year. Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature.

iii A pool of interdisciplinary job-oriented skill courses shall be designed by a common Board of studies by the participating departments/disciplines and the syllabus along with the pre requisites shall be prepared for each of the laboratory infrastructure requirements. The list of such courses shall be included in the curriculum structure of each branch of Engineering, so as to enable the student to choose from the list.

iv The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies as approved by the concerned BoS.

v The Board of studies of the concerned discipline of Engineering shall review the skill advanced courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest courses based on industrial demand.

vi If a student chooses to take a Certificate Course offered by industries/Professional bodies/APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the Department, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency/professional bodies as approved by the Board of studies.

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

viii requirements upon producing a valid certificate as approved by the concerned Board of Studies, the student is deemed to have fulfilled the attendance requirement of the course and acquire the credits assigned to the course.

ix 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. The recommended conversions and appropriate grades/marks are to be approved by the University/Academic Council.

18.Curricular Framework for Honors Programme

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Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.

i A student shall be permitted to register for Honors program at the beginning of 4th

ii semester provided that the student must have acquired a minimum of 8.0 SGPA upto the end of 2nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

iii Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.

iv In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

v Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.

vi It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.

vii The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOCs as approved by the concerned Head of the department in consultation with BoS.

viii Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component. MOOCs must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOCs. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOCs is a pass/fail course without any grades, the grade to be assigned will be as decided by the university/academic council.

ix The concerned BoS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

x If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the Minors will be shown in the transcript. Courses which are dropped under the Minor will not be shown in the transcript.

xi In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech. Degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xii Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

19. Curricular Framework for Minor Programme:

i Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering.

ii Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

iii The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE,CE,ME etc. or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

iv The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.

v There shall be no limit on the number of programs offered under Minor. The University/Institution can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

vi The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOCs as approved by the concerned Head of the department in consultation with BoS.

vii A student shall be permitted to register for Minors program at the beginning of 4^{th} semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) up to the end of 2^{nd} semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4^{th} semester. If a student fails to acquire 8 SGPA up to 3^{rd} semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

viii A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

ix Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

x In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.

xi Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course

completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

xii A committee should be formed at the level of College/Universities/department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

xiii If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

xiv In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

20. General Instructions:

a. The academic regulations should be read as a whole for purpose of any interpretation.
b. Malpractices rules-nature and punishments are appended.
c. Where the words "he", "him", "his", occur in the regulations, they also include "she", "her", "hers", respectively.
d. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.
e. The Principal may change or amend the academic regulations of common B.o.S 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 Principal.
f. The above rules and regulations are to be approved/ratified by the College Academic Council as and when any modifications are to be done.

21.MOOCs through SWAYAM Platform:

There shall be five professional elective courses and four open elective courses, which are Choice Based Credit Courses (CBCC), offered from V semester onwards. Among them, one elective course shall be pursued through MOOCs. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's assignment submissions given by SWAYAM. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.

A Student must complete the SWAYAM MOOC course in all respects on or before 5 / 6 / 7 semester. Students' MOOC course score in terms of marks/grade/credits will be counted in their 5/6/7 semester marks sheet as the case may be. Students who have qualified in the proctored examinations conducted by the SWAYAM and apply for credit transfer as specified are exempted from appearing internal as well as external examination (for the specified equivalent credit course only) conducted by the university.

Necessary amendments in rules and regulations regarding adoption of SWAYAM MOOCS courses would be proposed

from time to time.

Credit Equivalence for SWAYAM MOOCs Courses: Courses of 04 weeks duration: 01 Credit Courses of 08 weeks duration: 02 Credits Courses of 12 weeks duration: 03 Credits Courses of 16 weeks duration: 04 Credits.

22.Credit Transfer Policy

Adoption of MOOCs is mandatory for all students, 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 40% of the total courses being offered in a particular Programme in a semester through the Online Learning courses through SWAYAM platform (www.swayam.gov.in).

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 through SWAYAM platform.
ii. The online learning courses available on the SWAYAM platform will be considered for credit transfer. SWAYAM course credits are as specified in the platform.
iii. Student registration for the MOOCs shall be only through the institution, it is mandatory for the student to share necessary information with the institution
iv. Credit transfer policy will be applicable to the Professional & Open Elective courses offered by the university under Choice Based Credit System (CBCS).
v. The institution shall select the courses to be permitted for credit transfer through SWAYAM. However, while selecting courses in the online platform institution would essentially avoid the courses offered through the curriculums it may otherwise lead to duplication and repetition of the same course
vi. The University/institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer in the forthcoming Semester.
vii. The institution shall also ensure that the student must complete the course and produce the course completion certificate as per the academic schedule given for the regular courses in that semester
viii. 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.
ix. The university shall ensure no overlap of SWAYAM MOOC exams with that of the university examination schedule. In case of delay in SWAYAM results, the university will re-issue the marks sheet for such students.
x. Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.
xi. 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 certificates of completion.
    b. Undertaking form filled by the students for credit transfer.
xii. The university 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 also be permitted to register for MOOCs offered through online platforms other than SWAYAM / NPTEL. In such cases, credit transfer shall be permitted only after seeking approval of the University at least three months prior to the commencement of the semester.

ACADEMIC REGULATIONS FOR B. TECH.(R20)
(LATERAL ENTRY SCHEME)
(Effective for the students getting admitted into II year through Lateral Entry Scheme from the Academic Year 2022-2023 and onwards)

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

Electronics & Communication Engineering

1. Award of B.Tech. Degree

A student admitted in Lateral Entry Scheme (LES) will be declared eligible for the award of the B.Tech degree if the student fulfills the following academic regulations:

a)Pursues a course of study for not less than three academic years and not more than six academic years.

b) Registers for *124* credits and secures all *124*credits from II to IV year of Regular B. Tech. program.

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

3. All The regulations except 8.1 are to be adopted as that of B. Tech. (Regular).

4. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.9

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 internal evaluation and end examination taken together.

ii A student shall be promoted from III year 2nd Semester to IV year 1st Semester only if the student fulfills the academic requirements of securing **25 credits** of the subjects that have been studied up to III Year 1st 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.

5. Course Pattern

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

5.2. 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.

5.3. 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 fulfillment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

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

Electronics & Communication Engineering

RULES FOR DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

S. No.	**Nature of Malpractices/Improper conduct**	**Punishment**
	If the Candidate:	
1 (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
1 (b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The Hall Ticket of the candidate is to be cancelled.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all examinations, if his involvement is established. Otherwise, the candidate is debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already

	additional sheet, during or after the examination.	appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject only.
6	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. If the candidate physically assaults the invigilator/ officer-in-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or Intentionally tears of the script or any part there of inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all the examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including

	clause 6 to 8.	practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person (s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject only or in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations, depending on the recommendation of the committee**.**
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Institution for further action to award suitable punishment.	

Note: -

Whenever the performance of a student is cancelled in any subject/subjects due to Malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fulfill all the norms required for the award of Degree.

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Electronics & Communication Engineering

SKUCET Curriculum
B. Tech Course Structure – R20
ELECTRONICS AND COMMUNICATION ENGINEERING

Semester – 0 Common for All Branches of Engineering				
S.No	**Course No**	**Course Name**	**Category**	**L-T-P-C**
1		Physical Activities – Sports, Yoga and Meditation, Plantation	MC	0-0-12-0
2		Career Counseling	MC	4-0-4-0
3		Orientation to all branches – career options, tools, etc.	MC	6-0-0-0
4		Orientation on admitted Branch – corresponding labs, tools and platforms	EC	4-0-6-0
5		Proficiency Modules & Productivity Tools	ES	4-2-4-0
6		Assessment on basic aptitude and mathematical skills	MC	4-0-6-0
7		Remedial Training in Foundation Courses	MC	4-2-4-0
8		Human Values & Professional Ethics	MC	6-0-0-0
9		Communication Skills – focus on Listening, Speaking, Reading, Writing skills	BS	4-2-4-0
10		Concepts of Programming	ES	4-0-4-0
Total				40-6-44-0

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Electronics & Communication Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
I Year Ist Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Linear Algebra & Calculus	BS	3-0-0	3
2.		Applied Physics	BS	3-0-0	3
3.		Communicative English	HS	3-0-0	3
4.		Problem Solving & Programming	ES	3-0-0	3
5.		Engineering Drawing	ES	1-0-4	3
6.		Communicative English Lab	HS	0-0-3	1.5
7.		Applied Physics Lab	BS	0-0-3	1.5
8.		Problem Solving & Programming Lab	ES	0-0-3	1.5
9		Environmental Science	MC	2-0-0	0
				Total	**19.5**

Category	**CREDITS**
Basic Science course	7.5
Engineering Science Courses	7.5
Humanities and social science	4.5
TOTAL CREDITS	**19.5**

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
I Year IInd Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Differential Equations & Vector Calculus	BS	3-0-0	3
2.		Chemistry	BS	3-0-0	3
3.		Data Structures	ES	3-0-0	3
4.		Network Theory	ES	3-0-0	3
5.		Electronics & Communication Engineering Workshop	ES	0-0-3	1.5
6.		Basic Engineering Workshop	ES	0-0-3	1.5
7.		Chemistry Lab	BS	0-0-3	1.5
8.		Data Structures Lab	ES	0-0-3	1.5
9.		Network Theory Lab	ES	0-0-3	1.5
				Total	**19.5**

Category	**CREDITS**
Basic Science course	7.5
Engineering Science Courses	12
TOTAL CREDITS	**19.5**

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Electronics & Communication Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
II Year Ist Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Complex Variables and Transforms	BS	3-0-0	3
2.		Signals and Systems	PC	3-0-0	3
3.		Electronic Devices and Circuits	PC	3-0-0	3
4.		Digital Logic Design	PC	3-0-0	3
5.		Managerial Economics & Financial Analysis	HS	3-0-0	3
6.		Simulation Lab	PC	0-0-3	1.5
7.		Electronic Devices and Circuits Lab	PC	0-0-3	1.5
8.		Digital Logic Design Lab	PC	0-0-3	1.5
9.		**Skill oriented course – I** Application Development with Python	SC	1-0-2	2
10.		**NCC/NSS ACTIVITIES**			
				Total	**21.5**

Category	**CREDITS**
Basic Science course	3
Professional Core Courses	13.5
Humanities and Social science	3
Skill oriented course	2
TOTAL CREDITS	**21.5**

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
II Year IInd Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Probability Theory & Stochastic Processes	BS	3-0-0	3
2.		Analog Circuits	PC	3-0-0	3
3.		EM Waves and Transmission Lines	PC	3-0-0	3
4.		Communication Systems	PC	3-0-0	3
5.		Electrical Technology	ES	3-0-0	3
6		UHV-II: Universal Human Values – Understanding harmony and Ethical Human Conduct	HS	2-1-0	3
7.		Analog Circuits Lab	PC	0-0-3	1.5
8.		Communication Systems Lab	PC	0-0-3	1.5
9.		Electrical Technology Lab	ES	0-0-3	1.5
10.		**Skill Oriented Course –II** Soft Skills	SC	1-0-2	2
				Total	**21.5**
Community Service Project (Mandatory) for 2 months duration during summer vacation					

Category	**CREDITS**
Basic Science course	3
Humanities and Social science	3
Engineering Science Courses	4.5
Professional Core Courses	12
Skill oriented course	2
TOTAL CREDITS	**24.5**

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Electronics & Communication Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
III Year I Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Control Systems	PC	3-0-0	3
2.		Linear and Digital IC Applications	PC	3-0-0	3
3.		Microprocessors and Microcontrollers	PC	3-0-0	3
4.		**Professional Elective – I**	PE	3-0-0	3
5.		**Open Elective – I**	OE	3-0-0	3
6.		IC Applications Lab	PC	0-0-3	1.5
7.		Microprocessors and Microcontrollers Lab	PC	0-0-3	1.5
8.		**Skill oriented course– III** PCB Design and Development	SC	1-0-2	2
9.		Evaluation of Community Service Project/Internship	PR		1.5
				Total	**21.5**

List of Professional Electives-I	**List of Open Electives-I**
1.Computer System Architecture 2.Bio Medical Electronics 3.Information Theory and Coding	Candidate should select the subject from list of subjects offered by other departments.

Category	**CREDITS**
Professional Core Courses	12
Professional Elective Courses	3
Open Elective Course/Job Oriented Elective	3
Skill oriented course	2
Summer Internship/Community Service Project	1.5
TOTAL CREDITS	**21.5**

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Electronics & Communication Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
III Year II Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Antennas & Microwave Engineering	PC	3-0-0	3
2.		VLSI Design	PC	3-0-0	3
3.		Digital Signal Processing	PC	3-0-0	3
4.		**Professional Elective-II**	PE	3-0-0	3
5.		**Open Elective-II**	ES	3-0-0	3
6.		Antennas & Microwave Engineering Lab	PC	0-0-3	1.5
7.		VLSI Lab	PC	0-0-3	1.5
8.		Digital Signal Processing Lab	ES	0-0-3	1.5
9.		**Skill Oriented Course –IV** Industrial IOT	SC	1-0-2	2
10		**Mandatory Non-Credit Course-III** Constitution of India	MC	2-0-0	0
				Total	**21.5**
Industrial/Research Internship (Mandatory) for 2 months duration during summer vacation					

List of Professional Electives-II	**List of Open Electives-II**
1) Digital Data Communications 2) Embedded Systems 3)Fuzzy and Neural Networks	Candidate should select the subject from list of subjects offered by other departments.

Category	**CREDITS**
Professional Core Courses	13.5
Professional Elective Courses	3
Open Elective Course/Job Oriented Elective	3
Skill oriented course	2
TOTAL CREDITS	**21.5**

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

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
IV Year I Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		**Professional Elective – III**	PE	3-0-0	3
2.		**Professional Elective – IV**	PE	3-0-0	3
3.		**Professional Elective – V**	PE	3-0-0	3
4.		**Open Elective-III**	OE	3-0-0	3
5.		**Open Elective – IV**	OE	3-0-0	3
6		**Humanities Elective-I**			
7.		**Skill oriented course– V** System Verilog	SC	1-0-2	2
8.		Evaluation of Industrial Internship	PR	0-0-0	3
				Total	**23**

List of Professional Electives-III	**List of Professional Electives-V**
1) DSP Processors & Architectures 2) Internet of Things 3) Electronic Measurements and Instrumentation	.1) Smart Sensors 2) Radar Engineering 3) Cellular & Mobile Communications
List of Professional Electives-IV	**Humanities Elective-I**
1) Real Time Operating Systems 2) Digital Image Processing 3) Satellite Communications	1)Entrepreneurship and Design Thinking 2)Management Science 3)Organizational Behavior
List of Open Electives-III & IV Candidate should select the subject from list of subjects offered by other departments.	

Category	**CREDITS**
Professional Elective Courses	9
Open Elective Course/Job Oriented Elective	6
Humanities and Social Science Elective	3
Skill oriented course	2
Industrial Internship	3
TOTAL CREDITS	**23**

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

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
IV Year II Semester					
S.No	**Course Code**	**Course Name**	**Category**		**Credits**
1.		Full Internship / Project work	PROJ		12
				Total	**12**

Category	**CREDITS**
Full Internship/Project work	12
TOTAL CREDITS	**12**

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

LIST OF OPEN ELECTIVES

Open Electives offered by Dept. of E.C.E(Offered to other Departments)

1. Fundamentals of Digital Electronics
2. Basics of Signals and Systems
3. Fundamentals of Communication Systems
4. Fundamentals of Microprocessors and Microcontrollers
5. Microcontroller & Applications
6. Electronic Sensors
7. Electronic Instrumentation
8. Principles of Signal Processing
9. Embedded System Design
10. Introduction to Image Processing
11. Introduction to Internet of things
12. Consumer Electronics

O**ut of Open elective courses at least one course should be completed through MOOCs**

Open Electives offered by Dept. of C.S.E(Offered to other Departments)

1. Principles of Software Engineering (OE-1)
2. Java Programming (OE-2)
3. Fundamentals of Operating Systems (OE-3)
4. Fundamentals of Computer Networks (OE-4)
5. Principles of Database Management Systems
6. Web Technologies
7. Cyber Security

O**ut of Open elective courses at least one course should be completed through MOOCs**

Open Electives offered by Dept. of E.E.E(Offered to other Departments)

1.Electrical circuit Theory (OE-1)
2.Generation of Electric Power (OE-2)
3.Renewable Energy Sources (OE-3)
4.Basics of Power Electronics (OE-4)

O**ut of Open elective courses at least one course should be completed through MOOCs**

Open Electives offered by Dept. of Mech. Engineering (Offered to other Departments)

1. Manufacturing Process
2. IC Engines
3. Automobile Engineering
4. Non-Conventional Sources of Energy
5. Non-Destructive Evaluation
6. Workshop Technology
7. Total Quality Management
8. Basic Thermodynamics.
9. Robotics

O**ut of Open elective courses at least one course should be completed through MOOCs**

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Electronics & Communication Engineering

Open Electives offered by Dept. of Civil Engineering (Offered to other Departments)

Open Elective-I

1. Engineering Material
2. Dister Mitigation and Management
3. Environmental Economics

Open Elective-II

1. Traffic Engineering
2. Ground Improvement Techniques
3. Environmental Pollution Control

Open Elective-III

1. Environmental Impact Assessment
2. Low Cost-Effective Housing Techniques
3. Water shed Management

Open Elective-IV

1. Construction Planning and Project Management
2. Noise and Air Pollution
3. Geographic Information System GIS

O**ut of Open elective courses at least one course should be completed through MOOCs**

Skill Oriented Courses

1. Skill Oriented Course – I (III Sem) – Application development with Python
2. Skill Oriented Course – II (IV Sem) – Soft skills
3. Skill Oriented Course –III – PCB Design and Development
4. Skill Oriented Course – IV – Industrial IoT
5. Skill Oriented Course – V – System Verilog

Humanities Electives – I (VII Sem)

1.Entrepreneurship and Incubation
2.Management Science
3.Organizational Behavior

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

Honors Degree in Electronics and Communications Engineering

Note
1.A student can opt any Four subjects @ 4 credits per subject
2.Concerned BoS can add or delete the subjects as per the decision of the board.
3.Prerequisites to be defined by the board for each course.
4.Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each

S.No.	Course No.	CourseName	L	T	P	Credits
1.		FPGA Design and Implementation	3	1	0	4
2.		Low power VLSI Design.	3	1	0	4
3.		Advanced 3G and 4G Wireless Mobile Communications	3	1	0	4
4.		Micro Electromechanical Systems	3	1	0	4
5.		VLSI Design for Testability	3	1	0	4
6		Speech Processing	3	1	0	4
7		MOOC course (8/12 weeks duration)				2
8		MOOCcourse (8/12 weeks duration)				2

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Electronics & Communication Engineering

Minor Degree in Electronics and Communications Engineering

Note

1.A student can opt any Four subjects @ 4 credits per subject
2.Concerned BoS can add or delete the subjects as per the decision of the board.
3.Prerequisites to be defined by the board for each course.
4.Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)

S.No	Course Code	CourseName	L	T	P	Credits
1.		Electronic Devices and Basic Circuits	3	1	0	4
2.		Digital Electronics	3	1	0	4
3.		Signal Analysis	3	1	0	4
4.		Principal of Communication	3	1	0	4
5		Microprocessors	3	1	0	4
6		MOOC Course (8 Weeks)				2
7		MOOC Course (8 Weeks)				2

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Electronics & Communication Engineering

Note:

1. Eligible and interested students can register either for Honors or for a Minor in IV Semester as per the guidelines issued by the University
2. Students shall register for NCC/NSS/NSO activities and will be required to participate in an activity for two hours in a week during third semester.
3. Lateral entry students shall undergo a bridge course in Mathematics during third semester

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Electronics & Communication Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
I Year Ist Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Linear Algebra & Calculus	BS	3-0-0	3
2.		Applied Physics	BS	3-0-0	3
3.		Communicative English	HS	3-0-0	3
4.		Problem Solving & Programming	ES	3-0-0	3
5.		Engineering Drawing	ES	1-0-4	3
6.		Communicative English Lab	HS	0-0-3	1.5
7.		Applied Physics Lab	BS	0-0-3	1.5
8.		Problem Solving & Programming Lab	ES	0-0-3	1.5
9		Environmental Science	MC	2-0-0	0
				Total	**19.5**

Category	**CREDITS**
Basic Science course	7.5
Engineering Science Courses	7.5
Humanities and social science	4.5
TOTAL CREDITS	**19.5**

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Electronics & Communication Engineering

Course Code	LINEAR ALGEBRA & CALCULUS (Common to all branches of Engineering)	L	T	P	C
		3	0	0	3

I Year 1st Semester

Course Objectives:

- This course will illuminate the students in the concepts of calculus and linear algebra.
- 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.

Bridge Course: Limits, continuity, Types of matrices .

Course Outcomes (CO): Student will be able to

- develop the use of matrix algebra techniques that is needed by engineers for practical applications
- Utilize mean value theorems to real life problems
- familiarize with functions of several variables which is useful in optimization
- Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems
- Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions

UNIT - I	**Matrix Operations and Solving Systems of Linear Equations**	

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation

UNIT - II	**Mean Value Theorems**	

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof);

UNIT - III	**Multivariable calculus**	

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers

UNIT - IV	**Multiple Integrals**	

Double integrals, change of order of integration, change of variables. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates. Finding areas and volumes using double and triple integrals.

UNIT - V	**Beta and Gamma Functions**	

Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.
4. T.K.V Iyengar, B. Krishn Gandhi, S. Ranganatham and M.V.S.N. Prasad., S. chand Publishers.

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Electronics & Communication Engineering

Course Code	APPLIED PHYSICS (ECE, CSE & EEE Branches)	L	T	P	C
		3	0	0	3
I Year 1st Semester					

Course Objectives:

- To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization.
- To explain the significant concepts of dielectric and magnetic materials this leads to potential applications.
- To impart knowledge in basic concepts of lasers and optical fiber and its propagation along with its Engineering applications.
- To identify the importance of semiconductors and superconductors in the functioning of electronic devices.
- To teach the concepts related to quantum mechanics and electromagnetic theory which led to their fascinating applications.

Course Outcomes (CO):

- identify the wave properties of light and the interaction of energy with the matter
- apply electromagnetic wave propagation in different guided media
- asses the electromagnetic wave propagation and its power in different media
- calculate conductivity of semiconductors (L3)
- interpret the difference between normal conductor and superconductor
- demonstrate the application of nanomaterials

UNIT - I	**Wave Optics**

Interference: Principle of Superposition-Interference of light-Conditions for sustained Interference - Interference in thin films (reflected light)-Newton's Rings-Determination of Wavelength and refractive index.

Diffraction: Introduction-Fresnel and Fraunhofer diffraction-Fraunhofer Diffraction-Single andDouble slits - Diffraction Grating.

Polarisation: Introduction-Types of polarization- Polarisation by reflection and double refraction-Nicol's Prism-Half wave and Quarter wave plate.

UNIT - II	**Dielectric & Magnetic Materials**

Dielectric: Introduction--Dielectric Polarization-Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations: Electronic, Ionic and Orientation polarisations (Qualitative) - Lorentz (internal) field-Clausius -Mossotti equation.

Magnetic Materials: Introduction-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability-Classification of Magnetic Materials-Hysteresis-soft and hard magnetic materials

UNIT - III	**Lasers & Fiber Optics**

Lasers: Introduction-Spontaneous and Stimulated emission of radiation-Einstein's coefficients-Population inversion -Pumping Mechanisms-He-Ne laser- Semiconductor laser- Applications of laser.

Fibre optics: Introduction to Optical Fibers-Total Internal Reflection-Critical angle of propagation-Acceptance Angle-Numerical Aperture-Classification of fibers based on Refractive index profile – Propagation of electromagnetic wave through optical fiber–modes-Block Diagram of Fiber optic Communication -Medical Applications.

UNIT - IV	**Quantum Mechanics & Electromagnetic waves**

Quantum Mechanics: Dual nature of matter- Schrodinger's time independent wave equation-Schrodinger's time dependent wave equation-Significance of wave function-Particle in one dimensional infinite potential well.

Electromagnetic waves: Gauss' theorem for divergence and Stokes' theorem for curl (Qualitative)-Fundamental laws of Electric and Magnetic Fields-Derivation of Maxwell's Equations (Integral form and Differential form)-Electromagnetic wave propagation in non-conducting media-Propagation of Electromagnetic waves in dielectric medium.

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UNIT - V	**Semiconductors & Superconductors**

Semiconductors: Introduction-Intrinsic semiconductors – Intrinsic carrier concentration and Fermi level- Intrinsic conductivity – Extrinsic semiconductors - P-type Semiconductor & N-type Semiconductor - Drift and Diffusion currents- Einstien's relation -Hall effect-Hall coefficient - Applications of Hall effect -Applications of Semiconductors.

Superconductors: Introduction-Properties of superconductors-Critical magnetic field-Meissner effect-Josephson Effect (AC & DC)-Types of Superconductors-SQUID-Applications of superconductors.

Textbooks:

1. M. N. Avadhanulu, P.G. Kshirsagar& TVS Arun Murthy" AText book of Engineering Physics"- S. Chand Publications, 11th Edition 2019.
2. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2012.

Reference Books:

1. Shatendra Sharma, Jyotsna Sharma, "Engineering Physics", Pearson Education,2018.
2. David J.Griffiths, "Introduction to Electrodynamics"- 4/e, Pearson Education,2014.
3. Applied Physics – P.K.Palanisamy SciTech Publications Pvt. Ltd.,
4. Engineering Physics- K. Vijay Kumar, S. Chand Publications.

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Course Code	COMMUNICATIVE ENGLISH (Common to All Branches of Engineering)	L	T	P	C
		3	0	0	3

I Year 1st Semester

Course Objectives:

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing
- .

Course Outcomes (CO):

- Retrieve the knowledge of basic grammatical concepts
- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
- Apply grammatical structures to formulate sentences and correct word forms
- Analyze discourse markers to speak clearly on a specific topic in informal discussions
- Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
- Create a coherent paragraph interpreting a figure/graph/chart/table

UNIT - I	**On the Conduct of Life: William Hazlitt**	

Lesson: Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information. Reading for Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. Grammar and Vocabulary: Parts of Speech, Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh- questions; word order in sentences.

UNIT - II	**The Brook: Alfred Tennyson**	

Lesson: Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts. Speaking: Discussion in pairs/small groups on specific topics followed by short structured talks. Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. Grammar and Vocabulary: Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

UNIT - III	**The Death Trap: Saki**	

Lesson: Listening: Listening for global comprehension and summarizing what is listened to. Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Writing: Summarizing, Paragraph Writing Grammar and Vocabulary: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

UNIT - IV	**Innovation: Muhammad Yunus**	

Lesson: Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video. Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Reading: Studying the

use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. Writing: Letter Writing: Official Letters/Report Writing Grammar and Vocabulary: Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice.		
UNIT - V	**Motivation: The Dancer with a White Parasol: Ranjana Dave**	
Lesson: Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. Reading: Reading for comprehension. Writing: Writing structured essays on specific topics using suitable claims and evidences. Grammar and Vocabulary: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)		

Textbooks:

1. Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. Oxford Learners Dictionary, 12th Edition, 2011
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)
7. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler
8. A Remedial English Grammar For Foreign Students by Frederick T Wood.
9. Oxford English Grammar Course by Michael Swan & Catherine Walter

Web links

www.englishclub.com
www.easyworldofenglish.com
www.languageguide.org/english/
www.bbc.co.uk/learningenglish
www.eslpod.com/index.html www.myenglishpages.com

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Electronics & Communication Engineering

Course Code	PROBLEM SOLVING AND PROGRAMMING (Common to all Branches Of Engineering)	L	T	P	C
		3	0	0	3
I Year 1st Semester					

Course Objectives:

- To illustrate the basic concepts of C programming language.
- To discuss the concepts of Functions, Arrays, Pointers and Structures.
- To familiarize with Stack, Queue and Linked lists data structures.
- To explain the concepts of non-linear data structures like graphs and trees.
- To learn different types of searching and sorting techniques

Course Outcomes (CO):

- Analyse the basic concepts of C Programming language.
- Design applications in C, using functions, arrays, pointers and structures.
- Apply the concepts of Stacks and Queues in solving the problems.
- Explore various operations on Linked lists.
- Demonstrate various tree traversals and graph traversal techniques.
- Design searching and sorting methods

UNIT - I	**Introduction to C Language** -

C language elements, variable declarations and data types, operators and expressions, decision statements - If and switch statements, loop control statements - while, for, do-while statements, arrays

UNIT - II	**Functions**

Functions, types of functions, Recursion and argument passing, pointers, storage allocation, pointers to functions, expressions involving pointers, Storage classes – auto, register, static, extern, Structures, Unions, Strings, string handling functions, and Command line arguments.

UNIT - III	**Data Structures**,

Overview of data structures, stacks and queues, representation of a stack, stack related terms, operations on a stack, implementation of a stack, evaluation of arithmetic expressions, infix, prefix, andpostfix notations, evaluation of postfix expression, conversion of expression from infix to postfix, recursion, queues - various positions of queue, representation of queue, insertion, deletion, searching operations.

UNIT - IV	**Linked Lists**

Singly linked list, dynamically linked stacks and queues, polynomials using singly linked lists, using circularly linked lists, insertion, deletion and searching operations, doubly linked lists and its operations, circular linked lists and its operations.

UNIT - V	**Trees, Graphs ,Searching & Sorting**

Trees - Tree terminology, representation, Binary trees, representation, binary tree traversals. binary tree operations, **Graphs** - graph terminology, graph representation, elementary graph operations, Breadth First Search (BFS) and Depth First Search (DFS), connected components, spanning trees. **Searching and Sorting** – sequential search, binary search, exchange (bubble) sort, selection sort, insertion sort.

Textbooks:

1. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Second Edition, Prentice Hall Publication.
2. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Computer Science Press.
3. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. AnandaRao, Pearson Education.
4. B.A. Forouzon and R.F. Gilberg, “COMPUTER SCIENCE: A Structured Programming Approach Using C”, Third edition, CENGAGE Learning, 2016.
5. Richard F. Gilberg & Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, Second Edition, CENGAGE Learning, 2011.

Reference Books:

1. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E. Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T. Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

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Electronics & Communication Engineering

Course Code	ENGINEERING DRAWING (Common to CSE, ECE & EEE)	L	T	P	C
		1	0	4	3

I Year 1st Semester

Course Objectives:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting in orthographic and isometric drawings.
- Train the usage of 2D and 3D modeling.

Course Outcomes (CO):

- draw various curves applied in engineering.
- Show projections of planes graphically
- show projections of solids graphically.
- draw isometric and orthographic drawings

UNIT - I	**Introduction to Engineering graphics**

Principles of Engineering Graphics and their significance-Conventions in drawing-lettering - BIS conventions. Conic sections including the rectangular hyperbola- general and special methods.

UNIT - II	**Projection of Points & Lines:**

Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by lines

UNIT - III	**Projections of Regular Planes:**

Inclined to one plane and both planes by rotational method.

UNIT - IV	**Projections of Solids:**

Projections of regular solids inclined to one plane and both planes rotational or Auxilary views method. – Prism, Cylinder, Pyramid, Cone.

UNIT - V	**Isometric Projections and Orthographic Projections**

Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

Orthographic Projections: Systems of projections, conventions and application to orthographic projections (Conversion of isometric Views to Orthographic Views).

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Textbooks:

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
3. Engineering Drawing, Sankar Prasad Dey

Reference Books:

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.
3. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009

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Electronics & Communication Engineering

Course Code	COMMUNICATIVE ENGLISH LAB (Common to All Branches of Engineering)	L	T	P	C
		0	0	3	1.5

I Year 1st Semester

Course Objectives:

- students will be exposed to a variety of self instructional, learner friendly modes of language
- learning
- students will learn better pronunciation through stress, intonation and rhythm
- students will be trained to use language effectively to face interviews, group discussions,
- public speaking
- students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

Course Outcomes (CO):

- Retrieve and reminisce the sounds of English Language
- Understand the different aspects of the English language
- Apply communication skills through various language learning activities
- Analyze the English speech sounds, stress, rhythm, intonation and syllable
- Evaluate and exhibit acceptable etiquette essential in social and professional settings
- Create awareness on mother tongue influence and neutralize it

List of Topics

1. Phonetics
2. Reading comprehension
3. Describing objects/places/persons
4. Role Play or Conversational Practice
5. JAM
6. Etiquettes of Telephonic Communication
7. Information Transfer
8. Note Making and Note Taking
9. E-mail Writing
10. Group Discussions-1
11. Resume Writing
12. Debates
13. Oral Presentations
14. Poster Presentation
15. Interviews Skills-1

Suggested Software

Orel, Walden Infotech, Young India Films

Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

Web Links

www.esl-lab.com
www.englishmedialab.com
www.englishinteractive.net

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Electronics & Communication Engineering

Course Code	APPLIED PHYSICS LAB (Common to ECE, CSE & EEE Branches)	L	T	P	C
		0	0	3	1.5

I Year 1st Semester

Course Objectives:

- Understands the concepts of interference and diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and hall effect in a semiconductor.
- Apply the principles of semiconductors in various electronic devices.
- Understand the role of Optical fiber parameters in engineering applications.
- Recognize the significance of laser by studying its characteristics and its application in finding the particle size.

Course Outcomes (CO):

- operate optical instruments like microscope and spectrometer
- determine thickness of a hair/paper with the concept of interference
- estimate the wavelength of different colors using diffraction grating and resolving power
- plot the intensity of the magnetic field of circular coil carrying current with distance
- evaluate the acceptance angle of an optical fiber and numerical aperture
- determine magnetic susceptibility of the material and its losses by B-H curve

Experiments(Execute any 12 experiments)

1. Determination of wavelength of LASER light using diffraction grating.
2. Determine the thickness of the wire using wedge shape method.
3. Determination of the radius of curvature of the lens by Newton's ring method.
4. Determination of Dispersive power of a prism.
5. Magnetic field along the axis of a circular coil carrying current-Stewart Gee's method.
6. Rigidity modulus of material of a wire-dynamic method (Torsional pendulum).
7. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle.
8. To determine the energy gap of a semiconductor.
9. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
10. Determination of particle size using LASER.
11. Determination of dielectric constant of dielectric material using charging and dischargingof capacitor.
12. Resolving power of a grating.
13. Determination of hysteresis loss by tracing B-H Curve of ferromagnetic material.
14. To determine the measurement of resistance with varying temperature.
15. Resistivity of semiconductor by Four probe method.

References Books:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

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Electronics & Communication Engineering

Course Code	PROBLEM SOLVING AND PROGRAMMING LAB (Common to All Branches of Engineering)	L	T	P	C
		0	0	3	1.5

I Year 1st Semester

Course Objectives:

- To get familiar with the basic concepts of C programming.
- To design programs using arrays, strings, pointers and structures.
- To illustrate the use of Stacks and Queues
- To apply different operations on linked lists.
- To demonstrate Binary search tree traversal techniques.
- To design searching and sorting techniques.

Course Outcomes (CO):

- Demonstrate basic concepts of C programming language.
- Develop C programs using functions, arrays, structures and pointers.
- Illustrate the concepts Stacks and Queues.
- Design operations on Linked lists.
- Apply various Binary tree traversal techniques.
- Develop searching and sorting methods.

List of Experiments:

Week l

Write C programs that use both recursive and non-recursive functions

(i)To find the factorial of a given integer.

(ii)To find the GCD (greatest common divisor) of two given integers.

Week 2

a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program that uses functions to perform the following:

i) Addition of Two Matrices ii) Multiplication of Two Matrices

Week 3

a) Write a C program that uses functions to perform the following operations:

i) To insert a sub-string in to a given main string from a given position.

ii) To delete n characters from a given position in a given string.

Week 4

a) Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn‘t contain T.

b) Write a C program to count the lines, words and characters in a given text.

Week 5

a) Write a C Program to perform various arithmetic operations on pointer variables.

b) Write a C Program to demonstrate the following parameter passing mechanisms:

i) call-by-value ii) call-by-reference

Week 6

Write a C program that uses functions to perform the following operations:

(i)Reading a complex number

(ii)Writing a complex number

(iii)Addition of two complex numbers

(iv)Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 7

Write C programs that implement stack (its operations) using

(i)Arrays (ii) Pointers

Week 8

Write C programs that implement Queue (its operations) using

(i)Arrays (ii) Pointers

Week 9

Write a C program that uses Stack operations to perform the following:

(i) Converting infix expression into postfix expression

(ii) Evaluating the postfix expression

Week 10

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 11

Write a C program that uses functions to perform the following operations on Doubly linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on circular linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following:

i) Creating a Binary Tree of integers

ii) Traversing the above binary tree in preorder, inorder and postorder.

Week 14

Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers:

(i) Linear search (ii) Binary search

Week 15

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order

(i) Bubble sort

(ii) Selection sort

(iii) Insertion sort

(iv) Description Language

Text Books

1. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.
2. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
3. Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

Reference Books:

1. PradipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E.Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.
3. A.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T.Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

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Electronics & Communication Engineering

Course Code	ENVIRONMENTAL SCIENCE	L	T	P	C
		2	0	0	0

I Year 1st 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):

Students should be able to

- Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources
- Understand flow and bio-geo- chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
- Casus of population explosion, value education and welfare programmes

UNIT – I: Multidisciplinary Nature of Environmental Studies

Definition, Scope and Importance – Need for Public Awareness.

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

UNIT – II: Ecosystems, Biodiversity, and its Conservation

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

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

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

UNIT – III: Environmental Pollution and Solid Waste Management

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of :

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

e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

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

UNIT – IV:	**Social Issues and the Environment**

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

UNIT – V:	**Human Population and the Environment**

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

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

TEXT BOOKS :

1. Text book 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.Azeem Unnisa, 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 – Prentice 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
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Electronics & Communication Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
I Year II Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Differential Equations & Vector Calculus	BS	3-0-0	3
2.		Chemistry	BS	3-0-0	3
3.		Data Structures	ES	3-0-0	3
4.		Network Theory	ES	3-0-0	3
5.		Electronics & Communication Engineering Workshop	ES	0-0-3	1.5
6.		Basic Engineering Workshop	ES	0-0-3	1.5
7.		Chemistry Lab	BS	0-0-3	1.5
8.		Data Structures Lab	ES	0-0-3	1.5
9.		Network Theory Lab	ES	0-0-3	1.5
				Total	**19.5**

Category	**CREDITS**
Basic Science course	7.5
Engineering Science Courses	12
TOTAL CREDITS	**19.5**

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Electronics & Communication Engineering

Course Code	DIFFERENTIAL EQUATIONS & VECTOR CALCULUS (Common to ECE, EEE ,Civil & Mechanical Branches)	L	T	P	C
		3	0	0	3

I Year 2nd Semester

Course Objectives:

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

Course Outcomes (CO):

- solve the differential equations related to various engineering fields
- Identify solution methods for partial differential equations that model physical processes
- interpret the physical meaning of different operators such as gradient, curl and divergence
- estimate the work done against a field, circulation and flux using vector calculus

UNIT - I	**Linear Differential Equations of Higher Order**

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.Simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems.

UNIT - II	**Partial Differential Equations – First order**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's method and non-linear PDEs (Standard Forms).

UNIT - III	**Applications of Partial Differential Equations**

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation

UNIT - IV	**Multivariable Calculus (Vector differentiation)**

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

UNIT - V	**Multivariable Calculus (Vector integration)**

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

Textbooks:
1. 1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011. 2. 2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
Reference Books:
1. 1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011. 2. 2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018 3. 3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013. 4. 4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002. 5. 5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011. 6. 6.T.K.V Iyengar, B. Krishn Gandhi, S. Ranganatham and M.V.S.N. Prasad., S. chand Publishers.

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Electronics & Communication Engineering

Course Code	CHEMISTRY (Common CSE,ECE and EEE Branches)	L	T	P	C
		3	0	0	3

I Year 2nd Semester

Course Objectives:

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

Course Outcomes (CO):

- **Demonstrate:** The materials of construction for battery and electrochemical series
- **Explain:** The preparation, properties, and applications of thermosetting and thermoplastics
- **Explain:** The constituents of Portland cement and factory affecting the refractory material
- **Explain:** Difference between the UV-Visible and IR spectroscopy
- **Discuss:** The setting and hardening of cement and concrete phase

UNIT - I	**Structure and Bonding Models:**	

Schrodinger wave equation (Eigen-value and Eigen-function). **Crystal field theory:** Crystal field theory and the energy level diagrams for transition metal ions, Salient features –splitting in octahedral and tetrahedral geometry**,** magnetic properties and colours.

UNIT - II	**Polymer Chemistry**	

Polymers: Basic concepts of polymerization, types of polymerization addition and condensation polymerization. **Plastomers:** thermosetting and theromoplastics composition properties and engineering applications of PVC, teflon, bakelite and nylons. **Rubber:** rubber-processing of natural rubber and Vulcanisation of rubber, compounds of rubber, elastomers-buna **S**, buna **N** preparation, properties and its applications. .

UNIT - III	**Electrochemistry and Fuel cells**	

Electrochemical cells: galvanic cells, types of electrodes (standard hydrogen, calomel and quinhydrone). **Batteries:** Nickel-cadmium, lithium ion batteries advantages, disadvantages and its applications. **Fuel cells:** Hydrogen-oxygen and methane-oxygen fuel cells advantages, disadvantages and its applications

UNIT - IV	**Advanced Engineering Materials**	

Building materials: Portland cement composition, classification, preparation (dry and wet processes).Constituents, phases and reactivity of clinker, Setting and hardening of cement. **Refractories:** Definition,criteries of refractories, Classification, properties, Factors affecting the refractory materials and applications. Failures of refractories.

UNIT - V	**Instrumental methods and Applications**	

Electromagnetic spectrum and absorption of radiations. The absorption laws: Beer-Lambert's law. principle, instrument ans its applications of UV-Visible and Infrared spectroscopy. Principle, instrumentation and its applications of pH metry.

Textbooks:

1. **1**.A text book of engineering chemistry., Jain and Jain, Dhanpat Rai Publishing Company., 15th edition, New Delhi,**2008**.
2. **2**. Chemistry of engineering., Prof. K.N. Jayaveera, Dr. G.V. Subba Reddy and Dr. C. Ramachandraiah. McGraw hill higher education. Hyderabad, **2009.**
3. **3**. Peter Atkins, Julio de Paula and James Keeler, Atkin's Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. J.D Lee, Concise Inorganic Chemistry,5/e, OxfordUniversity Press,2008.
2. Skoog and West, Principles of instrumental Ananlysis, 6/e, Thomson,2007.
3. .H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
4. Engineering chemistry 3e,B.Rama Devi et al., Cengage Learning.
5. Text book of Spectroscopy by Y.R. Sharma

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Electronics & Communication Engineering

Course Code	DATA STRUCTURES (Common to ECE and EEE)	L	T	P	C
		3	0	0	3

I Year 2nd Semester

Course Objectives:

- To teach the representation of solution to the problem using algorithm
- To explain the approach to algorithm analysis
- To introduce different data structures for solving the problems
- To demonstrate modelling of the given problem as a graph
- To elucidate the existing hashing techniques

Course Outcomes (CO):

Students should be able to

- Select Appropriate Data Structure for solving a real world problem
- Select appropriate file organization technique depending on the processing to be done
- Construct Indexes for Databases
- Analyse the Algorithms
- Develop Algorithm for Sorting large files of data

UNIT - I	

Introduction Algorithm Specification, Performance analysis, Performance Measurement. Arrays: Arrays, Dynamically Allocated Arrays. Structures and Unions. Sorting: Motivation, Quick sort, how fast can we sort, Merge sort, Heap sort

UNIT - II	

Stack, Queue and Linked lists Stacks, Stacks using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues. Linked lists: Singly Linked Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Additional List Operations, Doubly Linked Lists.

UNIT - III	

Trees Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Binary Search Trees, Counting Binary Trees, Optimal Binary search Trees, AVL Trees. B-Trees: BTrees, B + Trees

UNIT - IV	

Graphs and Hashing The Graph Abstract Data Type, Elementary Graph Operations, Minimum Cost Spanning Trees, Shortest Paths and Transitive Closure Hashing: Introduction to Hash Table, Static Hashing, Dynamic Hashing.

UNIT - V	

Files and Advanced sorting File Organization: Sequential File Organization, Direct File Organization, Indexed Sequential File Organization. Advanced sorting: Sorting on Several keys, List and Table sorts, Summary of Internal sorting, External sorting.

Textbooks:
1. 1. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C", 2nd Edition, Galgotia Book Source, Pvt. Ltd., 2004. 2. 2. Alan L. Tharp, "File Organization and Processing", Wiley and Sons, 1988.
Reference Books:
1. 1. D. Samanta, "Classic Data Structures", 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012. 3. Peter Bras, "Advanced Data Structures", Cambridge University Press, 2016 2. 2. Richard F.Gilberg, Behrouz A.Forouzan, "Data Structures A Pseudo code Approach with C", Second Edition, Cengage Learning 2005.

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Electronics & Communication Engineering

Course Code	NETWORK THEORY	L	T	P	C
		3	0	0	3

I Year 2nd Semester

Course Objectives:

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

Course Outcomes (CO):

- Solve network problems using mesh and nodal analysis techniques
- Analyze networks using Thevenin, Norton, Maximum power transfer, Superposition,Miller and Millman theorems
- Compute responses of first order and second order networks using time & frequency domain analysis
- Design resonant circuits for given bandwidth
- Utilize z, y, ABCD and h parameters for analyzing two port circuit behavior

UNIT - I	**Introduction to Electrical Circuits**	

Passive components and their V-I relations, Energy sources - Ideal, Non-ideal, Independent and dependent sources, Source transformation Kirchoff's laws, Star–to-Delta or Delta-to-Star Transformations, Mesh analysis and Nodal analysis problem solving, Super node and Super mesh for DC Excitations.

UNIT - II	**Network Theorems**	

Superposition theorem, Thevenin & Norton theorems, Maximum power transfer theorem, Reciprocity theorem, Millman theorem, Miller Theorem, Tellegan's Theorem, Compensation theorem - problem solving using dependent sources also, Duality and dual networks.

UNIT - III	**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 (sinusoidal) excitation, Response as related to s-plane rotation of roots. Solutions using Laplace transform method.

UNT - IV	**Resonance and Coupled Circuits**	

Self inductance, Mutual inductance, dot rule, coefficient of coupling, Analysis of multi-winding coupled circuits, series & parallel connection of coupled inductors.

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

UNIT-V	**Two Port Networks & Network Functions**

Two Port Networks, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters, hybrid and inverse hybrid parameters, relationship between parameters, interconnection of two port networks.

Concept of complex frequency, driving point and transfer functions for one port and two port network, poles & zeros of network functions, Restriction on Pole and Zero locations of network function

Textbooks:
1. .W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013. 2. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
References
1. D. Roy Choudhury, "Networks and Systems", New Age International Publications,1998. 2. Network lines and Fields by John. D. Ryder 2nd edition, Asia publishing house. 3. Bhise, Chadda, Kulshreshtha, "Engineering network analysis and filter design" Umesh Publication, 2000. 4. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, Fourth Edition, Tata McGraw Hill Publishing Company, New Delhi, 2003.

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Electronics & Communication Engineering

Course Code	ELECTRONICS & COMMUNICATION ENGINEERING WORKSHOP	L	T	P	C
		0	0	3	1.5

I Year 2nd Semester

Course Objectives:

- To introduce electronic components, measuring instruments and tools used in electronic workshop.
- To equip with the knowledge of understanding data sheets of electronic components
- To give practical experience on soldering the electronic components on a PCB
- To introduce EDA tools
- To know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system
- To provide training on Productivity tools like word processors, spreadsheets, presentations
- To provide knowledge in understanding working of various communication systems

Course Outcomes (COs):

- Identify discrete components and ICs
- Assemble simple electronic circuits over a PCB
- Testing of various components
- Interpret specifications (ratings) of the component
- Demonstrate disassembling and assembling a Personal Computer and make the computer ready to use
- Make use of Office tools for preparing documents, spread sheets and presentations
- Demonstrate working of various communication systems

List of Experiments/Exercises

1. Familiarization of commonly used Electronic Workshop Tools : Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
   - Provide some exercises so that electronics hardware tools and instruments are learned to be used by the students
2. Familiarization of Electronic Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
   - Provide some exercises so that electronic measuring instruments are learned to be used by the students
3. Electronic Components: Familiarization/Identification of electronic components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, color coding, package, symbol, cost etc.
4. Testing of electronic components like Resistor, Capacitor, Diode, Transistor, ICs etc.
   - Compare values of components like resistors, inductors, capacitors etc with the measured values by using electronic instruments
5. Study of Cathode Ray Oscilloscope (CRO)
   - Find the Amplitude and Frequency of a signal
   - Measure the Unknown Frequency & Phase difference of signals using Lissajous figures
6. Interpret data sheets of discrete components and IC's.
   - Write important specifications/ratings of components & ICs and submit it in the form of a report
7. Introduction to EDA Tools: MULTISIM/PSPICE/TINA schematic capture tool, Learning of basic functions of creating a new project, getting and placing parts, connecting placed parts, simulating the schematic, plotting and analyzing the results.
   - Provide some exercises so that students are familiarized in using EDA tools
8. Assembling and Testing of simple electronic circuits on breadboards; identifying the components and its location on the PCB, soldering of the components, testing the assembled circuit for correct functionality.

9. Familiarization with Computer Hardware & Operating System:
   - Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.
   - Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer.
   - Install Operating system on the computer. Students should record the entire installation process.

10. Familiarization with Office Tools
   - Word Processor: Able to create documents using the word processor tool. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied.
   - Spreadsheet: Able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells.
   - Presentations: creating, opening, saving and running the presentations, Selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyper-linking, running the slide show, setting the timing for slide show.

11. Familiarization of PA system with different microphones, loud speakers, mixer etc. epresent the same in the form of diagrams, write specifications and submit it in the form of a report.

12. Understand working of various Communication Systems like Television, Satellite Transmitter & Receiver, Radio Receiver, Mobile Phone Prepare demo boards/charts of various communication systems.

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Electronics & Communication Engineering

Course Code	BASIC ENGINEERING WORKSHOP	L	T	P	C
		0	0	3	1.5

I Year 2nd Semester

Course Objectives:

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

Course Outcomes (CO):

- apply wood working skills in real world applications.
- build different parts with metal sheets in real world applications.
- apply fitting operations in various applications.
- apply different types of basic electric circuit connections.
- demonstrate soldering and brazing.

List of Experiments/Exercises

Wood Working:

Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint
b) Mortise and Tenon joint
c) Corner Dovetail joint or Bridle joint

Sheet Metal Working:

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

Fitting:

Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two wheeler tyre

Electrical Wiring:

Familiarities 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

design and analysis aspects of the circuit.

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Electronics & Communication Engineering

Course Code	DATA STRUCTURES LAB (Common to All Branches of Engineering)	L	T	P	C
		0	0	3	1.5

I Year 2nd Semester

Course Objectives:

- To introduce to the different data structures
- To elucidate how the data structure selection influences the algorithm complexity
- To explain the different operations that can be performed on different data structures
- To introduce to the different search and sorting algorithms.

Course Outcomes (CO):

At the end of the course students should be able to

- Select the data structure appropriate for solving the problem
- Implement searching and sorting algorithms
- Design new data types
- Illustrate the working of stack and queue
- Organize the data in the form of files

List of Experiments:.

1. String operations using array of pointers
2. Searching Algorithms (With the Number of Key Comparisons) Sequential, Binary and Fibonacci Search Algorithms.
3. Sorting Algorithms: Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort, and Radix Sort. Using the system clock, compute the time taken for sorting of elements. The time for other operations like I/O etc should not be considered while computing time.
4. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List
5. Stack implementation using arrays
6. Stack implementation using linked lists
7. Queue implementation using arrays. Implement different forms of queue. While implementing you should be able to store elements equal to the size of the queue. No positions should be left blank.
8. Queue implementation using linked lists
9. Creation of binary search tree, performing operations insertion, deletion, and traversal.
10. Breadth first search
11. Depth first search
12. Travelling sales man problem
13. File operations
14. Indexing of a file
15. Reversing the links (not just displaying) of a linked list.
16. Consider a linked list consisting of name of a person and gender as a node. Arrange the linked list using ‘Ladies first’ principle. You may create new linked lists if necessary.
17. An expression can be represented in three ways: infix, prefix and postfix. All the forms are necessary in different contexts. Write modules to convert from one form to another form.
18. A table can be defined as a collection of rows and columns. Each row and column may have a label. Different values are stored in the cells of the table. The values can be of different data types. Numerical operations like summation, average etc can be performed on rows/columns which contain numerical data. Such operationsare to be prevented on data which is not numeric. User may like to insert row/columns in the already existing table. User may like to remove row/column.
    Create table datatype and support different operations on it.

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Electronics & Communication Engineering

Course Code	CHEMISTRY LAB (Common CSE,ECE and EEE Branches)	L	T	P	C
		0	0	3	1.5

I Year 2nd Semester

Course Objectives:

- Verify the fundamental concepts with experiment

Course Outcomes (CO):

- **Determination:** Hardness of water by using EDTA
- **Estimation:** Amount of dissolved oxygen given water sample
- **Analysis:** Difference between the UV-Visible and IR spectroscopy
- **Explain:** Verification of Beer-Lambert's law
- **Identify:** Acid -base buffer solution pH meter

List of Experiments

Chemical methods: Volumetric analysis

1. Estimation of Ferrous (Fe^{2+}) Ion using Standard Potassium Dichromate

Iodometry Titrations:

2.Estimation of Copper (Cu^{2+}) Ion using Standard Potassium Dichromate

(i) Part-I : Standardization of sodium thiosulphate ($Na_2S_2O_3$) solution with standard $K_2Cr_2O_7$

(ii) Part-II: Estimation of Copper

Complexometry Titrations:

3.Estimation of Calcium hardness of water using Standard EDTA solution

4.Estimation of Copper by using Standard EDTA solution

5.Dissolved Oxygen: To test the amount of dissolved oxygen present in the given water sample.

Physical methods: Instrumental Analysis

6. pH metric titration of (i) strong acid vs strong base, (ii) weak acid vs strong base
7. Determination of cell constant and conductance of solutions
8. Determination of colorimetric titration with $KMnO_4$ solution
9. Verification of Beer-Lambert's law with $K_2Cr_2O_7$ solution.
10. Viscosity determination of Kerosin and Petrol by Red-wood viscometer

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Electronics & Communication Engineering

Course Code	NETWORK THEORY LAB	L	T	P	C
		0	0	3	1.5

I Year 2nd Semester

Course Objectives:

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

Course Outcomes (CO):

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

List of Experiments

Any 10 of the following experiments are to be conducted in Hardware & Simulation (Multisim/Open source software):

1. Verification of Kirchoff's Laws
2. Apply Mesh & Nodal Analysis techniques for solving electrical circuits (problems with dependent sources also)
3. Verification of Superposition & Reciprocity Theorem
4. Verification of Thevenin's and Norton's Theorem
5. Verification of Maximum Power Transfer Theorem
6. Verification of Millman and Miller Theorm
7. Measure and calculate RC time constant for a given RC circuit
8. Measure and calculate RL time constant for a given RL circuit
9. Measure and analyze (settling time, overshoot, undershoot, etc.) step response of for a given series RLC circuit for following cases:
   (i) $\zeta = 1$ (critically damped system) (ii) $\zeta > 1$ (over damped system)
   (iii) $\zeta < 1$ (under damped system)
   Choose appropriate values of R, L, and C to obtain each of above cases one at a time.
10. Design a series RLC resonance circuit. Plot frequency response and find resonance frequency , Bandwidth , Q – factor.
11. Design a parallel RLC resonance circuit. Plot frequency response and find resonance frequency , Bandwidth , Q – factor.
12. Measure and calculate Z, Y parameters of two-port network.
13. Measure and calculate ABCD & h parameters of two-port network.

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Electronics & Communication Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
II Year Ist Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Complex Variables and Transforms	BS	3-0-0	3
2.		Signals and Systems	PC	3-0-0	3
3.		Electronic Devices and Circuits	PC	3-0-0	3
4.		Digital Logic Design	PC	3-0-0	3
5.		Managerial Economics & Financial Analysis	HS	3-0-0	3
6.		Simulation Lab	PC	0-0-3	1.5
7.		Electronic Devices and Circuits Lab	PC	0-0-3	1.5
8.		Digital Logic Design Lab	PC	0-0-3	1.5
9.		**Skill oriented course – I** Application Development with Python	SC	1-0-2	2
10.		**NCC/NSS ACTIVITIES**			
				Total	**21.5**

Category	**CREDITS**
Basic Science course	3
Professional Core Courses	13.5
Humanities and Social science	3
Skill oriented course	2
TOTAL CREDITS	**21.5**

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Electronics & Communication Engineering

Course Code	Complex variables and Transforms (Common to ECE & EEE)	L	T	P	C
		3	0	0	3

II Year 1st Semester

Course Objectives:

This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The student develops the idea of using continuous/discrete transforms.

Course Outcomes (CO): Student will be able to

- Understand the analyticity of complex functions and conformal mappings.
- Apply cauchy's integral formula and cauchy's integral theorem to evaluate improper integrals along contours.
- Understand the usage of laplace transforms, fourier transforms and z transforms.
- Evaluate the fourier series expansion of periodic functions.
- Understand the use of fourier transforms and apply z transforms to solve difference equations.

UNIT - I	**Complex Variable – Differentiation**:

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method-Conformal mappings-standard and special transformations (sin z, e^z, cos z, z^2) Mobius transformations (bilinear) and their properties.

UNIT - II	**Complex Variable – Integration**:

Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof);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, Evaluation of certain improper integrals (around unit circle, semi circle with f(z) not having poles on real axis).

UNIT - III	**Laplace Transforms**

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

UNIT - IV	**Fourier series**

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions- typical wave forms - Parseval's formula- Complex form of Fourier series.

UNIT - V	**Fourier transforms & Z Transforms:**

Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem .

Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.

Textbooks:
3. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. 4. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India
Reference Books:
1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers. 2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.
Online Learning Resources:
1. nptel.ac.in/courses/111107056 2. onlinelibrary.wiley.com 3. https://onlinecourses.nptel.ac.in/noc18ma12.

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Electronics & Communication Engineering

Course Code	SIGNALS AND SYSTEMS	L	T	P	C
		3	0	0	3

II Year 1st Semester

Course Objectives:

- To introduce students to the basic idea of signal and system analysis and its characterization in time and frequency domains.
- To present Fourier tools through the analogy between vectors and signals.
- To teach concept of sampling and reconstruction of signals.
- To analyze characteristics of linear systems in time and frequency domains.
- To understand Laplace and z-transforms as mathematical tool to analyze continuous and discrete-time signals and systems.

Course Outcomes (CO):

CO1: Understand the mathematical description and representation of continuous-time and discrete-time signals and systems. Also understand the concepts of various transform techniques.
CO2: 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.
CO3: Analyze the frequency spectra of various continuous-time and discrete-time signals using different transform methods.
CO4: Classify the systems based on their properties and determine the response of them.

UNIT - I	**Signals and Systems**

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.

UNIT - II	**Fourier Series and Fourier Transform**

Fourier series: Trigonometric & Exponential, Properties of Fourier series, concept of discrete spectrum, Illustrative Problems.
Continuous Time Fourier Transform: Definition, Computation and properties of Fourier transform for different types of signals and systems, Inverse Fourier transform. Statement and proof of sampling theorem of low pass signals, Illustrative Problems.

UNIT - III	**Laplace Transform**

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.

UNIT - IV	**Signal Transmission through LTI systems**

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.

UNIT - V	**DTFT & Z-Transform**

Discrete Time Fourier Transform: Definition, Computation and properties of Discrete Time Fourier transform for different types of signals and systems.
Z–Transform: Definition, ROC, Properties, Poles and Zeros in Z-plane, The 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.
Reference Books:
5. BP Lathi, "Principles of Linear Systems and Signals", 2nd Edition, Oxford University Press, 015. 6. Matthew Sadiku and Warsame H. Ali, "Signals and Systems A primer with MATLAB", CRC Press, 2016. 7. Hwei Hsu, "Schaum's Outline of Signals and Systems", 4thEdition, TMH, 2019.

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Electronics & Communication Engineering

Course Code	ELECTRONIC DEVICES & CIRCUITS	L	T	P	C
		3	0	0	3

II Year 1st Semester

Course Objectives:

- To understand the basic principles of all semiconductor devices.
- To be able to solve problems related to diode circuits, and amplifier circuits.
- To analyze diode circuits, various biasing and small signal equivalent circuits of amplifiers.
- To be able to compare the performance of BJTs and MOSFETs
- To design rectifier circuits and various amplifier circuits using BJTs and MOSFETs.

Course Outcomes (CO):

CO1: Understand principle of operation, characteristics and applications of Semiconductor diodes, Bipolar Junction Transistor and MOSFETs.
CO2: Applying the basic principles solving the problems related to Semiconductor diodes, BJTs, and MOSFETs.
CO3: Analyze diode circuits for different applications such as rectifiers, clippers and clampers also analyze biasing circuits of BJTs, and MOSFETs.
CO4: Design of diode circuits and amplifiers using BJTs, and MOSFETs.
CO5: Compare the performance of various semiconductor devices.

UNIT - I	**Review of Semiconductors and Diodes**	

Review of Semiconductors: Intrinsic semiconductors, Doped Semiconductors, Current Flow in Semiconductors, PN Junction with Open Circuit, PN Junction with Applied Voltage, Capacitive Effects in PN Junction.
Diodes: Introduction, The Ideal Diode – current voltage characteristic, rectifier, diode logic gates, Terminal Characteristics of Junction Diodes– forward bias,reversebias, and breakdown regions, Modeling the Diode Forward Characteristics- exponential model, graphical analysis and Iterative analysis using the exponential model, constant voltage drop model, the small signal model.

UNIT - II	**Zener Diodes and Bipolar Junction Transistors(BJTs)**	

Zener Diodes– Zenerdiode Characteristics, Voltage shunt regulator, Temperature Effects, Rectifier Circuits– half-wave, full-wave and bridge rectifier circuits, rectifier with a filter capacitor, C-L-C filter, Clipping and Clamping Circuits– limiter circuit, the clamped capacitor, voltage doubler, Special Diode Types– UJT, Schottkybarrier diode, Varactor diode, photo diode, light emitting diode(LED), Problem Solving.
Bipolar Junction Transistors(BJTs): Physical Operation - simplified structure and modes of operation, Operation of the npn, and pnp transistors: cutoff, active, andsaturation modes, V-ICharacteristics- of different configurations - graphical representation of transistor characteristics, dependence of collector current on collector voltage, the Early Effect.

UNIT - III	**BJT Amplifiers**	

BJT circuits at DC,Applying the BJT in Amplifier Design- Voltage Amplifier,Voltage Transfer Characteristic (VTC), Small-Signal Voltage Gain, determining the VTC by Graphical Analysis, Q-point, Small-signal operation and models- the transconductance, input resistance at the base, input resistance at the emitter, Voltage gain, separating the Signal and the DC Quantities, The Hybrid-π Model, the T Model, Basic BJT Amplifier Configurations - Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, Biasing in BJT Amplifier Circuits- Fixed bias, Self bias, voltage divider bias circuits, biasing using a Constant-Current Source,CE amplifier – Small signal analysis and design,Transistor breakdown and Temperature Effects, Problem solving.

UNIT - IV	**MOSFET's**	

MOS Field-Effect Transistors (MOSFETs)**:** Introduction, Device Structure and Physical Operation – device structure, operation with zero gate voltage, creating a channel for current flow, operation for different drain to source voltages, the P-channel MOSFET,CMOS, V-I characteristics–i_D - v_{DS}characteristics, i_D – v_{GS}characteristics, finite output resistance in saturation, characteristics of the p- Channel MOSFET, MOSFET Circuits at DC, Applying the MOSFET in Amplifier Design – voltage

transfer characteristics, biasing the MOSFET to obtain linear amplification, the small signal voltage gain, graphical analysis, the Q-point. Problem solving.		
UNIT - V	**MOSFET Amplifiers**	
MOSFET Small Signal Operation Models– the dc bias, separating the DC analysis and the signal analysis, Small signal equivalent circuit models, the transconductance, the T equivalent circuit model, Basic MOSFET Amplifier Configurations– three basic configurations, characterizing amplifiers, common source(CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, the amplifier frequency response,Biasing in MOSFET Amplifier Circuits– biasing by fixing V_{GS} with and without source resistance, biasing using drain to gate feedback resistor, biasing using constant current source, Common Source Amplifier using MOSFETs – Small signal analysis and design, Body Effect, Problem Solving		

Textbooks:

1. Adel. S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits," 6th Edition, Oxford University Press, 2011.
2. J. Millman, C Chalkias, "Integrated Electronics", 4thEdition, McGraw Hill Education (India) Private Ltd., 2015.
3. Millman and Taub, "Pulse,Digital and Switching Waveforms", 3rd Edition, Tata McGraw- Hill Education, 2011.

Reference Books:

1. Behzad Razavi, "Fundamentals of Micro Electronics", Wiley, 2010.
2. Donald A Neamen, "Electronic Circuits – Analysis and Design," 3rdEdition, McGraw Hill (India), 2019.
3. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory", 9th Edition, Pearson/Prentice Hall, 2006.
4. K.Lal Kishore, "Electronic Circuit Analysis", 2ndEdition, B S Publications, 2008.

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Electronics & Communication Engineering

Course Code	DIGITAL LOGIC DESIGN	L	T	P	C
		3	0	0	3
II Year 1st Semester					

Course Objectives:

- To familiarize with the concepts of different number systems and Boolean algebra.
- To introduce the design techniques of combinational, sequential logic circuits.
- To model combinational and sequential circuits using HDLs.

Course Outcomes (CO):

CO1: Understand the properties of Boolean algebra, other logic operations, and minimization of Boolean functions using Karnaugh map.
CO2: Make use of the concepts to solve the problems related to the logic circuits.
CO3: Analyze the combinational and sequential logic circuits.
CO4: Develop digital circuits using HDL, and Compare various Programmable logic devices
CO5: Design various logic circuits using Boolean algebra, combinational and sequential logic circuits.

UNIT - I	**Number Systems, Boolean algebra and Logic Gates**

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.

UNIT - II	**Minimization of Boolean functions and Combinational Logic Circuits**

The Karnaugh map method (up to five variables), product of sums simplifications, don't care conditions, Tabular method, Introduction, Combinational circuits, design procedure, adders, subtractors, 4-bit binary adder/ subtractor circuit, BCD adder, carry look- a-head adder, binary multiplier, magnitude comparator, decoders and encoders, multiplexers, demultiplexers,

UNIT - III	**Sequential Logic Circuits**

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

UNIT - IV	**Finite State Machines and Programmable Logic Devices**

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.

UNIT - V	**Hardware Description Language**

Types of PLD's: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs, Design of sequential circuits using ROMs, PLAs, CPLDs and FPGAs

Textbooks:

1. M. Morris Mano, "Digital Design", 3rd Edition, PHI. (Unit I to IV)
2. Stephen Brown and ZvonkoVranesic, "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. ZviKohavi 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", 2nd Edition, Prentice Hall PTR.
4. D.P. Leach, A.P. Malvino, "Digital Principles and Applications", TMH, 7th Edition.

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Electronics & Communication Engineering

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	L	T	P	C
		3	0	0	3

II Year 1st Semester

Course Objectives:

- To inculcate the basic knowledge of micro economics and financial accounting
- To make the students learn how demand is estimated for different products
- To know the input- output relationship for optimizing production and cost
- To give an overview on investment appraisal methods to promote the students to learn howto plan long-term investment decisions.
- To provide fundamental skills on Accounting and to explain the process of preparing Financial statements

Course Outcomes (CO):

- Understand the fundamentals of Economics viz., Demand, Production, cost andrevenue
- Apply concepts of production , cost and revenues for effective business decisions
- Students can analyze how to invest their capital and maximize returns
- Evaluate the capital budgeting techniques
- Prepare the accounting statements and evaluate the financial performance of business entity.

UNIT - I	**Introduction To Managerial Economics**

Introduction to Economics and Managerial Economics – Definitions-Nature and Scope of Managerial Economics–Demand Analysis- Demand determinants- Law of Demand – Exceptions of law of demand

UNIT - II	**Elasticity And Forecasting Demand**

Elasticity of Demand- Definition-Types-Measurement - Significance of Elasticity of Demand Demand Forecasting- Factors governing demand forecasting- Methods of demand forecasting (survey methods- statistical methods- expert opinion method- test marketing- controlled experiments- judgmental approach to demand forecasting).

UNIT - III	**Theory Of Production And Cost Analysis**

Production Function – Iso-quants- Iso-costs - MRTS- least cost combination of inputs- Cobb-Douglas production function -laws of returns - Internal and External economies of scale. Cost concepts- opportunity cost- fixed Vs variable costs-explicit costs Vs Implicit costs- out of pocket costs Vs Imputed costs- Break-Even Analysis (BEA)- Determination of Break Even Point -Simple Problems- Managerial significance and limitations of BEA.

UNIT - IV	**Forms Of Business Organizations And New EconomicEnvironment**

Business & New Economic Environment- Forms of business organizations-Factors affecting the choice of form of business organization- Features and evaluation of Sole Proprietorship- Partnership- Joint Stock Company- Public Enterprises and their types- Liberalization- Privatization-Globalization - Changing Business Environment in Post-liberalization scenario.

UNIT - V	**Capital Budgeting And Financial Accounting**

Concept of Capital - Significance - Types of Capital - Components of Working Capital - Sources of Short-term and Long-term Capital - Estimating Working capital requirements – Cash Budget - Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects : Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) method (simple problems)-Introduction to Financial Accounting-Double-Entry Book Keeping- preparation of Journal- Ledger-Trial Balance- Final Accounts (Trading & Profit and Loss Account and Balance Sheet with simple adjustments).

Textbooks:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

Reference Books:

1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
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, 2013.

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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Electronics & Communication Engineering

Course Code	SIMULATION LAB	L	T	P	C
		0	0	3	1.5

II Year 1st Semester

Course Objectives:

- To realize the concepts studied in theory
- To simulate various Signals and Systems through MATLAB
- To apply the concepts of signals to determine their energy, power, psd etc.
- To analyze the output of a system when it is excited by different types of deterministic and random signals.
- To generate random signals for the given specifications

Course Outcomes (CO):

CO1: Learn how to use the MATLAB software and know syntax of MATLAB programming.
CO2: Understand how to simulate different types of signals and system response.
CO3: Find the Fourier Transform of a given signal and plot amplitude and phase characteristics.
CO4: Analyze the response of different systems when they are excited by different signals and plot power spectral density of signals.
CO5: Generate/Simulate different random signals for the given specifications

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/Discrete 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 find response of a low pass filter and high pass filter, when a speech signal is passed through these filters.
11. Write a program to generate Complex Gaussian noise and find its mean, variance, Probability Density Function (PDF) and Power Spectral Density (PSD).
12. Generate a Random data (with bipolar) for a given data rate (say 10kbps). Plot the same for a time period of 0.2 sec.
13. To plot pole-zero diagram in S-plane of given signal/sequence and verify its stability.

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

References:

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

Online Learning Resources/Virtual Labs:

https://www.vlab.co.in/

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Electronics & Communication Engineering

Course Code	ELETCRONIC DEVICES AND CIRCUITS LAB	L	T	P	C
		0	0	3	1.5

II Year 1st Semester

Course Objectives:

- To verify the theoretical concepts practically from all the experiments.
- To analyse the characteristics of Diodes, BJT, MOSFET, UJT.
- To design the amplifier circuits from the given specifications.
- To Model the electronic circuits using tools such as PSPICE/Multisim.

Course Outcomes (CO):

- Understand the basic characteristics and applications of basic electronic devices.
- Observe the characteristics of electronic devices by plotting graphs.
- Analyze the Characteristics of UJT, BJT, MOSFET.
- Design MOSFET / BJT based amplifiers for the given specifications. Simulate all circuits in PSPICE /Multisim.

Experiments(Execute any 12 experiments)

1. Verification of Volt- Ampere characteristics of a PN junction diode and find static, dynamic and reverse resistances of the diode from the graphs obtained.
2. Design a full wave rectifier for the given specifications with and without filters, and verify the given specifications experimentally. Vary the load and find ripple factor. Draw suitable graphs.
3. Verify various clipping and clamper circuits using PN junction diode and draw the suitable graphs.
4. Design a Zener diode-based ***voltage regulator*** against variations of supply and load. Verify the same from the experiment.
5. Study and draw the ***output*** and ***transfer*** characteristics of MOSFET (Enhance mode) in Common Source Configuration experimentally. Find ***Threshold voltage (VT), gm, & K*** from the graphs.
6. Study and draw the ***output*** and ***transfer*** characteristics of MOSFET (Depletion mode) or JFET in Common Source Configuration experimentally. Find ***I_{DSS}, g_m, & V_P*** from the graphs.
7. Verification of the input and output characteristics of BJT in **Common Emitter** configuration experimentally and find required ***h – parameters*** from the graphs.
8. Study and draw the input and output characteristics of BJT in **Common Base** configuration experimentally, and determine required ***h – parameters*** from the graphs.
9. Study and draw the Volt Ampere characteristics of UJT and determine ***η, IP, Iv, VP, &Vv*** from the experiment.
10. Design and analysis of voltage- divider bias/self-bias circuit using BJT.
11. Design and analysis of voltage- divider bias/self-bias circuit using JFET.
12. Design and analysis of self-bias circuit using MOSFET.
13. Design a suitable circuit for switch using CMOSFET/JFET/BJT.
14. Design a small signal amplifier using MOSFET (common source) for the given specifications. Draw the frequency response and find the bandwidth.
15. Design a small signal amplifier using BJT(common emitter) for the given specifications. Draw the frequency response and find the bandwidth.

Tools / Equipment Required: Software Toollike Multisim/ Pspice or Equivalent, DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

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Electronics & Communication Engineering

Course Code	DIGITAL LOGIC DESIGN LAB (Common to ECE and EEE)	L	T	P	C
		0	0	3	1.5
II Year 1st Semester					

Course Objectives:

- To understand various pin configurations of the Digital ICs used in the laboratory
- To conduct the experiments and verify the truth tables of various logic circuits.
- To analyze the logic circuits
- To design sequential and combinational logic circuits and verify their properties.
- To design of any sequential/combinational circuit using Hardware Description Language.

Course Outcomes (CO):

CO1: Understand the pin configuration of various digital ICs used in the lab
CO2: Conduct the experiment and verify the properties of various logic circuits.
CO3: Analyze the sequential and combinational circuits.
CO4: Design of any sequential/combinational circuit using Hardware/ HDL.

List of Experiments:

1. Verification of truth tables of the following Logic gates
   Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive-OR (vi) Exclusive-NOR
2. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.
3. Verification of functional table of 3 to 8-line Decoder /De-multiplexer
4. 4variable logic function verification using 8 to1 multiplexer.
5. Design full adder circuit and verify its functional table.
6. Verification of functional tables of (i) JK Edge triggered Flip–Flop (ii) JK Master Slav Flip–Flop (iii) D Flip-Flop
7. Design a four-bit ring counter using D Flip–Flops/JK Flip Flop and verify output
8. Design a four bit Johnson's counter using D Flip-Flops/JK Flip Flops and verify output
9. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.
10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test It with a low frequency clock and sketch the output waveforms.
11. Design MOD–8 synchronous counter using T Flip-Flop and verify the result and sketch the output waveforms.
12. (a) Draw the circuit diagram of a single bit comparator and test the output
    (b) Construct 7 Segment Display Circuit Using Decoder and7 Segment LED and test it.

ADD on Experiments:

1. Design BCD Adder Circuit and Test the Same using Relevant IC
2. Design Excess-3 to 9- Complement convertor using only four Full Adders and test the Circuit.
3. Design an Experimental model to demonstrate the operation of 74154 De-Multiplexer using LEDs for outputs.
4. Design of any combinational circuit using Hardware Description Language
5. Design of any sequential circuit using Hardware Description Language

References:

M. Morris Mano, "Digital Design", 3rd Edition, PHI

Online learning resources/virtual labs:
https://www.vlab.co.in/

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Electronics & Communication Engineering

Course Code	APPLICATION DEVELOPMENT WITH PYTHON	L	T	P	C
		1	0	2	2
II Year 1st Semester					

Course Objectives:

- To learn the basic concepts of software engineering and life cycle models
- To explore the importance of Databases in application Development
- Acquire programming skills in core Python
- To understand the importance of Object-oriented Programming

Course Outcomes (CO):

Students should be able to

- Identify the issues in software requirements specification and enable to write SRS documents for software development problems
- Explore the use of Object oriented concepts to solve Real-life problems
- Design database for any real-world problem
- Solve mathematical problems using Python programming language

Module 1. Basic concepts in software engineering and software project management

Basic concepts: abstraction versus decomposition, the evolution of software engineering techniques, Software development life cycle
Software project management: project planning and project scheduling

Task:
1. Identifying the Requirements from Problem Statements

Module 2. Basic Concepts of Databases
Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table), Data Manipulation Language(DML) Statements
Task:
1. Implement Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table)
2. Implement Data Manipulation Language(DML) Statements

Module 3. Python Programming:
Introduction to Python: Features of Python, Data types, Operators, Input and output, Control Statements, Looping statements
Python Data Structures: Lists, Dictionaries, Tuples.

Strings: Creating strings and basic operations on strings, string testing methods.

Functions: Defining a function- Calling a function- Types of functions-Function Arguments- Anonymous functions- Global and local variables

OOPS Concepts; Classes and objects- Attributes- Inheritance- Overloading- Overriding- Data hiding

Modules and Packages: Standard modules-Importing own module as well as external modules Understanding Packages Powerful Lamda function in python Programming using functions, modules and external packages

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Electronics & Communication Engineering

Working with Data in Python: Printing on screen- Reading data from keyboard- Opening and closing file- Reading and writing files- Functions-Loading Data with Pandas-Numpy

Tasks:

1. OPERATORS

a. Read a list of numbers and write a program to check whether a particular element is present or not using membership operators.
b. Read your name and age and write a program to display the year in which you will turn 100 years old.
c. Read radius and height of a cone and write a program to find the volume of a cone.
d. Write a program to compute distance between two points taking input from the user (Hint: use Pythagorean theorem)

2. CONTROL STRUCTURES

a. Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if…elif…else statement.
b. Write a program to create and display a dictionary by storing the antonyms of words. Find the antonym of a particular word given by the user from the dictionary using while loop.
c. Write a Program to find the sum of a Series 1/1! + 2/2! + 3/3! + 4/4! +…….+ n/n!. (Input :n = 5, Output : 2.70833)
d. In number theory, an abundant number or excessive number is a number for which the sum of its proper divisors is greater than the number itself. Write a program to find out, if the given number is abundant. (Input: 12, Sum of divisors of 12 = 1 + 2 + 3 + 4 + 6 = 16, sum of divisors 16 > original number 12)

3: LIST

a. Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5).
b. Read a list of numbers and print the sum of odd integers and even integers from the list.(Ex: [23, 10, 15, 14, 63], odd numbers sum = 101, even numbers sum = 24)
c. Read a list of numbers and print numbers present in odd index position. (Ex: [10, 25, 30, 47, 56, 84, 96], The numbers in odd index position: 25 47 84).
d. Read a list of numbers and remove the duplicate numbers from it. (Ex: Enter a list with duplicate elements: 10 20 40 10 50 30 20 10 80, The unique list is: [10, 20, 30, 40, 50, 80])

4: TUPLE

a. Given a list of tuples. Write a program to find tuples which have all elements divisible by K from a list of tuples. test_list = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)]
b. Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: test_list = [(“GFG”, “IS”, “BEST”), (“GFg”, “AVERAGE”), (“GfG”,), (“Gfg”, “CS”)], Output : [(„GFG“, „IS“, „BEST“)]).
c. Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)

5: SET

a. Write a program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x*x).
b. Write a program to perform union, intersection and difference using Set A and Set B.
c. Write a program to count number of vowels using sets in given string (Input : “Hello World”, Output: No. of vowels : 3)
d. Write a program to form concatenated string by taking uncommon characters from two strings using set concept (Input : S1 = "aacdb", S2 = "gafd", Output : "cbgf").

6: DICTIONARY

a. Write a program to do the following operations:
i. Create a empty dictionary with dict() method
ii. Add elements one at a time
iii. Update existing key‟s value
iv. Access an element using a key and also get() method
v. Deleting a key value using del() method
b. Write a program to create a dictionary and apply the following methods:
i. pop() method
ii. popitem() method
iii. clear() method
c. Given a dictionary, write a program to find the sum of all items in the dictionary.
d. Write a program to merge two dictionaries using update() method.

7: STRINGS

a. Given a string, write a program to check if the string is symmetrical and palindrome or not. A string is said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward.
b. Write a program to read a string and count the number of vowel letters and print all letters except 'e' and 's'.
c. Write a program to read a line of text and remove the initial word from given text. (Hint: Use split() method, Input : India is my country. Output : is my country)
d. Write a program to read a string and count how many times each letter appears. (Histogram).

8: USER DEFINED FUNCTIONS

a. A generator is a function that produces a sequence of results instead of a single value. Write a generator function for Fibonacci numbers up to n.
b. Write a function merge_dict(dict1, dict2) to merge two Python dictionaries.
c. Write a fact() function to compute the factorial of a given positive number.
d. Given a list of n elements, write a linear_search() function to search a given element x in a list.

9: BUILT-IN FUNCTIONS

a. Write a program to demonstrate the working of built-in statistical functions mean(), mode(), median() by importing statistics library.
b. Write a program to demonstrate the working of built-in trignometric functions sin(), cos(), tan(), hypot(), degrees(), radians() by importing math module.
c. Write a program to demonstrate the working of built-in Logarithmic and Power functions exp(), log(), log2(), log10(), pow() by importing math module.
d. Write a program to demonstrate the working of built-in numeric functions ceil(), floor(), fabs(), factorial(), gcd() by importing math module.

10. CLASS AND OBJECTS

a. Write a program to create a BankAccount class. Your class should support the following methods for
i) Deposit
ii) Withdraw
iii) GetBalanace
iv) PinChange
b. Create a SavingsAccount class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).

c. Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employee_info() method and also using dictionary (dict).
d. Access modifiers in Python are used to modify the default scope of variables. Write a program to demonstrate the 3 types of access modifiers: public, private and protected.

11. FILE HANDLING

a. . Write a program to read a filename from the user, open the file (say firstFile.txt) and then perform the following operations:
   i. Count the sentences in the file.
   ii. Count the words in the file.
   iii. Count the characters in the file.

b. . Create a new file (Hello.txt) and copy the text to other file called target.txt. The target.txt file should store only lower case alphabets and display the number of lines copied.
c. Write a Python program to store N student‟s records containing name, roll number and branch. Print the given branch student‟s details only.

References:

1. Rajib Mall, “Fundamentals of Software Engineering”, 5th Edition, PHI, 2018.
2. RamezElmasri, Shamkant, B. Navathe, “Database Systems”, Pearson Education, 6th Edition, 2013.
3.Reema Thareja, “Python Programming - Using Problem Solving Approach”, Oxford Press, 1st Edition, 2017.
4. Larry Lutz, “Python for Beginners: Step-By-Step Guide to Learning Python Programming”, CreateSpace Independent Publishing Platform, First edition, 2018

Online Learning Resources/Virtual Labs:

1. http://vlabs.iitkgp.ernet.in/se/
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php
3. https://python-iitk.vlabs.ac.in

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Electronics & Communication Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
II Year II Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Probability Theory & Stochastic Processes	BS	3-0-0	3
2.		Analog Circuits	PC	3-0-0	3
3.		EM Waves and Transmission Lines	PC	3-0-0	3
4.		Communication Systems	PC	3-0-0	3
5.		Electrical Technology	ES	3-0-0	3
6		UHV-II: Universal Human Values – Understanding harmony and Ethical Human Conduct	HS	2-1-0	3
7.		Analog Circuits Lab	PC	0-0-3	1.5
8.		Communication Systems Lab	PC	0-0-3	1.5
9.		Electrical Technology Lab	ES	0-0-3	1.5
10.		**Skill Oriented Course –II** Soft Skills	SC	1-0-2	2
				Total	**21.5**
Community Service Project (Mandatory) for 2 months duration during summer vacation					

Category	**CREDITS**
Basic Science course	3
Humanities and Social Science	3
Engineering Science Courses	4.5
Professional Core Courses	12
Skill oriented course	2
TOTAL CREDITS	**24.5**

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Electronics & Communication Engineering

Course Code	PROBABILITY THEORY AND STOCHASTIC PROCESSES	L	T	P	C
		3	0	0	3

II Year 2nd Semester

Course Objectives:

- To gain the knowledge of the basic probability concepts and acquire skills in handling situations involving more than one random variable and functions of random variables.
- To understand the principles of random signals and random processes.
- To be acquainted with systems involving random signals.
- To gain knowledge of standard distributions that can describe real life phenomena

Course Outcomes (CO):

CO1: Understanding the concepts of Probability, Random Variables, Random Processes and their characteristics learn how to deal with multiple random variables, conditional probability, joint distribution and statistical independence. (L1)
CO2: Formulate and solve the engineering problems involving random variables and random processes. (L2)
CO3: Analyze various probability density functions of random variables. (L3)
CO4: Derive the response of linear system for Gaussian noise and random signals as inputs. (L3)

UNIT - I	**Probability & Random Variable**

Probability through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, Independent Events, Problem Solving.

Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous, Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Methods of defining Conditioning Event, Conditional Density, Properties, Problem Solving.

UNIT - II	**Operations on Random variable**

Operations on Single Random Variable: Introduction, Expectation of a random variable, moments-moments about the origin, Central moments, Variance and Skew, Chebyshev's inequality, moment generating function, characteristic function, transformations of random variable.
Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected), Unequal Distribution, Equal Distributions.

UNIT - III	**Operations on Multiple Random variables**

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, Properties of Gaussian random variables, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT - IV	**Random Processes**

Random Processes-Temporal Characteristics: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Second-Order and Wide-Sense Stationarity, N-Order and Strict-Sense Stationarity. Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-

Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

Random Processes-Spectral Characteristics: The Power Density Spectrum and its Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum and its Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

UNIT - V	**Random Signal Response of Linear Systems**	Lecture Hrs

Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band Limited and Narrowband Processes, Properties.

Noise Definitions: White Noise, colored noise and their statistical characteristics, Ideal low pass filtered white noise, RC filtered white noise.

Textbooks:

1. Peyton Z. Peebles, "Probability, Random Variables & Random Signal Principles", 4th Edition, TMH, 2002.
2. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, PHI, 2002

Reference Books:

1. Simon Haykin, "Communication Systems", 3rd Edition, Wiley, 2010.
2. Henry Stark and John W.Woods, "Probability and Random Processes with Application to Signal Processing," 3rd Edition, Pearson Education, 2002.
3. George R. Cooper, Clave D. MC Gillem, "Probability Methods of Signal and System Analysis," 3rd Edition, Oxford, 1999.

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Electronics & Communication Engineering

Course Code	ANALOG CIRCUITS	L	T	P	C
		3	0	0	3

II Year 2nd Semester

Course Objectives:

- To review analysis & design of single stage amplifiers using BJT & MOSFETs at low and high frequencies.
- To understand the characteristics of Differential amplifiers, feedback and power amplifiers.
- To examine the response of tuned amplifiers and multivibrators
- To categorize different oscillator circuits based on the application
- To design the electronic circuits for the given specifications and for a given application.

Course Outcomes (CO):

CO1: Understand the characteristics of differential amplifiers, feedback and power amplifiers. (L2)
CO2: Examine the frequency response of multistage and differential amplifier circuits using BJT & MOSFETs at low and high frequencies. (L3)
CO3: Investigate different feedback and power amplifier circuits based on the application. (L4)
CO4: Derive the expressions for frequency of oscillation and condition for oscillation of RC and LC oscillator circuits. (L4)
CO5: Evaluate the performance of different tuned amplifiers and multivibrators (L5)
CO6: Design analog circuits for the given specifications and application. (L6)

UNIT - I	Multistage and Differential Amplifiers	

Introduction – Recap of Small Signal Amplifiers, Multistage 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.

UNIT - II	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 CS and CE Amplifiers, High-Frequency Response of the CG and Cascode Amplifiers, High-Frequency Response of the Source and Emitter Followers, High-Frequency Response of Differential Amplifiers and Multistage amplifiers.

UNIT - III	Feedback Amplifiers & Oscillators	

Feedback Amplifiers: Introduction, The General Feedback Structure, Some Properties of Negative Feedback, The Four Basic Feedback Topologies, The Feedback Voltage Amplifier (Series—Shunt), The Feedback Transconductance Amplifier (Series—Series), The Feedback Trans-resistance Amplifier (Shunt—Shunt), The Feedback Current Amplifier (Shunt—Series), Summary.
Oscillators: General Considerations, Phase Shift Oscillator, Wien-Bridge Oscillator, LC Oscillators, Relaxation Oscillator, Crystal Oscillators, Illustrative Problems.

UNIT - IV	Power Amplifiers	

Introduction, Classification of Output Stages, Class A Output Stage, Class B Output Stage, Class AB Output Stage, Biasing the Class AB Circuit, CMOS Class AB Output Stages, Power BJTs, Variations on the Class AB Configuration, MOS Power Transistors.

UNIT - V	Tuned Amplifiers and Multivibrators	

Tuned Amplifiers: Basic Principle, Use of Transformers, Single Tuned Amplifiers, Amplifiers with multiple Tuned Circuits, Stagger Tuned Amplifiers.
Multivibrators: Analysis and Design of Bistable, Monostable, and Astable Multivibrators.

Textbooks:
1. Adel. S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits," 6th Edition, Oxford University Press, 2011. 2. J. Millman, C Chalkias, "Integrated Electronics", 4thEdition, McGraw Hill Education(India) Private Ltd., 2015. 3. Millman and Taub, "Pulse,Digital and Switching Waveforms", 3rd Edition, Tata McGraw-Hill Education, 2011.
Reference Books:
1. Behzad Razavi, "Fundamentals of Micro Electronics", Wiley, 2010. 2. Donald A Neamen, "Electronic Circuits – Analysis and Design," 3rdEdition, McGraw Hill (India), 2019. 3. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory", 9th Edition, Pearson/Prentice Hall, 2006. 4. K.Lal Kishore, "Electronic Circuit Analysis", 2ndEdition, B S Publications, 2008.

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Electronics & Communication Engineering

Course Code	ELECTROMAGNETIC WAVES AND TRANSMISSION LINES	L	T	P	C
		3	0	0	3

II Year 2nd Semester

Course Objectives:

- To introduce fundamentals of static and time varying electromagnetic fields.
- To teach problem solving in Electromagnetic fields using vector calculus.
- To demonstrate wave concept with the help of Maxwell's equations.
- To introduce concepts of polarization and fundamental theory of electromagnetic waves in transmission lines and their practical applications.
- To analyze reflection and refraction of electromagnetic waves propagated in normal and oblique incidences.

Course Outcomes (CO):

CO1: Explain basic laws of electromagnetic fields and know the wave concept. (L2)
CO2: Solve problems related to electromagnetic fields. (L3)
CO3: Analyze electric and magnetic fields at the interface of different media. (L3)
CO4: Derive Maxwell's equations for static and time varying fields. (L3)
CO5: Analogy between electric and magnetic fields. (L5)
C06: Describes the transmission lines with equivalent circuit and explain their characteristic with various lengths. (L2)

UNIT - I	**Static Electric Fields**

Recap of Vector Analysis: Coordinate systems and transformation-Cartesian, Cylindrical and Spherical coordinates
Recap of Vector Calculus: Differential length area and volume, line surface and volume integrals, Del operator, gradient, divergent and curl operations.
Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Divergence Theorem, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Convection andConduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

UNIT - II	**Static Magnetic Fields & Time varying Fields**

Magnetic Fields: Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Magnetic dipole, Ampere's Force Law, Inductances and Magnetic Energy, Illustrative Problems.
Faraday's Law and Transformer e.m.f, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's equations for time varying fields, Maxwell's Equations in Different Final Forms and Word Statements, Illustrative Problems

UNIT - III	**Boundary Conditions and Uniform Plane Wave**

Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Wave Equations for Conducting and Perfect Dielectric Media. **Uniform Plane Waves** – Definition, All Relations between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization, Illustrative Problems.

UNIT - IV	**Reflection and Refraction of Plane Waves**

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 – Applications, Power Loss in a Plane Conductor, Illustrative Problems.

UNIT - V	**Transmission Lines**

Transmission Lines: Introduction, Transmission line parameters, Transmission line equivalent circuit, Transmission line equations and their solutions in their phasor form, input impedance, standingwave ratio, Transmission of finite length- half wave, quarter wave transmission line, Smith chart, graphical analysis of transmission lines using Smith chart, stub matching- single and double stub matching, Illustrative Problems.

Textbooks:

3. Matthew N.O. Sadiku, "Elements of Electromagnetics", 4th edition. Oxford Univ. Press, 2008.
4. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", 7thedition.,TMH, 2006.

Reference Books:

3. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2000.
4. John D. Krauss, "Electromagnetics", 4th Edition, McGraw- Hill publication, 1999.
5. Electromagnetics, Schaum's outline series, 2nd Edition, Tata McGraw-Hill publications, 2006.

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Electronics & Communication Engineering

Course Code	COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

II Year 2nd Semester

Course Objectives:

- To introduce various modulation and demodulation techniques of analog and digital communication systems.
- To analyze different parameters of analog and digital communication techniques.
- To Know Noise Figure in AM & FM receiver systems.
- To understand Function of various stages of AM, FM transmitters and Know Characteristics of AM &FMreceivers.
- To analyze the performance of various digital modulation techniques in the presence of AWGN.
- To evaluate the performance of each modulation scheme to know the merits and demerits interms of bandwidth and power efficiency

Course Outcomes (CO):

CO1: Recognize/List the basic terminology used in analog and digital communication techniques for transmission of information/data.
CO2: Explain/Discuss the basic operation of different analog and digital communication systems at baseband and passband level.
CO3: Compute various parameters of baseband and passband transmission schemes by applying basic engineering knowledge.
CO4: Analyze/Investigate the performance of different modulation & demodulation techniques to solve complex problems in the presence of noise.
CO5: Evaluate/Assess 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.

UNIT - I **Continuous Wave Modulation**

Introduction: The communication Process, Communication Channels, Baseband and Passband Signals, Analog vs Digital Communications, Need for the modulation.
Amplitude Modulation(AM): AM and its modifications – DSB, SSB,VSB. Frequency Translation, Frequency Division Multiplexing (FDM).
Angle Modulation:Frequency Modulation(FM), Phase Modulation, PLL, Nonlinear Effects in FM, Superheterodyne Receivers.

UNIT - II **Noise and Pulse Modulation**

Introduction to Noise: Types of Noise, Receiver Model,Noise in AM, DSB, SSB, and FM Receivers, Pre-Emphasis and De-emphasis in FM.
Introduction to Pulse Modulation: The Sampling Process, PAM, TDM, Bandwidth-Noise Trade off, Quantization process, PCM, Noise considerations in PCM systems, Delta Modulation, DPCM, Coding speech at low bit rates.

UNIT - III **Baseband Pulse Transmission**

Introduction, Matched Filter, Properties of Matched Filter, Error rate due to noise, Inter Symbol Interference (ISI), Nyquist Criterion for distortion less baseband binary transmission, Correlative level coding, Baseband M-ary PAM transmission, QAM, MAP and ML decoding, Equalization, Eye pattern.

UNIT - IV **Digital Passband Transmission**

Introduction, Passband Transmission Model, Gram-Schmidt Orthogonalization Procedure, Geometric Interpretation of Signals, Response of bank of correlators in noise, Correlation receiver, Probability of Error, Detection of Signals with unknown phase.

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UNIT - V	**Digital Modulation Schemes & Information Theory**	
Coherent Digital Modulation Schemes – ASK, BPSK, BFSK, QPSK, Non-coherent BFSK, DPSK. M-ary Modulation Techniques, Power Spectra, Bandwidth Efficiency, Timing and Frequency synchronization. Information theory: Entropy, Mutual Information and Channel capacity theorem.		
Textbooks:		
1. Simon Haykin, "Communication Systems", JohnWiley& Sons, 4th Edition, 2004. 2. 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.		

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Course Code	ELECTRICAL TECHNOLOGY	L	T	P	C
		3	0	0	3

II Year 2nd Semester

Course Objectives:

- To know about various characteristics of DC Generators and motors.
- To know about principle of operation of a DC machine working as a generator and motor.
- To understand computation and predetermination of regulation ofa 1-ϕ transformer.
- To know about principle of operation of three phase and single phase induction motor.
- To understand the operation of electrical instruments.

Course Outcomes (COs):

CO1: Able to solve the problems the e.m.f. generated on DC Generator.
CO2: Able to acquire knowledge about how to determine the efficiency and regulation of single phase transformer and synchronous machine.
CO3: Analyze the working of induction motors.
CO4: understanding the working principle and operation of alternators.
CO5: Able to acquire knowledge about electrical measuring instruments.

UNIT - I	**DC Machines**

Principle of operation of DC machine, EMF Equation, Types of Generators, magnetization and load Characteristics of DC Generators.-Numerical problems DC Motor- Types of DC Motors Characteristics of DC Motors- 3point starters for dc shunt motor-losses and efficiency-Swinburne's test, load test-speed control of DC shunt motor-Numerical problems.

UNIT - II	**Transformers**

Principle of operation of Transformer-constructional features- Phasor Diagram on no load and load – equivalent circuit-losses, efficiency and regulation of a transformer, OC & SC tests on transformer Numerical problems.

UNIT - III	**Three Phase Induction Motor & Single Phase Induction Motor**

THREE PHASE INDUCTION MOTORS: Principle of operation of 3-phase Induction motor-slip ring and squirrel cage motors- slip torque characteristics-efficiency calculation-starting methods-speed control of induction motor-Numerical problems.

SINGLE PHASE INDUCTION MOTORS: Principle of operation of 1-phase Induction motor- constructional features-shaded pole motors-capacitor motor-split phase motors-equivalent circuit.

UNIT - IV	**Alternators**

Constructional features- Principle of operation-types-EMF equation- distribution and coil span factors- pre determination of regulation by synchronous impedance method – OC & SC test- Numerical problems.

UNIT - V	**Basic Instruments**

Introduction, classification of instruments, operating principles essential features of measuring instruments, Moving coil permanent magnet(PMMC) instruments, Moving iron of Ammeters and Voltmeters(All the above topics are only elementary treatment).

Textbooks:
1. Principle of Electrical Engineering by V.K.Mehta, Rohith Mehta, S.Chand publications. 2. Principles of Electrical Engineering by V.K Mehta, S.Chand publications. 3. Electrical Technology-volume II – B L Theraja- S. Chand.
Reference Books:
1. 1. Electrical Machinery- J B Guptha- katsonbooks . 2. 2. Electrical Machines – I J Nagrath and D P Kothari- PHI Publications.

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Electronics & Communication Engineering

Course Code	UHV-II: UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT	L	T	P	C
		2	1	0	3
II Year 2nd Semester					

Course Objectives

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

Thus, this course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

Course Methodology

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. The course is in the form of 28 lectures (discussions) and 14 practice sessions.
3. It is free from any dogma or value prescriptions.
4. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation – the whole existence is the lab and every activity is a source of reflection.
5. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.
6. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

Catalogue Description

Every human being has two sets of questions to answer for his/her life: a) what to do? and, b) how to do? The first set pertains to the value domain, and the other to the skill domain. Both are complimentary, but value domain has a higher priority. Today, education has become more and more skill biased, and hence, the basic aspiration of a human being, that is to live with happiness and prosperity, gets defeated, in spite of abundant technological progress. This course is aimed at giving inputs that will help to ensure the right understanding and right feelings in the students in their life and profession, enabling them to lead an ethical life. In this course, the students learn the process of self-exploration, the difference between the Self and the Body, the naturally acceptable feelings in relationships in a family, workplace and society, the comprehensive human goal in the society, the mutual fulfillment in the nature and the co-existence in existence. As a natural outcome of such inputs, they are able to evaluate an ethical life and profession ahead.

Course Syllabus

Module 1: Introduction-Basic Human Aspiration, its fulfillment through All-encompassing Resolution

The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution

Module2: Right Understanding (Knowing)- Knower, Known & the Process

The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).

Module 3: Understanding Human Being

Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self

Module 4: Understanding Nature and Existence

A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self-awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).

Module 5: Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living

Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavor viz.,
realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence

Textbook

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

References

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
9. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers, Oxford University Press
10. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Mode of Evaluation:

Based on participation of student in classroom discussions/Self-assessment/Peer assessment/Assignments/ Seminar/Continuous Assessment Test/Semester End Exam
Socially relevant project/Group Activities/Assignments may be given importance in this course

Course Outcomes

At the end of the course, the students will be able to
1. Evaluate the significance of value inputs in formal education and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Analyze the value of harmonious relationship based on trust and respect in their life and profession
4. Examine the role of a human being in ensuring harmony in society and nature.
5. Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.

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Electronics & Communication Engineering

Course Code	ANALOG CIRCUITS LAB	L	T	P	C
		0	0	3	1.5

II Year 2nd Semester

Course Objectives:

- To review analysis & design of single stage amplifiers using BJT & MOSFETs at low andhigh frequencies.
- To understand the characteristics of Differential amplifiers, feedback and power amplifiers.
- To examine the response of tuned amplifiers and multivibrators
- To categorize different oscillator circuits based on the application
- To design the electronic circuits for the given specifications and for a given application.

Course Outcomes (CO):

CO1: Know about the usage of equipment/components/software tools used to conduct the experimentsin analog circuits.
CO2: Conduct the experiment based on the knowledge acquired in the theory about various analogcircuits using BJT/MOSFETs to find the important parameters of the circuit (viz. Voltage gain, Current gain, bandwidth, input and output impedances etc) experimentally.
CO3: Analyze the given analog circuit to find required important metrics of it theoretically.CO4:Draw the relevant graphs between important metrics of the system from the observed measurements.
CO5: Compare the experimental results with that of theoretical ones and infer the conclusions.CO6: Design the circuit for the given specifications.

List of Experiments:

1. Design and Analysis of Darlington pair.
2. Frequency response of CE – CC multistage Amplifier
3. Design and Analysis of Cascode Amplifier.
4. Frequency Response of Differential Amplifier
5. Design and Analysis of Series – Series feedback amplifier and find the frequency response ofit.
6. Design and Analysis of Shunt – Shunt feedback amplifier and find the frequency response ofit.
7. Design and Analysis of Class A power amplifier
8. Design and Analysis of Class AB amplifier
9. Design and Analysis of RC phase shift oscillator
10. Design and Analysis of LC Oscillator
11. Frequency Response of Single Tuned amplifier
12. Design and Analysis of Bistable Multivibrator
13. Design and Analysis of Monostable Multivibrator
14. Design and Analysis of Astable Multivibrator

Note: At least 12 experiments shall be performed. Both BJT and MOSFET based circuits shall be implemented.
Faculty members who are handling the laboratory shall see that students are given design specificationsfor a given circuit appropriately and monitor the design and analysis aspects of the circuit.

Online learning resources/Virtual labs:
https://www.vlab.co.in/

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Electronics & Communication Engineering

Course Code	COMMUNICATION SYSTEMS LAB	L	T	P	C
		0	0	3	1.5

II Year 2nd Semester

Course Objectives:

- To understand the basics of analog and digital modulation techniques.
- To Integrate theory with experiments so that the students appreciate the knowledge gained fromthe theory course.
- To design and implement different modulation and demodulation techniques and their applications.
- To develop cognitive and behavioral skills for performance analysis of various modulation techniques.

Course Outcomes (CO):

CO1: Know about the usage of equipment/components/software tools used to conduct the experimentsin analog and digital modulation techniques.
CO2: 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. CO3: Analyze the performance of a given modulation scheme to find the important metrics of the system theoretically.
CO4: Draw the relevant graphs between important metrics of the system from the observed measurements.
CO5: Compare the experimental results with that of theoretical ones and infer the conclusions.

List of Experiments:

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

Section-A

1. AM Modulation and Demodulation
2. DSB-SC Modulation and Demodulation
3. Frquency 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. BASK 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 touse readymade kits for conducting the experiments. They are advised to make the students work in the laboratory by constructing the circuits and analysing them during the lab sessions.

Online learning resources/virtual labs:
https://www.vlab.co.in/

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Electronics & Communication Engineering

Course Code	ELECTRICAL TECHNOLOGY LAB	L	T	P	C
		0	0	3	1.5

II Year 2nd Semester

Course Objectives:

- To find OCC characteristics of DC generator and also finding critical resistance and critical speed.
- To draw the performance characteristics of DC motor and finding the efficiency.
- To analyze the speed controlling methods.
- To find the efficiency of single phase transformer.
- To verify the parallel operation of single phase transformers.

Course Outcomes (CO):

CO1: Understand the OCC characteristics of DC generator
CO2: Conduct the experiment and draw the characteristics of DC motor.
CO3: Analyze efficiency of single phase transformer.
CO4: Understand the parallel operation of single phase transformers.

List of Experiments:

15. Magnetization characteristics of DC shunt generator. Determination of critical fieldResistance and critical speed.
16. Load test on DC shunt generator. Determination of characteristics.
17. Brake test on DC shunt motor. Determination of performance curves.
18. Brake test on DC series motor.
19. Brake test on DC compound motor.
20. Swinburne's tests on DC shunt motor, Predetermination of efficiency.
21. Speed control of DC shunt motor (Armature control and Field control method).
22. Retardation test on D.C.Shunt Machine
23. Field's Test on a pair of Similar DC series Machines
24. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.
25. OC and SC test on single phase transformer
26. Parallel operation of single phase transformers.
27. Sumpner's test on single phase transformers.
28. Scott connection of single phase transformers
29. Separation of losses of single phase transformer.

Note: At least 10 experiments shall be performed from above list.

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Electronics & Communication Engineering

Course Code	SOFT SKILLS	L	T	P	C
		1	0	2	2

II Year 2nd Semester

Course Objectives:

- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To develop leadership skills and organizational skills through group activities
- To function effectively with heterogeneous teams

Course Outcomes (CO):

By the end of the program students should be able to

- Memorize various elements of effective communicative skills
- Interpret people at the emotional level through emotional intelligence
- apply critical thinking skills in problem solving
- analyse the needs of an organization for team building
- Judge the situation and take necessary decisions as a leader
- Develop social and work-life skills as well as personal and emotional well-being

UNIT – I	Soft Skills & Communication Skills	10 Hrs

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

Activities:

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

UNIT – II	Critical Thinking	10 Hrs

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking

Activities:

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

UNIT – III	Problem Solving & Decision Making	

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution –
Methods of decision making – Effective decision making in teams – Methods & Styles

Activities:

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 & Group Discussion

UNIT – IV	Emotional Intelligence & Stress Management	10 Hrs

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, 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	Leadership Skills	10 Hrs

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk-Taking - Team Building - Time Management

Activities:

Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

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 or for good Leadership – Mahendar Singh Dhoni etc.

Textbooks:

1. Personality Development and Soft Skills (English, Paperback, Mitra Barun K.)Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha KapoorPublisher : I K International Publishing House; 0 edition (February 28, 2018)

Reference Books:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India

Online Learning Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc

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Electronics & Communication Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
III Year I Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Control Systems	PC	3-0-0	3
2.		Linear and Digital IC Applications	PC	3-0-0	3
3.		Microprocessors and Microcontrollers	PC	3-0-0	3
4.		**Professional Elective – I**	PE	3-0-0	3
5.		**Open Elective – I**	OE	3-0-0	3
6.		IC Applications Lab	PC	0-0-3	1.5
7.		Microprocessors and Microcontrollers Lab	PC	0-0-3	1.5
8.		**Skill oriented course– III** PCB Design and Development	SC	1-0-2	2
9.		Evaluation of Community Service Project/Internship	PR		1.5
				Total	**21.5**

List of Professional Electives-I	List of Open Electives-I
1.Computer System Architecture 2.Bio Medical Electronics 3.Information Theory and Coding	Candidate should select the subject from list of subjects offered by other departments.

Category	CREDITS
Professional Core Courses	12
Professional Elective Courses	3
Open Elective Course/Job Oriented Elective	3
Skill oriented course	2
Summer Internship/Community Service Project	1.5
TOTAL CREDITS	**21.5**

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Course Code	CONTROL SYSTEMS	L	T	P	C
		3	0	0	0

III Year 1st Semester

Course Objectives:

- To introduce concepts of open loop and closed loop systems, mathematical models of mechanical and electrical systems and concept of feedback.
- To describe characteristics of the given system in terms of the transfer function.
- To provide knowledge in analyzing the system response in time-domain and frequency domain
- To impart skills for designing different control systems for different applications as per given specifications.
- To introduce concepts of state variable analysis and design

Course Outcomes (CO):

- Identify open and closed loop control system
- Formulate mathematical model for physical systems
- Use standard test signals to identify performance characteristics of first and second-order systems
- Analyze stability of the closed and open loop systems
- Design closed-loop control system to satisfy dynamic performance specifications using frequency response, root-locus, and state-space techniques

UNIT - I **Introduction**

Introduction: Overview of System, Control System, Open Loop Control System, Closed loop Control System, Different Examples, Mathematical models of Physical Systems, Differential equations of physical systems, Transfer functions, Block diagram Algebra, Signal flow graphs with illustrative examples Effects of Feedback, Feedback Characteristics and its advantages, Linearizing effect of feedback.

UNIT - II **Time Response Analysis**

Controller Components, DC Servomotor (Armature Controlled and Field Controlled) with necessary derivation for transfer function, AC Servomotor and its transfer function, AC Tachometer, Potentiometer, Synchros, AC Position Control Systems.

Time Response Analysis, Standard test Signals, Time response of first and second order systems, steady state errors and error constants, Effect of adding a zero to a system, Design specifications of second order systems, Performance indices.

UNIT - III **Concepts of Stability**

Concepts of Stability and Algebraic Criteria: The concept of Stability, Necessary Conditions for Stability, Routh-Hurwitz Stability Criterion, Relative stability analysis,

The Root Locus Technique: Introduction, The Root Locus concepts, Construction of Root Loci

UNIT - IV **Frequency Response Analysis**

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

UNIT - V **State Variable Analysis and Design**

State Variable Analysis and Design: Introduction, Concepts of State, State Variables and State models, State models for linear continuous-time systems, State variables and linear discrete-time systems, Solution of state equations and Concepts of Controllability and Observability.

Textbooks:

1. I. J. Nagarath and M. Gopal, "Control System Engineering," New Age International Publishers, Fifth Edition

Reference Books:

1. Katsuhiko Ogata, Modern Control Engineering, Pearson, 5th Edition, 2010.
2. S. Salivahanan, R. Rengaraj, and G. R. Venkata Krishnan, Control Systems Engineering, Pearson, 5th edition, 2015.
3. Benjamin C. Kuo, Frarid Golnaraghi, Automatic Control Systems, Wiley Student Edition, Eighth Edition2015.

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Electronics & Communication Engineering

Course Code	LINEAR AND DIGITAL IC APPLICATIONS	L	T	P	C
		3	0	0	3

III Year 1st Semester

Course Objectives:

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of PLL.
- To introduce the concepts of waveform generation and introduce some special functionICs.
- Exposure to digital IC's

Course Outcomes (CO):

CO1: List out the characteristics of Linear and Digital ICs
CO2: Discuss the various applications of linear & Digital ICs.
CO3: Solve the application-based problems related to linear and digital ICs.
CO4: Analyze various applications circuits of linear and digital ICs.
CO5: Design the circuits using either linear ICs or Digital ICs from the given specifications.

UNIT– I ICs andOP-AMPS

INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER: Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC.

UNIT–II Applications of OP-AMP

LINEAR APPLICATIONS OF OP-AMP: Inverting and non-inverting amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator, and differentiator.
NON-LINEAR APPLICATIONS OF OP-AMP: Sample and Hold circuit, Log and Anti log amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square wave form generators, Oscillators

UNIT-III Active Filters and other ICs

ACTIVE FILTERS: Introduction, Butterworth filters – 1st order, 2nd order low pass and high passfilters, band pass, band reject and all pass filters.
TIMER AND PHASE LOCKED LOOPS: Introduction to IC 555 timer, description of functional diagram, monostable and astable 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.

UNIT–IV Voltage Regulators and Converters

VOLTAGE REGULATOR: Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.
D to A and A to D CONVERTERS: 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.

UNIT-V Digital ICs

CMOS LOGIC: 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.
COMBINATIONAL CIRCUITS USING TTL 74XX ICS: Study of logic gates using74XX ICs, Four-bit parallel adder (IC7483), Comparator (IC7485), Decoder (IC74138, IC74154), BCD-to-7-segment decoder (IC 7447), Encoder (IC 74147), Multiplexer (IC 74151), Demultiplexer (IC74154).
SEQUNTIAL CIRCUITS USING TTL 74XX ICS: Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC74194),4-bit asynchronous binary counter (IC7493).

Textbooks:

1. D.Roy Choudhury, Shail B.Jain, "LinearIntegratedCircuit",4thedition(2012),New Age International Pvt.Ltd., New Delhi,India
2. Ramakant.A.Gayakwad, "OP-AMP and Linear Integrated Circuits", 4th edition (2012), PrenticeHall/Pearson Education, New Delhi.
3. Floyd, Jain,"DigitalFundamentals",8thedition(2009),PearsonEducation,NewDelhi.

References:

1. Sergio Franco(1997),Designwithoperationalamplifiersandanalogintegratedcircuits,McGrawHill,New Delhi.
2. Gray,Meyer(1995),AnalysisandDesignofAnalogIntegratedCircuits,WileyInternational,NewDelhi.

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Course Code	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

III Year 1st Semester

Course Objectives:

- To introduce fundamental architectural concepts of Microprocessors and Microcontrollers.
- To impart knowledge on addressing modes and instruction set of 8086 and 8051
- To introduce assembly language programming concepts
- To explain memory and I/O interfacing with 8086 and 8051

Course Outcomes (CO):

- Distinguish between microprocessors & microcontrollers
- Develop assembly language programming
- Describe interfacing of 8086 with peripheral devices
- Design applications using microcontrollers

UNIT - I

8086 MICROPROCESSORS: Evaluation of microprocessors. Overview of 8085. Register organization of 8086, architecture, signal description of 8086, physical memory organization, general bus operations, I/O addressing capability, special processor activities, 8086-Minimum mode and maximum mode of operation, Timing diagram.

UNIT - II

8086 INSTRUCTION SET AND ASSEMBLER DIRECTIVES: Addressing modes of 8086, Instruction set of 8086, Assembler Directives and operators.8086 Assembly language programs involving logical, branch and call instructions, sorting, evaluation of arithmetic expressions, string manipulation.

UNIT - III

PROGRAMMABLE PERIPHERAL DEVICES AND THEIR INTERFACING: Memory interfacing to 8086 (static RAM and EPROM). 8255 PPI-various modes of operation and interfacing to 8086. D/A and A/D converter interfacing, Stepper motor interfacing. Interrupt structure of 8086, Vector interrupt table. Interrupt service routines.8259 PIC architecture and interfacing cascading of interrupt controller and its importance

UNIT - IV

8051 MICROCONTROLLERS: Architecture of 8051 microcontroller. Pin Diagram of 8051, and external memories, counters and timers, serial communication, interrupts.

UNIT - V

8051 ASSEMBLY LANGUAGE PROGRAMMING: Instruction set of 8051, Addressing modes of 8051, Assembly Language Programming examples using 8051.Interfacing to LCD, Keyboard, ADC & DAC.

Textbooks:

1. Microprocessor Architecture, Programming and Applications with8085 By Ramesh S Gaonkar.
2. Advanced microprocessor and peripherals-A.K. Ray and K.M.Bhurchandi, 2nd edition, TMH, 2000.
3. 8051 microcontroller and embedded systems by Mazidi and Mazidi ,pearson education 2000.

Reference Books:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.
3. Andrew N. Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide: Designing and Optimizing System Software, Elsevier, 2004.
4. John H. Davies, Newnes, MSP 430 Microcontroller Basics, Elsevier Pulications,2008.

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Electronics & Communication Engineering

Course Code	COMPUTER SYSTEM ARCHITECTURE (Professional Elective-I)	L	T	P	C
		3	0	0	3

III Year 1st Semester

Course Objectives:

- To discuss organization and design of a digital computer.
- To explain how to use RTL to represent memory and Arithmetic/ Logic/ Shift operations
- To introduce computer languages, machine, symbolic and assembly levels
- To present organization of central processing unit and concepts of micro-programmed control
- To explain how input-output devices communicate with the other components and methods of data transfer
- To teach different types of addressing modes and memory organization.

Course Outcomes (CO):

- Conceptualize basics of organizational and architectural issues of a digital computer
- Emphasize representation of data types, numbers employed in arithmetic operations and binary coding of symbols used in data processing
- Develop low-level programs to perform different basic instructions
- Evaluate various modes of data transfer between CPU and I/O devices
- Analyze various issues related to memory hierarchy

UNIT - I

Data Representation: Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Other Binary Codes
Register Transfer and Micro-operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations, Arithmetic Logic Shift Unit

UNIT - II

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Complete Computer Description, Design and Accumulator Logic.
Programming the Basic Computer: Machine Language, Assembly Language, the Assembler, Program Loops, programming arithmetic and logic operations

UNIT - III

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC).

UNIT - IV

Micro-programmed Control: Control Memory, Address Sequencing, Micro-program example, Design of Control Unit.
Computer Arithmetic: Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating-Point Arithmetic Operations

UNIT - V

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor (IOP), Serial Communication
Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

Textbooks:

1. M. Morris Mano, Computer System Architecture, Pearson Education, Third edition, 2017.

Reference Books:

1. Carl Hamacher, ZvonkoVranesic and SafwatZaky, Computer Organization, McGraw Hill, 5th Edition
2. John D. Carpinelli, Computer Systems Organization and Architecture, Pearson Education, 2018, Fifteenth reprint
3. William Stallings, "Computer Organization and Architecture: Designing for Performance", Eighth Edition, Pearson

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Electronics & Communication Engineering

Course Code	BIO MEDICAL ELECTRONICS (Professional Elective-I)	L	T	P	C
		3	0	0	3

III Year 1st Semester

Course Objectives:

- Understand the basic medical instrumentation system and bioelectric potentials.
- Illustrate different types of electrodes to acquire bio-signals.
- Demonstrate clinical laboratory measurements and assistive devices.
- Discuss about the latest developments in medical imaging systems.
- Outline patient care and safety while using biomedical equipment.

UNIT - I

Components of Medical Instrumentation Systems: Basic Medical Instrumentation System, Static and dynamic characteristics of medical instruments, Bio-signals and characteristics. Problems encountered with measurements from human beings. Sources of Bioelectric Potentials, Resting and Action Potentials.

UNIT - II

Bio-Potential Electrodes and Physiological Transducers: Electrode potential and its equivalent circuit, Types of Electrodes-Surface Electrodes, Needle Electrodes, Micro Electrodes. Biochemical Transducers.
Bio-Signal Acquisition: Electrical Conduction system of the heart, Electrocardiogram, ECG leads, Einthoven triangle, Plethysmography, EEG 10-20 lead system and EMG.

UNIT - III

Clinical laboratory Measurements: Blood cell Counter, Blood flow meters- Electromagnetic blood flow meter, Ultrasonic Doppler blood flow meter, automated blood pressure measurements.
Physiological Assist Devices & Therapeutic Equipment: Pacemakers -External & internal, Defibrillators-External & internal, Hemodialysis machine.

UNIT - IV

Monitory and Imaging Equipment: Spirometry, Ventilators, Arrhythmia Monitor, Foetal Monitor and Incubator. X-ray machine, Computed Tomography (CT), Magnetic Resonance Imaging System, Ultrasound Imaging system

UNIT - V

Patient Care and Safety: The elements of Intensive Care Monitor, Diagnosis, Calibration and reparability of Patient Monitoring equipment, Shock Hazards and Prevention, Physiological Effects and Electrical Current, Shock Hazards from Electrical Equipment, Methods of Accident Prevention, Isolated Power Distribution System.

Textbooks:

1. Leslie Cromwell, F.J. Weibell, E.A. Pfeiffer, Biomedical Instrumentation an Measurements. 2nd Edition, PHI, 2004.
2. Dr. M. Arumugam, Biomedical Instrumentation. 2nd Edition, Anuradha publications, 2002.

Reference Books:

1. R.S. Khandpur, Hand-book of Biomedical Instrumentation. 2nd Edition, TMH, 2003.
2. John G. Webster, Medical Instrumentation, Application and Design. John Wiley, 3rd Edition, 2009.
3. Onkar N. Pandey, Rakesh Kumar, Bio-Medical Electronics and Instrumentation. 3rd Edition, Katson Books, 2002.

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Electronics & Communication Engineering

Course Code	INFORMATION THEORY AND CODING (Professional Elective-I)	L	T	P	C
		3	0	0	3

III Year 1st Semester

Course Objectives:

- To teach basic parameters of Information, concepts of source coding techniques and error control coding techniques.
- To transmit knowledge on Information theory and error control coding techniques for solving problems.
- To Introduce various source coding and channel coding techniques for error detection and error correction in the information bearing signals.
- To dissimilate block to variable length coding and variable to block length coding techniques for merits and demerits.
- To describe various systems for linear block codes and convolutional codes.

Course Outcomes (CO):

- Describe basic parameters of Information, the concepts of source coding techniques, and Error Control coding techniques
- Apply knowledge of Information theory and error control coding techniques to solve problems
- Analyze various source coding and channel coding techniques for error detection and error correction in the information bearing signals
- Compare various block to variable length coding and variable to block length coding techniques for merits and demerits
- Compare performance of linear block codes and convolutional codes
- Design various systems for linear block codes and convolutional codes

UNIT - I

Information Theory: Introduction, Definition of Entropy, Conditional Entropy, Relative Entropy, Basic Properties of Entropy, Mutual Information, Information Inequalities, Problem solving.
Block to Variable length Coding: 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, Shanon-Fano Coding, Free fix code, Coding an information Source, Huffman Coding, Example.
Variable to Block Length Coding: 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.

UNIT - II

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.
Universal Source Coding: Lempel-Ziv Algorithm, LZ -77 Encoding and Decoding, Lempel- Ziv Welch (LZW) Algorithm, LZW Encoding, and Decoding.
Coding of Sources with memory, Channel Capacity, Noisy Channel Coding Theorem, Differential Entropy, Gaussian Channel, Rate Distortion Theory, Blahut - Arimoto Algorithm, problem solving.

UNIT - III

Error Control Coding: 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.

UNIT - IV

Linear Block Codes, 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.

UNIT - V

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.

Electronics & Communication Engineering

Textbooks:

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

Reference Books:

1. Shu Lin, 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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Electronics & Communication Engineering

Course Code	LINEAR AND DIGITAL IC APPLICATIONS LAB	0	0	3	1.5

III Year 1st Semester

Course Objectives:

The objective of the course is to learn design, testing and characterizing of circuit behavior with digital and analog ICs.

Course Outcomes (CO):

CO1: Understand the pin configuration of each linear/digital IC and its functional diagram.CO2: Conduct the experiment and obtain the expected results.
CO3: Analyze the given circuit/designed circuit and verify the practical observations with the analyzed results.
CO4: Design the circuits for the given specifications using linear and digital ICs.
CO5: Acquaintance with lab equipment about the operation and its use.

List of Experiments:

PART–I: Linear IC Experiments

1. OP AMP Applications–Adder, Subtractor, Comparators.
2. Integrator and Differentiator Circuits using IC741.
3. Active Filter Applications–LPF, HPF(first order)
4. IC741 Waveform Generators–Sine, Square wave and Triangular waves.
5. IC555 Timer –Monostable and Astable Multivibrator Circuits.
6. Schmitt Trigger Circuits–usingIC741
7. IC565–PLL Applications.
8. VoltageRegulatorusingIC723, Three Terminal Voltage Regulators–7805,7809,7912.

PART–II: Digital IC Applications

1. 3-8decoder using74138
2. 4-bitcomparatorusing7485.
3. 8*1Multiplexerusing74151and2*4Demultiplexerusing74155.
4. D, JK Flip Flops using7474,7483.
5. Decade counter using 7490.
6. UP/DOWN counter using 74163
7. Universalshiftregistersusing74194/195.
8. RAM(16*4)using74189 (Read and Write operations).

Note: Atleast 12 experiments shall be performed.

References:

1. D.Roy Choudhury, Shail.B.Jain,“LinearIntegratedCircuit”,4thedition(2012),NewAgeInternational Pvt.Ltd., New Delhi,India RamakantA.Gayakwad,“OP-AMP and Linear Integrated Circuits”, 4thedition(2012) ,PrenticeHall/Pearson Education ,New Delhi.
2. Floyd,Jain,“DigitalFundamentals”,8thedition(2009),PearsonEducation,NewDelhi.

Online Learning Resources/Virtual Labs:

https://www.vlab.co.in/

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Electronics & Communication Engineering

Course Code	MICROPROCESSORS AND MICROCONTROLLERS LAB	0	0	3	1.5

III Year 1st Semester

Course Objectives:

- Write ALP for arithmetic and logical operations in 8086
- Familiarize with MASM, Embedded C& Code composer studio
- Write and execute programsin8086, 8051.

Course Outcomes (CO):

- Execution of different programs for 8086, 8051 in Assembly Level Language using MASM Assembler
- Design and implement some specific real time applications.

List of Experiments:

Intel8086(16bitMicro Processor)

1. Perform simple arithmetic operations using different addressing modes.
2. Sort an array of binary numbers.
3. Code Conversion (Eg. ASCII to Packed BCD form).
4. Addition of an array of BCD numbers stored in packed form.
5. String transfer and, String Comparison
6. Identification &displaying the activated key using DOS & BIOS function calls.

Intel8051(8bitMicrocontroller)

1. Detection of key closure (connected to a port line)by polling technique.
2. Delay generation using i) Nested loop &ii) Timers.
3. Counting of external event occurrence through port line
4. Sort an array of binary numbers.
5. Code Conversions

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Electronics & Communication Engineering

Course Code	PCB DESIGN AND DEVELOPMENT (Skill Oriented Course-III)	1	0	2	2

III Year 1st Semester

Course Outcomes (CO):

1. Understand basics of PCB designing.
2. Apply advance techniques, skills, and modern tools for designing and fabrication of PCBs.
3. Apply the knowledge and techniques to fabricate Multilayer, SMTand HDIPCB.
4. Understand concepts of Packaging.

Module 1:

Introduction to PCB designing concepts

Introduction to PCB: Brief History of PCB, Difference between PWB and PCB, Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer), PCB Materials

Introduction to Electronic design Automation (EDA): Brief History of EDA, Latest Trends in Market, Objectives, Different EDA tools, Introduction to SPICE and PSPICE Environment, Introduction and Working of PROTEUS

Module 2:

Component Package Types

Through Hole Packages: Axial lead, Radial Lead, Single Inline Package (SIP), Dual Inline Package (DIP), Transistor Outline (TO), Pin Grid Array (PGA)

Surface Mount Packages: Metal Electrode Face (MELF), Leadless Chip Carrier (LCC), Small Outline Integrated Circuit (SOIC), Quad Flat Pack (QPF) and Thin QFP (TQFP), Ball Grid Array (BGA), Plastic Leaded Chip Carrier (PLCC)

Module 3:

Development Tools and Practical of PCB Designing

Introduction to PCB Design using OrCAD tool and PROTEUS tool

PCB Designing Flow Chart: Schematic Entry, Net listing, PCB Layout Designing, Prototype Designing, Design Rule Check (DRC), Design for Manufacturing (DFM), PCB Making, Printing, Etching, Drilling, Assembly of components

Description of PCB Layers: Electrical Layers, Top Layer, Mid Layer, Bottom Layer, Mechanical Layers, Board Outlines and Cutouts, Drill Details, Documentation Layers, Components Outlines, Reference Designation, Text

Keywords & Their Description: Footprint, Pad stacks, Vias, Tracks, Color of Layers, PCB Track Size Calculation Formula

PCB Materials: Standard FR-4 Epoxy Glass, Multifunctional FR-4, Tetra Functional FR-4, NelcoN400-6, GETEK, BT Epoxy Glass, Cyanate Aster, Plyimide Glass, Teflon

Rules for Track: Track Length, Track Angle, Rack Joints, Track Size

Study of IPC Standards: IPC Standard for Schematic Design, IPC Standard for PCB Designing, IPC Standard for PCB Materials, IPC Standard For Documentation and PCB Fabrication

Tasks: Lab practice and designing concepts

Starting the PCB designing

- Understanding the schematic Entry
- Creating Library & Components
- Drawing a Schematic
- Flat Design / hierarchical Design
- Setting up Environment for PCB
- Design a Board

Auto routing

- Introduction to Auto routing
- Setting up Rules
- Defining Constraints
- Auto router Setup

PCB Designing Practice

- Inverting Amplifier or Summing Amplifier using op-amp

- Full-wave Rectifier
- Astable multivibrator using IC555
- RC Phase-shiftor Wein-bridge Oscillator using transistor.
- Full-Adder using half-adders.
- 4-bit binary /MOD N counter using D-Flip flops.
- One open-ended (analog/ digital/mixed circuit) experiments of similar nature and magnitude to th above are to be assigned by the teacher
- Design an 8051 Development board having Power section consisting Of IC7805,capacitor,resistor,headers,LED.
- Design an 8051 Development board having **Serial communication section** consisting of MA 232, Capacitors, DB9 connector, Jumper, LEDs
- Design an 8051 Development board having **Reset&Input/output sections** consisting of 89C51Microcontroller, Electrolytic Capacitor, Resistor, Jumper, Cryst Oscillator, Capacitors

Post Designing & PCB Fabrication Process

- Printing the Design
- Etching
- Drilling
- Interconnecting and Packaging electronic Circuits (IPC) Standards
- Gerber Generation
- Soldering and De-soldering
- Component Mounting
- PCB and Hardware Testing

Textbooks:

1. R S Khandpur, “Printed Circuit Boards: Design-Fabrication”, 1st Edition, Mc Graw Hill Education, 2017
2. Kraig Mitzner, “Complete PCB Design using OrCAD Capture and PCB Editor”, 1st Edition, Newnes.

Reference:

1. Michael Dsouza, “PCB Design: Printed Circuit Board”, 1st Edition, McGraw Hill Education, 2013.

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Electronics & Communication Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
III Year II Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Antennas & Microwave Engineering	PC	3-0-0	3
2.		VLSI Design	PC	3-0-0	3
3.		Digital Signal Processing	PC	3-0-0	3
4.		**Professional Elective-II**	PE	3-0-0	3
5.		**Open Elective-II**	ES	3-0-0	3
6.		Antennas & Microwave Engineering Lab	PC	0-0-3	1.5
7.		VLSI Lab	PC	0-0-3	1.5
8.		Digital Signal Processing Lab	ES	0-0-3	1.5
9.		**Skill Oriented Course –IV** Industrial IOT	SC	1-0-2	2
10		**Mandatory Non-Credit Course-III** Constitution of India	MC	2-0-0	0
				Total	**21.5**
Industrial/Research Internship (Mandatory) for 2 Months duration during summer vacation					

List of Professional Electives-I I	**List of Open Electives-II**
1) Digital Data Communications 2) Embedded Systems 3)Fuzzy and Neural Networks	Candidate should select the subject from list of subjects offered by other departments.

Category	**CREDITS**
Professional Core Courses	13.5
Professional Elective Courses	3
Open Elective Course/Job Oriented Elective	3
Skill oriented course	2
TOTAL CREDITS	**21.5**

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Electronics & Communication Engineering

Course Code	ANTENNAS AND MICROWAVE ENGINEERING	L	T	P	C
		3	0	0	3

III Year 2nd Semester

Course Objectives:

- To enable the student to understand the basic principles in antenna and microwave system design
- To enhance the student knowledge in the area of various antenna designs.
- To enhance the student knowledge in the area of microwave components and antenna for practical applications.

Course Outcomes (CO):

- Apply the basic principles and evaluate antenna parameters and link power budgets
- Design and assess the performance of various antennas
- Design a microwave system given the application specifications

UNIT - I	INTRODUCTION TO MICROWAVE SYSTEMS AND ANTENNAS	

Microwave frequency bands, Physical concept of radiation, Near- and far-field regions, Fields and Power Radiated by an Antenna, Antenna Pattern Characteristics, Antenna Gain and Efficiency, Aperture Efficiency and Effective Area, Antenna Noise Temperature and G/T, Impedance matching, Friis transmission equation, Link budget and link margin, Noise Characterization of a microwave receiver.

UNIT - II	RADIATION MECHANISMS AND DESIGN ASPECTS	

Radiation Mechanisms of Linear Wire and Loop antennas, Aperture antennas, Reflector antennas, Microstrip antennas and Frequency independent antennas, Design considerations and applications.

UNIT - III	ANTENNA ARRAYS AND APPLICATIONS	

Two-element array, Array factor, Pattern multiplication, uniformly spaced arrays with uniform and non-uniform excitation amplitudes, Smart antennas.

UNIT - IV	PASSIVE AND ACTIVE MICROWAVE DEVICES	

Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, attenuator, resonator, Principles of Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes, Microwave tubes: Klystron, TWT, Magnetron.

UNIT - V	MICROWAVE DESIGN PRINCIPLES	

Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design

Textbooks:

1. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation: Fourth Edition, Tata McGraw-Hill, 2006. (UNIT I, II, III)
2. David M. Pozar, "Microwave Engineering", Fourth Edition, Wiley India, 2012. (UNIT I,IV,V)

Reference Books:

1. Constantine A.Balanis, ―Antenna Theory Analysis and Design‖, Third edition, John Wiley India Pvt Ltd., 2005.
2. R.E.Collin, "Foundations for Microwave Engineering", Second edition, IEEE Press, 2001

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Electronics & Communication Engineering

Course Code	VLSI DESIGN	L	T	P	C
		3	0	0	3

III Year 2nd Semester

Course Objectives:

- Learn and Understand IC Fabrication process steps required for various MOS circuits
- Understand and Experience VLSI Design Flow
- Learn Transistor-Level CMOS Logic Design
- Understand VLSI Fabrication and Experience CMOS Physical Design
- Learn to Analyze Gate Function and Timing Characteristics

Course Outcomes (CO):

- Understand the properties of MOS active devices and simple circuits
- Know three sets of design rules with which nMOS and CMOS designs may befabricated.
- Understand the scaling factors determining the characteristics and performance ofMOS circuits in silicon technology.
- Know about scaling of MOS circuits
- Know about FPGA design, synthesis and different case studies

UNIT - I

Introduction and Basic Electrical Properties of MOS Circuits: Introduction to IC technology, Fabrication process: nMOS, pMOS and CMOS. I_{DS}vs V_{DS} Relationships, MOSTransistor Threshold Voltage, MOS transistor parameters, nMOS Inverter, Pull-up to Pulldown Ratio for nMOS inverter driven by another nMOS inverter, and through one or morepass transistors. Alternative forms of pull-up, The CMOS Inverter, Latch-up in CMOScircuits, Bi-CMOS Inverter, Comparison between CMOS and BiCMOS technology..

UNIT - II

MOS and Bi-CMOS Circuit Design Processes: MOS Layers, Stick Diagrams, DesignRules and Layout, Generalobservations on the Design rules, 2µ m Double Metal, DoublePoly, CMOS/BiCMOS rules, 1.2µ m Double Metal, Double Poly CMOS rules, LayoutDiagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams- Translation toMask Form.

UNIT - III

Basic Circuit Concepts: Sheet Resistance, Sheet Resistance concept applied to MOStransistors and Inverters, AreaCapacitance of Layers, Standard unit of capacitance, Some areaCapacitance Calculations, The Delay Unit, InverterDelays, Driving large capacitive loads,Propagation Delays, Wiring Capacitances, Choice of layers.

UNIT - IV

Scaling of MOS Circuits: Scaling models and scaling factors, Scaling factors for deviceparameters, Limitations of scaling, Limits due to sub threshold currents, Limits on logiclevels and supply voltage due to noise and current density,Introduction to Switch logic and Gate logic.

UNIT - V

FPGA Design: FPGA design flow, Basic FPGA architecture, FPGA Technologies, FPGAModes of operation, FPGA families-Xilinx XC4000 series FPGA, Xilinx Spartan II FPGAs,Xilinx Vertex FPGA.
Case studies: FPGA Implementation of Half adder and full adder.
Introduction to synthesis: Logic synthesis, RTL synthesis, High level Synthesis.

Textbooks:

1. Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas, and A.Pucknell and SholehEshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
2. Advanced Digital Design with the Verilog HDL, Michael D.Ciletti, Xilinx DesignSeries, Pearson Education.

Reference Books:

1. CMOS Digital Integrated Circuits Analysis and Design- Sung-Mo Kang, YusufLeblebici, Tata McGraw- Hill Education, 2003.
2. Analysis and Design of Digital Integrated Circuits in Deep submicron Technology,3rd Edition, DavidHodges.

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Electronics & Communication Engineering

Course Code	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

III Year 2nd Semester

Course Objectives:

- To describe discrete time signals and systems.
- To teach importance of FFT algorithm for computation of Discrete Fourier Transform.
- To expose various implementations of digital filter structures.
- To present FIR and IIR Filter design procedures.
- To outline need of Multi-rate Processing.

Course Outcomes (CO):

- Formulate difference equations for the given discrete time systems
- Apply FFT algorithms for determining the DFT of a given signal
- Compare FIR and IIR filter structures
- Design digital filter (FIR & IIR) from the given specifications

UNIT - I

Introduction to discrete time signals and systems
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.

UNIT - II

Discrete Fourier Transform
Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT.
Fast Fourier Transform
Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

UNIT - III

IIR Filters
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.

UNIT - IV

FIR Filters
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.

UNIT - V

Multirate digital signal processing
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 Processing (Nonlinear and Nonstationary signal processing).

Textbooks:

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. 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.

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Electronics & Communication Engineering

Course Code	DIGITAL DATA COMMUNICATIONS (Professional Elective-II)	L	T	P	C
		3	0	0	3

III Year 2nd Semester

Course Objectives:

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

Course Outcomes (CO):

- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network

UNIT - I

Overview of Data Communications- Networks – Building Network and its types– Overview of Internet - Protocol Layering - OSI Mode – Physical Layer – Overview of Data and Signals - introduction to Data Link Layer - Link layer Addressing- Error Detection and Correction

UNIT - II

Overview of Data link Control and Media access control - Ethernet (802.3) - Wireless LANs – Available Protocols – Bluetooth – Bluetooth Low Energy – WiFi – 6LowPAN–Zigbee – Network layer services – Packet Switching – IPV4 Address – Network layer protocols (IP, ICMP, Mobile IP)

UNIT - III

Routing - Unicast Routing – Algorithms – Protocols – Multicast Routing and its basics – Overview of Intradomain and interdomain protocols – Overview of IPv6 Addressing – Transition from IPv4 to IPv6

UNIT - IV

Introduction to Transport layer –Protocols- User Datagram Protocols (UDP) and Transmission Control Protocols (TCP) –Services – Features – TCP Connection – State Transition Diagram – Flow, Error and Congestion Control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

UNIT - V

Application Layer Paradigms – Client Server Programming – World Wide Web and HTTP – DNS - Electronic Mail (SMTP, POP3, IMAP, MIME) – Introduction to Peer-to-Peer Networks – Need for Cryptography and Network Security – Firewalls.

Textbooks:

Textbook:

1. Behrouz A. Forouzan, ―Data communication and Networking, Fifth Edition, Tata McGraw – Hill, 2013

Reference Books:

1. James F. Kurose, Keith W. Ross, ―Computer Networking - A Top-Down Approach Featuring the Internet‖, Seventh Edition, Pearson Education, 2016.
2. Nader. F. Mir, ― Computer and Communication Networks, Pearson Prentice Hall Publishers, 2nd Edition, 2014.
3. Larry L. Peterson, Bruce S. Davie, ―Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers, 2011

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Electronics & Communication Engineering

Course Code	EMBEDDED SYSTEMS (Professional Elective-II)	L	T	P	C
		3	0	0	3

III Year 2nd Semester

Course Objectives:

- To introduce major components of an embedded system
- To expose role of firmware, operating systems in correlation with hardware systems.
- To explain interfacing of various communication and I/O devices to an embedded system
- To demonstrate implementation of embedded systems for different applications

Course Outcomes (CO):

- Identify hardware and software components of an embedded system
- Choose appropriate embedded system architecture for the given application
- Discuss quality attributes and characteristics of an embedded system
- Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment

UNIT - I

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.

UNIT - II

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.

UNIT - III

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.

UNIT - IV

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.

UNIT - V

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.

Textbooks:

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

Reference Books:

1. Muhammad Ali Mazidi, Janice GillispieMazidi, 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, 3rdEdition Cengage Learning, 2012.
3. David. E. Simon, An Embedded Software Primer 1st Edition, Fifth Impression,Addison-Wesley Professional, 2007.

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

Course Code	FUZZY AND NEURAL NETWORKS (Professional Elective-II)	L	T	P	C
		3	0	0	3

III Year 2nd Semester

Course Outcomes:

- Understand the fundamentals and types of neural networks
- Explain the learning and adaptation capability of neural networks
- Design, Analyze and train the neural network models
- Describe the principles of knowledge based neural networks.
- Understand engineering applications that can learn using neural networks
- Understand the fuzzy sets, and apply the knowledge for representation using fuzzy rules

UNIT - I

INTRODUCTION: Background and History; Knowledge-based Information processing; Neural Information Processing; Hybrid Intelligence.
BASIC NEURAL COMPUTATIONAL MODELS: Basic concepts of Neural Nets (such as node properties, Network properties and Dynamics); Inference and learning (Data representation and functional classification); Classification models (single layer Perceptrons, multi-layer perceptrons); Association models (Hop field Nets, Bi- directional associative memories); Self organizing models (Kohonen Networks, Competitive learning, Hebbian learning).

UNIT - II

LEARNING: Supervised and Unsupervised learning; Statistical learning; Neural Network learning (Back propagation, Radial basis Function Networks, ART Networks); Genetic Algorithms.
KNOWLEDGE BASED NEURAL NETWORKS & INCREMENTAL LEARNING: Rule-based Neural networks; Network Training; Decision Tree Based NN's; Principles; Symbolic methods; Neural Network Approaches (Probabilistic NN's); Incremental RBCN.

UNIT - III

NN APPLICATIONS: Signal Processing; Computer Vision; Medical Applications; Automated Inspection and Monitoring; Business and Finance

UNIT - IV

FUZZINESS Vs PROBABILITY: Fuzzy Sets & Systems; The Geometry of Fuzzy sets; The Fuzzy Entropy theorem; The subset hood Theorem; The Entropy Subset hood theorem.

UNIT - V

FUZZY ASSOCIATIVE MEMORIES: Fuzzy & Neural Function Estimators; Fuzzy Hebbian FAMs; Adaptive FAMs.
COMPARISON OF FUZZY & NEURAL SYSTEMS: Case studies.

Textbooks:

1. Neural Networks in Computer Intelligence by Limin Fu, McGraw Hill Co., 1994.
2. Neural Networks & Fuzzy systems by B.Kosko, Prentice Hall (India) Ltd., 1992.
3. Neural Networks – A Comprehensive Foundation by S.Haykin, Maxell Macmillan International, 1991.

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Electronics & Communication Engineering

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

III Year 1st Semester

Course Outcomes (CO):

- 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
- Analyze the radiation characteristics to find the directivity and HPBW of a given antenna.
- Establish optical link between transmitter and receiver experimentally to find attenuation and signal strength of the received signal.

List of Experiments:

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.
8. 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.

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Electronics & Communication Engineering

Course Code	VLSI DESIGN LAB	L	T	P	C
		0	0	3	1.5

III Year 2nd Semester

Course Objectives:

Objectives:

- 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

Course Outcomes (CO):

- Understand how to use FPGA/CPLD hardware tools in the lab.
- Develop HDL source code for the given problem/experiment and simulate the given circuit with suitable simulator and verify the results.
- Analyze the obtained results of the given experiment/problem.
- Design and implement the experiments using FPGA/CPLD hardware tools.

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List of Experiments:

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
14. Moore machine Design

Note: Any TWELVE of the experiments are to be conducted

The students are required to design the schematic diagrams using CMOS logic and to draw the layout diagrams to perform the following experiments with the Industry standard EDA Tools.

Software Required: i. Mentor Graphics Software / Equivalent Industry Standard Software. ii. Personal computer system with necessary software to run the programs and to implement

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Electronics & Communication Engineering

Course Code	DIGITAL SIGNAL PROCESSING LAB	L	T	P	C
		0	0	3	1.5

III Year 2nd Semester

Course Outcomes (CO):

- Implement various DSP Algorithms using software packages.
- Implement DSP algorithms with Digital Signal Processor.
- Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital IIR-Butterworth, Chebyshev filters.
- Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filters using window techniques.
- Analyze digital filters using Software Tools.

The Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/ Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors

List of Experiments:

1. Generate the following standard discrete time signals.
   i) Unit Impulse ii) Unit step iii) Ramp iv) Exponential v) Sawtooth
2. Generate sum of two sinusoidal signals and find the frequency response (magnitude and phase).
3. Implement and verify linear and circular convolution between two given signals.
4. Implement and verify autocorrelation for the given sequence and cross correlation between two given signals.
5. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence.
6. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).
7. Implement and verify N-point IFFT of a given sequence.
8. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)
9. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter /High Pass Filter).
10. Design FIR filter (Low Pass Filter /High Pass Filter) using windowing technique.
    i. Using rectangular window
    ii. Using hamming window
    iii. Using Kaiser window
11. Design and verify Filter (IIR and FIR) frequency response by using Filter design and Analysis Tool.
12. Compute the Decimation and Interpolation for the given signal.
13. Real time implementation of an audio signal using a digital signal processor.
14. Compute the correlation coefficient for the two given audio signals of same length using a digital signal processor.

Note: Any TWELVE of the experiments are to be conducted.

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Electronics & Communication Engineering

Course Code	INDUSTRIAL IOT (Professional Elective-II)	L	T	P	C
		1	0	2	2

III Year 2nd Semester

Course Objectives:

- Students will learn the new evolution in hardware, software, and data.
- While the promise of the Industrial Internet of Things (IIoT) brings many new business prospects, it also presents significant challenges ranging from technology architectural choices to security concerns.
- Students acquire upcoming Industrial IoT: Roadmap to the Connected World Course offers important insights on overcoming the challenges and thrive in this exciting space.

Course Outcomes (CO):

- Discover key IIoT concepts including identification, sensors, localization, wireless protocols, data storage and security
- Explore IoT technologies, architectures, standards, and regulation
- Realize the value created by collecting, communicating, coordinating, and leveraging the data from connected devices
- Examine technological developments that will likely shape the industrial landscape in the future
- Understand how to develop and implement own IoT technologies, solutions, and applications

Syllabus

MODULE 1: Introduction & Architecture
What is IIoT and connected world? the difference between IoT and IIoT, Architecture of IIoT, IOT node, Challenges of IIOT.

Practice
1. Introduction to Arduino, Introduction to raspberry Pi.

https://www.youtube.com/watch?v=AQdLQV6vhbk

MODULE 2: IIOT Components
Fundamentals of Control System, introductions, components, closed loop & 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.

Practice
1. Measurement of temperature & 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.

MODULE 3: Communication Technologies of IIoT
Communication Protocols: IEEE 802.15.4, ZigBee, Bluetooth, BLE, NFC, RFID Industry standards communication technology (MQTT), wireless network communication.

Practice
1. Demonstration of MQTT communication.

MODULE 4: Visualization and Data Types of IIoT
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)

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

Textbooks:

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication)
2. Industrial Internet of Things: Cyber manufacturing 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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Electronics & Communication Engineering

Course Code	CONSITUTION OF INDIA (Mandatory Course)	L	T	P	C
		2	0	0	0

III Year 2nd Semester

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of india.
- To understand the central and state relation financial and administrative

Course Outcomes (CO):

- At the end of the semester/course, the student will be able to have a clear knowledge on the following:
- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government.
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
- Know the sources, features, and principles of Indian Constitution.
- Learn about Union Government, State government and its administration.
- Get acquainted with Local administration and Pachayati Raj.
- Be aware of basic concepts and developments of Human Rights.
- Gain knowledge on roles and functioning of Election Commission

UNIT - I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT - II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;
.

UNIT - III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT - IV

A.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

UNIT - V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women

Reference Books:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics

5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and Politics Hans
7. J. Raj Indian Government and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

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Electronics & Communication Engineering

Sri Krishnadevaraya University College of Engineering & Technology					
Dept. of Electronics & Communication Engineering					
IV Year I Semester					
S.No	**Course Code**	**Course Name**	**Category**	**L-T-P**	**Credits**
1.		Professional Elective – III	PE	3-0-0	3
2.		Professional Elective – IV	PE	3-0-0	3
3.		Professional Elective – V	PE	3-0-0	3
4.		Open Elective-III	OE	3-0-0	3
5.		Open Elective – IV	OE	3-0-0	3
6		Humanities Elective			
7.		**Skill oriented course– V** System Verilog	SC	1-0-2	2
8.		Evaluation of Industrial Internship	PR	0-0-0	3
				Total	**23**

List of Professional Electives-III	**List of Professional Electives-V**
1) DSP Processors & Architectures 2) Internet of Things 3) Electronic Measurements and Instrumentation	.1) Smart Sensors 2) Radar Engineering 3) Cellular & Mobile Communications
List of Professional Electives-IV	**Humanities Elective**
1) Real Time Operating Systems 2) Digital Image Processing 3) Satellite Communications	1)Entrepreneurship and Design Thinking 2)Management Science 3)Organizational Behavior
List of Open Electives-III & IV Candidate should select the subject from list of subjects offered by other departments.	

Category	**CREDITS**
Professional Elective Courses	9
Open Elective Course/Job Oriented Elective	6
Humanities and Social Science Elective	3
Skill oriented course	2
Industrial Internship	3
TOTAL CREDITS	**23**

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Electronics & Communication Engineering

Course Code	DSP PROCESSORS AND ARCHITECTURES (Professional Elective-III)	L	T	P	C
		3	0	0	3

IV Year I Semester

Course Objectives:

- To describe unique features of Digital signal processing.
- To demonstrate various computational parameters of DSP devices.
- To introduce architectural improvements in programmable DSP devices.
- To expose to basic DSP algorithms.
- To outline DSP processors for developing various applications.

Course Outcomes (CO):

- Summarize features of Digital Signal Processing
- Evaluate dynamic ranges and precision for the given DSP system
- Explain architectural features of DSP processors
- Analyze performance of DSP algorithms on programmable DSP platform for given application
- Select DSP processors for building real time applications

UNIT - I

Introduction to Digital Signal Processing: 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...

UNIT - II

Computational Accuracy in DSP Implementations Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of Error in DSP Implementation, A/D Conversion Errors, D/A Conversion Errors

UNIT - III

Architecture for Programmable DSP Devices DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Programmability and Program Execution, Speed Issues, Commercial Digital Signal Processing Devices, Data Addressing Modes of TMS320C54xx Processors, Memory space of TMS320C54xx Processors, TMS320C54xx Instructions and Programs

UNIT - IV

Implementation of Basic DSP Algorithms The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, PID Controller, Adaptive Filters,2-D Signal Processing, An FFT Algorithm for DFT Computation, A Butterfly Computation, Bit Reversed Index Generation, 4-point FFT Implementation on the TMS320C54xx, Computation of the Signal Spectrum

UNIT - V

Applications of Programmable DSP Devices A DSP System, DSP Based Biotelemetry Receiver, A Speech Processing System, An Image Processing System.

Textbooks:

Text Books:

1. B. Venkataramani and M. Bhaskar, Digital Signal Processors, Architecture, Programming and Applications, TMH, 2002.
2. Avtar Singh and S. Srinivasan, Digital Signal Processing, Thomson Publications, 2004.

Reference Books:

1. J. G. Proakis, Algorithms for Statistical Signal Processing, Pearson,2002.
2. Jonatham Stein, Digital Signal Processing, John Wiley, 2005.
3. K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, A Practical Approach to Digital Signal Processing. New Age International, 2006/2009
4. Lapsley et al., DSP Processor Fundamentals - Architectures & Features, S. Chand & Co.,2000

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Electronics & Communication Engineering

Course Code	INTERNET OF THINGS (Professional Elective-III)	L	T	P	C
		3	0	0	3

IV Year 1st Semester

Course Objectives:

To make students know the IoT ecosystem and to provide an understanding of the technologies and the standards relating to the Internet of Things.

Course Outcomes (CO):

- Understand the basics of Networking and Security.
- Understand predecessor of IoT technology and emergence of Internet of Things
- Understand architecture for Internet of Things
- Recognize various devices, sensors, actuators, and various processing paradigms for IoT

UNIT - I

Basics of Networking & Basics of Network Security: Network Types, Layered Network Models, Addressing, Internet of Things TCP/IP Transport layer, Security, Network Confidentiality, Cryptography, Message Integrity and Authenticity, Digital signatures, Key Management, Internet Security & Firewall.

UNIT - II

Predecessors of IoT & Emergence of IoT–Introduction, Wireless Sensor Networks, Machine-to-Machine Communications, Cyber Physical Systems, Architectural components of CPS, IoT versus M2M, IoT versus CPS, IoT versus WoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT.

UNIT - III

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model, and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

UNIT - IV

IoT Sensing and Actuation & IoT Processing Topologies and Types: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuators Types, Actuator Types, Actuator Characteristics, Data Formats, Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading, Offload location, Offload decision making, Offloading considerations.

UNIT - V

IoT Case Studies: Agricultural IoT, Components of an agricultural IoT, Advantages of IoT in agriculture, Case Studies, Vehicular IoT, Components of vehicular IoT, Advantages of vehicular IoT, Healthcare IoT, Components of healthcare IoT, Advantages and risk of healthcare IoT, Case Studies, Evolution of New IoT Paradigms, Challenges Associated with IoT, Emerging Pillars of IoT.

Textbooks:

1. Sudip Mishra, Anandarup Mukherjee, Arijit Roy: Introduction to IOT, Cambridge University Press
2. Bassi, Alessandro, et al, “Enabling things to talk”, Springer-Verlag Berlin -2016

Reference Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017
2. Neil Cameron: Arduino Applied-Comprehensive Projects for Everyday Electronics, Apress.
3. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, John Wiley & Sons.
4. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers.

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Electronics & Communication Engineering

Course Code	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (Professional Elective-III)	L	T	P	C
		3	0	0	3

IV Year 1st Semester

Course Objectives:

- To introduce various measuring systems and their functionality
- To teach various measurement metrics for performance analysis
- To explain principles of operation and working of different electronic instruments
- To familiarize the characteristics, operations, calibrations and applications of the different oscilloscopes.
- To provide exposure to different sensors and transducers

Course Outcomes (CO):

- Explain operation of various instruments required in measurements
- Apply measurement techniques for different types of tests
- Select specific instruments for specific measurement function
- Use oscilloscope to determine frequency and phase of a sinusoidal signal
- Compare different types of bridge circuits
- Analyze various measuring techniques for both electrical and nonelectrical quantities

UNIT - I

Performance characteristics of Instruments: 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, AC voltmeters Thermocouple type RF ammeter, ohm meters, series type, shunt type, multimeter for voltage, current and resistance measurements

UNIT - II

Unit 2
Oscilloscopes: 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, dual trace/beam CRO, Principles of sampling oscilloscope, storage oscilloscope, and digital storage oscilloscope, Digital frequency counters, time & Period measurements.

UNIT - III

Signal Generators and Analyzers: Fixed and variable frequency 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.

UNIT - IV

Bridges: Wheatstone bridge, Wein Bridge, errors and precautions in using bridges, AC bridges: Measurement of inductance-Maxwell's bridge, Anderson Bridge. Measurement of capacitance- Schearing Bridge, Kelvin Bridge, Q-meter, EMI and EMC, Interference and noise reduction techniques.

UNIT - V

Sensors and Transducers: 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.

Textbooks:

1. H.S.Kalsi, Electronic Instrumentation, 3rd edition, McGraw Hill Education, 2017.

Reference Books:

1. D. Helfrick, W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, ,1st edition, Pearson Education India, 2015
2. David A. Bell, Electronic Instrumentation and Measurements, Oxford Univ. Press, 2007
3. B.M. Oliver, J.M. Cage, Electronic Measurements and Instrumentation, TMH Reprint 2009.
Ernest O. Doebelin and Dhanesh N Manik, Measurement Systems, 6th Ed., TMH,2010

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Electronics & Communication Engineering

Course Code	REAL TIME OPERATING SYSTEMS (Professional Elective-IV)	L	T	P	C
		3	0	0	3

IV Year 1st Semester

Course Objectives:

- To introduce general idea, structure and functions of general purpose operating systems.
- To describe process & memory management techniques
- To impart knowledge about the fundamentals of Real Time Systems and interaction with RTOS
- To teach concepts of how process are created and controlled with RTOs.
- To introduce about the services rendered by RTOS in an application.
- To provide knowledge about the common problems in developing an RTOS.
- To discuss application development using RTOS

Course Outcomes (CO):

- Distinguish between general purpose and real time operating systems
- Describe real-time operating system requirements and design issues
- Illustrate role of operating systems in memory and I/O devices management
- Apply concepts of inter-task communication and synchronization via shared memory, message queues, signals, semaphores

UNIT - I

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

UNIT - II

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.

UNIT - III

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, Catch operation, Execution sequence of wait and signal operations.

UNIT - IV

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- Write operation for a block-mode device- I/O function mapping- Associating devices with drivers-Memory allocation map, fragmentation, free operation, Management unit.

UNIT - V

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

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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Electronics & Communication Engineering

Course Code	IMAGE PROCESSING (Professional Elective-IV)	L	T	P	C
		3	0	0	3

IV Year 1st Semester

Course Objectives:

- To introduce fundamentals of Image Processing.
- To expose various intensity transformations in spatial and frequency domains.
- To impart concepts of wavelets and various coding techniques for image compression.
- To dissimilate various segmentation techniques for images.
- To teach various color models and to introduce the concepts of color image segmentation.

Course Outcomes (CO):

- Analyze various types of images mathematically
- Compare image enhancement methods in spatial and frequency domains
- Demonstrate various segmentation algorithms for given image
- Justify DCT and wavelet transform techniques for image compression
- Describe various color models for color image processing

UNIT - I

Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighbourhood, adjacency, connectivity, distance measures

UNIT - II

Image Enhancements and Filtering- Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

UNIT - III

Image Segmentation, Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

UNIT - IV

Wavelets and Multi-resolution image processing- Uncertainty principles of Fourier Transform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Sub-band filter banks.

Image Compression, -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.

UNIT - V

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.

Textbooks:

Text Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education, 2008.
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India, 2nd edition 2004.

Reference Books:

1. Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, “Digital Image processing using MATLAB”, Tata McGraw Hill, 2010.
2. Milan Sonka, Vaclav Hlavac, Roger Boule, Image Processing, Analysis, and Machine Vision, Third Edition, Cengage Learning, 2016.
3. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image processing”, Tata McGraw Hill.
4. William K. Pratt, “Digital Image Processing”, John Wiley, 3rd Edition, 2004.

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Electronics & Communication Engineering

Course Code	SATELLITE COMMUNICATIONS (Professional Elective-IV)	L	T	P	C
		3	0	0	3

IV Year 1st Semester

Course Objectives:

- 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.
- To apply frequency allocation standards, reliability techniques, multiple access techniques power test methods to satellite systems.
- To analyze satellite navigation and global positioning system.
- To design Uplink and Downlink of a satellite.

Course Outcomes (CO):

- Understand the orbital and functional principles of satellite communication systems
- Architect, interpret, and select appropriate technologies for implementation of specified satellite communication systems
- 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.

UNIT - I

Introduction: Overview of Satellite Communications, GEO, MEO and LEO satellite systems, frequency bands
Orbital Mechanics: 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

UNIT - II

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

UNIT - III

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.

UNIT - IV

Error Control for Digital Satellite Links: Error control coding, Block codes, Convolution codes, - Implementation of error detection on satellite links.

UNIT - V

VSAT Systems: Overview of VSAT systems, Network architectures, Access control, multiple access selection
LEO Satellite systems: Orbits, Coverage and frequency bands, off axis scanning, delay and throughput, NGSO constellation design, Problems

Textbooks:

Textbooks:

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.
3. William K. Pratt, "Digital Image Processing", John Wiley, 3rd Edition, 2004.

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Electronics & Communication Engineering

Course Code	SMART SENSORS (Professional Elective-V)	L	T	P	C
		3	0	0	3

IV Year 1st Semester

Course Objectives:

To make student to acquire the knowledge on types of sensors/transducers, working principles, selection procedure, applications of sensing systems

Course Outcomes (CO):

- Understand measuring parameters, measuring systems, effects of environment, characteristics and parameters to be considered for designing an instrument
- Understand different types of sensors/transducers, working principles, selection procedure, applications of sensing systems
- Understand Challenges and applications of sensors and sensor networks
- Select a sensor/sensing system for a requirement
- Test, install and collect the data from a group of sensors.

UNIT - I

Introduction to Measurement: Measurement units, applications, elements, choosing appropriate measuring instruments. Instrument Types and Performance Characteristics: Review of instrument types, Static characteristics, dynamic characteristics Error during measurement process: Sources of systematic error, reduction and quantification of systematic errors, random errors, aggregation of measurement system errors. Calibration: Calibration of measuring instruments, Primary calibration, secondary calibration and field calibration. Calibration methods for different parameters (temperature, pressure, humidity, flow...etc.). Automatic Calibration mechanisms.

UNIT - II

Temperature Sensors: Thermo-resistive, Resistance Temperature Detectors, Silicon Resistive, Thermistors, Semiconductor, Optical, Acoustic, Piezoelectric
Humidity and Moisture Sensors: Capacitive, Electrical Conductivity, Thermal Conductivity, Optical Hygrometer, Time Domain Reflectometer.
Pressure and Force Sensors: Mercury Pressure, Bellows, Membranes, and Thin Plates, Piezoresistive, Capacitive, Optoelectronic, Vacuum, Strain Gauges, Tactile, Piezoelectric Force

UNIT - III

Occupancy and Motion Detectors: Ultrasonic, Microwave Motion, Capacitive Occupancy, Visible and Near-Infrared Light, Far-Infrared Motion, PIR Motion, Position, Displacement, and Level Sensors: Potentiometric, Gravitational, Capacitive, Inductive and Magnetic, Optical, Ultrasonic, Radar Velocity and Acceleration Sensors: Capacitive Accelerometers, Piezoresistive Accelerometers, Piezoelectric Accelerometers, Thermal Accelerometers, Heated-Plate Accelerometer, Heated Gas Accelerometer, Gyroscopes, Piezoelectric Cables

UNIT - IV

Flow Sensors: Pressure Gradient Technique, Thermal Transport, Ultrasonic, Electromagnetic, and Micro flow, Coriolis Mass Flow, Acoustic Sensors: Resistive Microphones, Fiber-Optic, Piezoelectric, Solid-State microphone, Light & Radiation Sensors: Photodiodes, Phototransistor, Photo resistors, Thermal detectors
Chemical Sensors: Metal-Oxide Chemical, ChemFET, Electro-chemical, Potentiometric, Conduct metric, Amperometric, Optical Chemical, Mass Detector

UNIT - V

Introduction to wireless sensor networks, Challenges for wireless sensor networks, Applications for wireless sensor networks, enabling technologies for wireless sensor networks.
Single node architecture – Hardware components, Energy consumption of Sensor nodes (only Operation states with different power consumption, Relationship between computation and communication, Power consumption of sensor and actuators is included), Deployment environments
Sensor Network Architecture - Sensor Network Scenarios, Optimization goals and figures of merit, Design principles of WSN, Service interfaces of WSNs, Gateway-concepts

Textbooks:

1. Measurement and Instrumentation Principles - Morris, AlanS
2. An Introduction to Error Analysis by John R.Taylor
3. Sensor Technology Handbook, John S.Wilson
4. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor
5. Networks" John-Wiley,First-Edition-2014.

Reference Books:

1. Mechanical Measurements – Beckwith, Marangoni,Lienhard
2. Measurement of Systems - Application and design - Earnest O.Doeblin
3. Electronic Instrumentation and Measurement Technique - Albert DHelfrick
4. Kazem Sohraby, Daniel Minoli, &Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley,2007.

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Electronics & Communication Engineering

Course Code	RADAR ENGINEERING (Professional Elective-V)	L	T	P	C
		3	0	0	3

IV Year 1st Semester

Course Objectives:

- To understand the basic principles of RADAR and its variants, RADAR based Microwave imaging.
- To apply the fundamental knowledge of various RADARs, Matched Filter and to find the range between the target and RADAR, frequency and phase of the received signal.
- To analyze the received data from the target using CW RADAR & MTI RADAR and to find the distance, tracking range for clutter analysis.

Course Outcomes (CO):

- Understand the basic operation of pulse and CW radar systems.
- Evaluate the radar performance based on pulse width, peak power and beam width.
- Choose suitable tracking radar for a given problem.
- Select appropriate criterion for detecting a target.
- Understand the working of phased array radars and navigational aids

UNIT - I

Radar and Radar Equation: Introduction, Radar block diagram and operation, frequencies, applications, types of displays, derivation of radar equation, minimum detectable signal, probability of false alarm and threshold detection, radar cross-section, system losses

UNIT - II

CW Radar – Doppler Effect, CW Radar, applications, FM – CW radar, altimeter, Multiple Frequency Radar. Pulse Radar – MTI, Delay Line Canceller, Multiple Frequencies, Range-gated Doppler Filters, Non-coherent MTI, Pulse Doppler Radar

UNIT - III

Tracking Radar- Sequential lobing, conical scanning, mono pulse, phase comparison mono pulse, tracking in range, comparison of trackers.

UNIT - IV

Detection – Introduction, Matched Filter, Detection Criteria, Detector characteristics.

UNIT - V

Phased Arrays – Basic concepts, feeds, phase shifters, frequency scan arrays, multiple beams, applications, advantages and limitations. Navigational Aids: Direction Finder, VOR, ILS and Loran

Textbooks:

1. M.I. Skolnik, Introduction Radar Systems, Second Edition, Mc Graw Hill Book Co., 1981

Reference Books:

1. F.E. Terman, Radio Engineering, Mc Graw Hill Book Co. (for Chapter 7 only), Fourth Edition 1955
2. Simon Kingsley & Shaun Quegan, Understanding RADAR Systems, McGraw Hill Bo

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Electronics & Communication Engineering

Course Code	CELLULAR & MOBILE COMMUNICATIONS (Professional Elective-V)	L	T	P	C
		3	0	0	3

IV Year 1st Semester

Course Objectives:

- To explain cell coverage for signal and traffic, diversity techniques and mobile antennas by the use of Engineering Mathematics.
- To present impairments due to multipath fading channel, fundamental techniques to overcome different fading effects, frequency management, Channel assignment and types of handoff.
- To teach concepts and solve problems on mobile antennas and cellular systems.
- To teach Co-channel and Non Co-channel interferences, different Hand-offs and dropped call rates.
- To describe performance evaluation of dropped call rate and false alarm rate

Course Outcomes (CO):

- Know about cell coverage for signal and traffic, diversity techniques and mobile antennas by the use of Engineering Mathematics
- Explain impairments due to multipath fading channel, fundamental techniques to overcome different fading effects, frequency management, Channel assignment and types of handoff
- Apply concepts to solve problems on mobile antennas and cellular systems
- Analyze Co-channel and Non Co-channel interferences, different Hand-offs and dropped call rates
- Evaluate performance of dropped call rate and false alarm rate
- Compare different handoffs

UNIT - I

Introduction to Cellular Mobile Radio Systems: Limitations of Conventional Mobile Telephone Systems, Basic Cellular Mobile System, Uniqueness of Mobile Radio Environment, Mobile Fading Characteristics, Operations of Cellular Systems, Evolution of Cellular Systems.

Fundamentals of Cellular Radio System Design: Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I from a Normal Case in an Omni Directional Antenna System, System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems- Cell Splitting, Sectoring, Microcell Zone Concept

UNIT - II

Cell Coverage for Signal and Traffic: Signal Reflections in Flat and Hilly Terrain, Effect of Human Made Structures, Phase Difference between Direct and Reflected Paths, Constant Standard Deviation, Straight Line Path Loss Slope, General Formula for Mobile Propagation Over Water and Flat Open Area, Near and Long Distance Propagation, Path Loss from a Point to Point Prediction Model in Different Conditions, Merits of Lee Model.

Cell Site and Mobile Antennas: Space Diversity Antennas, Umbrella Pattern Antennas, Minimum Separation of Cell Site Antennas, Mobile Antennas.

UNIT - III

Co-Channel Interference Reduction: Measurement of Real Time Co-Channel Interference, Design of Omnidirectional and directional Antenna System, Antenna Parameters and Their Effects, Diversity Techniques-Space Diversity, Polarization Diversity, Frequency Diversity, Time Diversity.

Non-Co-Channel Interference: Adjacent Channel Interference, Near End Far End Interference, Cross Talk, Effects on Coverageand Interference by Power Decrease, Antenna Height Decrease, Effects of Cell Site Components.

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UNIT - IV

Frequency Management and Channel Assignment: Numbering and Grouping, Setup Access and Paging Channels, Channel Assignments to Cell Site and Mobile Units, Channel Sharing and Borrowing, Sectorization, Overlaid Cells, Non Fixed Channel Assignment.

UNIT - V

Handoffs and Dropped Calls: Handoff Initiation, Types of Handoff, Delaying Handoff, Advantages of Handoff, Power difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoffs, Intersystem Handoff, Introduction to Dropped Call Rates and their Evaluation.

System Evaluation: Performance Evaluation, Blockage, Dropped-call rate, Signalling Evaluation- False Alarm Rate, Word error rate consideration and calculations, Measurement of averaged received signal level and level crossings.

Electronics & Communication Engineering

Textbooks:
1. W.C.Y. Lee, Mobile Cellular Telecommunications, McGraw Hill, 2nd Edn., 1989. 2. Theodore. S. Rapport, Wireless Communications, Pearson Education, 2nd Edn., 2002.
Reference Books:
1. W.C.Y Lee, Mobile Communications Engineering-Theory and Applications, McGraw Hill, Second Edition, ,2014. 2. Gordon L. Stuber, Principles of Mobile Communications, Springer International, 2nd Edn., 2001. **3.** Simon Haykin, Michael Moher, Modern Wireless Communications, Pearson Education, 2005

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Electronics & Communication Engineering

Course Code	MANAGEMENT SCIENCE (Humanities Elective-I)	L	T	P	C
		3	0	0	3

IV Year 1st Semester

Course Objectives:

The objectives of this course are

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

Course Outcomes (CO):

- Understand the concepts & principles of management and designs of organization in a practical world
- Apply the knowledge of Work-study principles & Quality Control techniques in industry
- Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
- Create Modern technology in management science.

UNIT - I **INTRODUCTION TO MANAGEMENT**

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 - Organisational Designs - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

UNIT - II **OPERATIONS MANAGEMENT**

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..

UNIT - III **HUMAN RESOURCES MANAGEMENT (HRM)**

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.

UNIT - IV **STRATEGIC & PROJECT MANAGEMENT**

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).

UNIT - V **CONTEMPORARY ISSUES IN MANAGEMENT**

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.

Reference Books:

1. Koontz &Weihrich, “Essentials of Management”, 6th edition, TMH, 2005.
2. Thomas N.Duening& John M.Ivancevich, “Management Principles and Guidelines”, Biztantra.
3. Kanishka Bedi, “Production and Operations Management”, Oxford University Press, 2004.
4. Samuel C.Certo, “Modern Management”, 9th edition, PHI, 2005

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Electronics & Communication Engineering

Course Code	ENTREPRENEURSHIP & INCUBATION (Humanities Elective-I)	L	T	P	C
		3	0	0	3

IV Year 1st Semester

Course Objectives:

The objectives of this course are

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up of New enterprise
- To facilitate the student in knowing various sources of finance in starting up of a business
- To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
- To encourage the student in creating and designing business plans

Course Outcomes (CO):

- Understand the concept of Entrepreneurship and challenges in the world of
- competition.
- Apply the Knowledge in generating ideas for New Ventures.
- Analyze various sources of finance and subsidies to entrepreneur/women
- Entrepreneurs.
- Evaluate the role of central government and state government in promoting
- Entrepreneurship.
- Create and design business plan structure through incubations.

UNIT - I

Entrepreneurship -Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship -Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mind set and personality-Recent trends in Entrepreneurship

UNIT - II

Starting the New Venture - Generating business idea – Sources of new ideas & methods ofgeneratingideas-Opportunityrecognition-Feasibilitystudy-Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan – Preparing project report -Presenting business plan to investors

UNIT - III

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

UNIT - IV

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

UNIT - V

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

Textbooks:

1. D F Kuratko and T V Rao, "Entrepreneurship" - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : login.cengage.com)
2. 2 . Nandan H, " Fundamentals of Entrepreneurship", PHI, 2013

Reference Books:

1. VasantDesai,"SmallScaleIndustriesandEntrepreneurship",HimalayaPublishing2012.
2. RajeevRoy"Entrepreneurship",2nd Edition,Oxford,2012.
3. B.Janakiramand M.Rizwana‖ "Entrepreneurship Development: Text &Cases",Excel Books, 2011.
4. StuartRead,Effectual"Entrepreneurship",Routledge,2013.

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Electronics & Communication Engineering

Course Code	ORGANISATIONAL BEHAVIOUR (Humanities Elective-I)	L	T	P	C
		3	0	0	3

IV Year 1st Semester

Course Objectives:

The objectives of this course are

- To make the student understand about the organizational behavior
- To enable them to develop self motivation,leadership and management
- To facilitate them to become powerful leaders
- Impart knowledge about group dynamics
- To make them understand the importance of change and development

Course Outcomes (CO):

- Understand the nature and concept of Organizational behavior
- Apply theories of motivation to analyze the performance problems
- Analyze the different theories of leadership
- Evaluate group dynamics
- Develop as powerful leader

UNIT - I

Organizational Behavior - Introduction to OB - Meaning and definition, scope - Organizing Process – Making organizing effective - Understanding Individual Behavior – Attitude - Perception - Learning - Personality Types

UNIT - II

Motivation and Leading - Theories of Motivation - Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Leading - Leading Vs Managing

UNIT - III

Leadership and Organizational Culture and Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management-Evaluating Leader-Women and Corporate leadership

UNIT - IV

Group Dynamics - Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making -Teambuilding-Conflict in the organization– Conflict resolution

UNIT - V

Organizational Change and Development - Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

Textbooks:

1. Luthans, Fred, "Organisational Behaviour" , McGraw-Hill, 12 Th edition 2011 2. P Subba Rao, Organisational Behaviour, Himalya Publishing House 2017

Reference Books:

1. McShane, "Organizational Behaviour", TMH 2009
2. Nelson, "Organisational Behaviour", Thomson, 2009.
3. Robbins, P.Stephen, Timothy A. Judge, "Organisational Behaviour", Pearson 2009.
4. Aswathappa, "Organisational Behaviour", Himalaya, 2009

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Electronics & Communication Engineering

Course Code	SYSTEM VERILOG (Skill Oriented Course)	L	T	P	C
		1	0	2	2

IV Year I Semester

Course Outcomes (CO):

Outcome 1: Ability to justify the need of verification and verification language SystemVerilog
Outcome 2: Ability to describe design and testbench 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

UNIT - I

Module 1

. Verification Methodology Overview
Introduction to Verification Methodology, Verification Process, Reusable TB,Verification Environment Architecture, Constraint Random Coverage Driven Verification,Verification Methodologies & Summary

Module 2

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

Module 3

System Verilog Datatypes
System Verilog Introduction & Logic Data Type, System Verilog Data Types - 2 State, Struct & Enum,System Verilog Data Types - Strings, Packages & Summary

Module 4

System Verilog Memories
SystemVerilog Memories - Introduction, Packed and Multi Dimensional Arrays, System Verilog Memories - Dynamic Arrays & Queues,SystemVerilog Memories - Associative Arrays, Array Methods & Summary

Module 5

System Verilog Tasks & Functions
SystemVerilog Tasks & Functions - Introduction, Void Functions, Fun return & Automatic Task SV Tasks & Functions -Pass by value & ref and Summary

Module 6

SystemVerilog Interfaces
SystemVerilog Interfaces - Introduction & Verilog ports Vs SV Interface,SystemVerilog Interfaces - Modports & Clocking Block,System Verilog Interfaces - Examples & Summary

Module 7

SystemVerilog Object Oriented Programming - Basics
SystemVerilog - Introduction, Class Data Type & Objects,SystemVerilog OOP - Constructor, Null Object, Object assignments and copy,SystemVerilog OOP - Shallow Vs Deep Copy & Summary

Module 8

System Verilog Object Oriented Programming - Advanced
System Verilog OOP - Introduction, Inheritance & Super,SystemVerilog OOP - Static properties & methods and Pass by ref,System Verilog OOP - Polymorphism, $cast, Virtual & Parametrised 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,SystemVerilog Case Studies

Module 14
: Universal Verification Methodology Overview
Introduction to UVM, UVM Concepts,UVM SoC TB, UVM AHB UVC,UVMSoC 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
4. S Prakash Rashinkar, Peter Paterson and Leena Singh, “System on Chip Verification Methodologies and Techniques”, Kluwer Academic, 1st Edition.

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

Electronics & Communication Engineering

Open Electives offered by Department of ECE to other Branches

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

Electronics & Communication Engineering

Open Electives offered by Department of ECE to other Branches

1. Fundamentals of Digital Electronics
2. Basics of Signals and Systems
3. Fundamentals of Communication Systems
4. Fundamentals of Microprocessors and Microcontrollers
5. Microcontroller & Applications
6. Electronic Sensors
7. Electronic Instrumentation
8. Principles of Signal Processing
9. Embedded System Design
10. Introduction to Image Processing
11. Introduction to Internet of things
12. Consumer Electronics

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Ananthapuramu – 515 003 (A.P) India

Electronics & Communication Engineering

Course Code	FUNDAMENTALS OF DIGITAL ELECTRONICS	L	T	P	C
		3	0	0	3

Open Elective for non ECE Students

Course Objectives:

- To familiarize with the concepts of different number systems and Booleanalgebra.
- To introduce the design techniques of combinational, sequential logiccircuits.

Course Outcomes (CO):

CO1: Understand the properties of Boolean algebra, other logic operations, and minimization of Boolean functions using Karnaugh map.
CO2: Make use of the concepts to solve the problems related to the logic circuits.
CO3: Analyze the combinational and sequential logic circuits.

UNIT - I **Binary Systems**

Binary Systems Introduction of Digital Computers and Digital Systems Binary umbers Base Conversion Complements R's Complement (R-1)'s Complement Binary Codes Decimal Codes Error Detection codes Reflected Code

UNIT - II **Binary Logic And Boolean Algebra**

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

UNIT - III **Boolean Function Implementation**

Need for simplification K – Map method 2 – Variable K – map 3 – Variable K – map 4 – variable K – map K – Map using Don't care condition Universal Gates NAND Gate NOR Gate NAND Implementation NOR Implementation

UNIT - IV **Basic Combinational Logic**

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, Demultiplexers

UNIT - V **UNIT-VI-SEQUENTIAL CIRCUITS**

Classification of sequential circuits, Basic Flip-Flops, Excitation and Characteristic Tables Flip Flop Conversions.

Textbooks:

1. Switching & Finite Automata theory- ZviKohavi, TMH,2nd Edition.
2. Digital Design-Morris Mano, PHI, 3rd Edition,2006.
3. Switching Theory and Logic design-A. Anand Kumar,2008.

Reference Books:

1. An Engineering Approach to Digital Design-Fletcher, PHI.
2. Fundamentals of Logic Design-Charles H.Roth.5th Edition, 2004, Thomson publications.
3.Digital Logic Applications and Design-John M.Yarbrough, 2006, Thomson Publications

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Electronics & Communication Engineering

Course Code	BASICS OF SIGNALS AND SYSTEMS	L	T	P	C
		3	0	0	3

Open Elective for non ECE Students

Course Objectives:

- To introduce students to the basic idea of signal and system analysis and its characterization in time and frequency domains.
- To present Fourier tools through the analogy between vectors and signals.
- To teach concept of sampling and reconstruction of signals.
- To analyze characteristics of linear systems in time and frequency domains.
- To understand Laplace and z-transforms as mathematical tool to analyze continuous and discrete-time signals and systems.

Course Outcomes (CO):

CO1: Understand the mathematical description and representation of continuous-time and discrete-time signals and systems. Also understand the concepts of various transform techniques.
CO2: 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.
CO3: Analyze the frequency spectra of various continuous-time and discrete-time signals using different transform methods.
CO4: Classify the systems based on their properties and determine the response of them.

UNIT - I	**Signals and Systems**

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.

UNIT - II	**Fourier Series and Fourier Transform**

Fourier series: Trigonometric & Exponential, Properties of Fourier series, concept of discrete spectrum, Illustrative Problems.
Continuous Time Fourier Transform: Definition, Computation and properties of Fourier transform for different types of signals and systems, Inverse Fourier transform. Statement and proof of sampling theorem of low pass signals, Illustrative Problems.

UNIT - III	**Laplace Transform**

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.

UNIT - IV	**Signal Transmission through LTI systems**

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.

UNIT - V	**DTFT & Z-Transform**

Discrete Time Fourier Transform: Definition, Computation and properties of Discrete Time Fourier transform for different types of signals and systems.
Z–Transform: Definition, ROC, Properties, Poles and Zeros in Z-plane, The 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.
Reference Books:
1. BP Lathi, "Principles of Linear Systems and Signals", 2nd Edition, Oxford University Press, 015. 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", 4thEdition, TMH, 2019.

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Electronics & Communication Engineering

Course Code	FUNDAMENTALS OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

Open Elective for non ECE Students

Course Objectives:

- To introduce various modulation and demodulation techniques of analog communication systems.
- To analyze different parameters of analog communication techniques.
- To Know Noise Figure in AM & FM receiver systems.

Course Outcomes (CO):

CO1: Recognize/List the basic terminology used in analog communication techniques for transmission of information/data.
CO2: Explain/Discuss the basic operation of different analog communication systems at baseband and passband level.
CO3: Analyze/Investigate the performance of different modulation & demodulation techniques to solve complex problems in the presence of noise.

UNIT - I **INTRODUCTION TO COMMNICATION SYSTEMS**

Communication process, Elements of Communication Systems; Modulation: Need for Modulation, Forms of Modulation: AM, FM, PM, Advantages,Disadvantages and Applications.

UNIT - II **AMPLITUDE MODULATION AND DEMODULATION**

Introduction,Mathematical Representation of AM, Modulation Factors, Percentage of Modulation, Power Relationships, Virtues and imitations of AM.DSB AM: Analog Message Conventions, AM Signals and Spectra, DSB signals and spectra.SSB AM: SSB Signals and Spectra, SSB generation, VSB Generation, Demodulation of AM, Square law detector

UNIT - III **FREQUENCY, PHASE MODULATION AND DEMODULATION**

FM:Introduction,Mathematical Representation of FM, Modulation Index, Deviation Sensitivity, Deviation Ratio, Bandwidth of FM (Carson's rule), Narrow band FM, Wide band FM, Voltage and Power for FM, Pre-emphasis and Deemphasis,Illustrative Problems.PM: Introduction, Narrow Band PM, Phase Modulation and Indirect FM; FM demodulators, Slope detector, Balanced slope discriminators, Phase difference discriminators, Ratio detector,PLL Detectors, Distortion and Transmission estimates

UNIT - IV **TRANSMITTERS AND RECEIVERS:**

AM Transmitters: Balanced Modulator, Square Law Modulator, and Product Modulator.
Receivers: Super Heterodyne Receiver, Double Conversion Receiver and Independent Sideband Receiver.FM Transmitters: Direct FM and VCO's, Mixer, Divider, Multiplier. Receivers: Local Oscillator, Slope Detector,Phase Locked Loop, Introduction to IC 565 applications, FM demodulator

UNIT - V **PULSE MODULATION TECHNIQUES**

Definition, Types: PAM, PWM, PPM, Sampling,Nyquist rate, Flat top sampling, Generation and Detection of PAM, PWM, PPM.

Textbooks:

1. A.Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", McGraw-Hill International Edition, 5th Edition, 2010.
2. "Electronic Communications systems" Modulation and Transmission-Robert Schoenbeck, UBS Publications, New Delhi.

Reference Books:

1. Simon Haykin, "Communication Systems", Wiley-India edition, 3rd edition, 2010
2. Sham Shanmugam, "Digital and Analog Communication Systems", Wiley-India edition, 2006.
3. B.P. Lathi, &Zhi Ding, "Modern Digital & Analog Communication Systems", Oxford University Press, International 4th edition, 2010.
4. Linear Integrated Circuits – D. Roy Chowdhury, New Age International (p) Ltd, 2nd Edition

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Electronics & Communication Engineering

Course Code	FUNDAMENTALS OF MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

Open Elective for non ECE Students

Course Objectives:

- To introduce fundamental architectural concepts of Microprocessors and Microcontrollers.
- To impart knowledge on addressing modes and instruction set of 8086 and 8051
- To introduce assembly language programming concepts
- To explain memory and I/O interfacing with 8086 and 8051

Course Outcomes (CO):

- Distinguish between microprocessors & microcontrollers
- Develop assembly language programming
- Describe interfacing of 8086 with peripheral devices
- Design applications using microcontrollers

UNIT - I **8086 MICROPROCESSOR**:

Evaluation of microprocessors. Overview of 8085. Register organization of 8086,architecture, signal description of 8086, physical memory organization, general bus operations, I/O addressing capability, special processor activities, 8086-Minimum mode and maximum mode of operation, Timing diagram.

UNIT - II **8086 INSTRUCTION SET AND ASSEMBLER DIRECTIVES**:

Addressing modes of 8086, Instruction set of 8086, Assembler Directives and operators.8086 Assembly language programs involving logical,branch and call instructions, sorting, evaluation of arithmetic expressions, string manipulation.

UNIT - III **PROGRAMMABLE PERIPHERAL DEVICES AND THEIR INTERFACING**:

Memory interfacing to 8086 (static RAM and EPROM). 8255 PPI-various modes of operation and interfacing to 8086. D/A and A/D converter interfacing, Stepper motor interfacing. Interrupt structure of 8086, Vector interrupt table. Interrupt service routines.8259 PIC architecture and interfacing cascading of interrupt controller and its importance

UNIT - IV **8051 MICROCONTROLLER**:

Architecture of 8051 microcontroller. Pin Diagram of 8051, and external memories, counters and timers, serial communication, interrupts.

UNIT - V **-8051 ASSEMBLY LANGUAGE PROGRAMMING**:

Instruction set of 8051, Addressing modes of 8051,Assembly Language Programming examples using 8051.Interfacing to LCD,Keyboard,ADC& DAC.

Textbooks:

1. Microprocessor Architecture, Programming and Applications with8085 By Ramesh S Gaonkar.
2. Advanced microprocessor and peripherals-A.K. Ray and K.M.Bhurchandi, 2nd edition, TMH, 2000.
3. 8051 microcontroller and embedded systems by mazidi and mazidi ,pearson education 2000

Reference Books:

1. Microprocessors Interfacing-Douglas V.Hall, Revised 2nd edition, 2007.
2. The 8088 and 8086 Microprocessors- Walter A. Triebel, Avtar Singh, PHI, 4th Edition, 2003.
3. 8051 Microcontroller-Internals, Instructions, Programming and Interfacing by SubrataGhoshal,

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Electronics & Communication Engineering

Course Code	MICROCONTROLLERS & APPLICATIONS	L	T	P	C
		3	0	0	3

Open Elective for non ECE Students

Course Objectives:

- Describe theArchitecture of 8051 Microcontroller and Interfacing of 8051 to external memory.
- Write 8051 Assembly level programs using 8051 instruction set.
- Describe the Interrupt system, operation of Timers/Counters and Serial port of 8051.
- Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051

Course Outcomes (CO):

- Understand the importance of Microcontroller and Acquire the knowledge of Architecture of 8051 Microcontroller.
- Apply and Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to using 8051 I/O ports.
- Develop the 8051 Assembly level programs using 8051 Instruction set
- Design the Interrupt system, operation of Timers/Counters and Serial port of 8051

UNIT - I

8051 Microcontroller:
Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture-Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

UNIT - II

Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples to use these instructions.

UNIT - III

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.

UNIT - IV

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

UNIT - V -

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.

Textbooks:

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.
2. Kenneth J. Ayala, "The 8051 Microcontroller", 3rd Edition, Thomson/Cengage Learning.

Reference Books:

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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Electronics & Communication Engineering

Course Code	ELECTRONIC SENSORS	L	T	P	C
		3	0	0	3

Open Elective for non ECE Students

Course Objectives:

- Learn the characterization of sensors.
- Known the working of Electromechanical, Thermal, Magnetic and radiation sensors
- Understand the concepts of Electro analytic and smart sensors
- Able to use sensors in different applications

Course Outcomes (CO):

- Learn about sensor Principle, Classification and Characterization.
- Explore the working of Electromechanical, Thermal, Magnetic, radiation and Electro analytic sensors
- Understand the basic concepts of Smart Sensors
- Design a system with sensors

UNIT - I

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization
Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance StrainGauge, Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators,Ultrasonic Sensors

UNIT - II

Thermal Sensors: Introduction, Gas thermometric Sensors,Thermal Expansion Type ThermometricSensors, Acoustic Temperature Sensor ,Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer ,Nuclear Thermometer ,Magnetic Thermometer ,ResistanceChange Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, ThermalRadiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, SpectroscopicThermometry, Noise Thermometry, Heat Flux Sensors

UNIT - III

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors,Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros

UNIT - IV

Radiation Sensors: Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors
Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization,Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media

UNIT - V

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart SensorInterface, the Automation Sensors –Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing –Sensors for environmentalMonitoring

Textbooks:

1. "Sensors and Transducers - D. Patranabis" –PHI Learning Private Limited., 2003.
2. Introduction to sensors- John veteline, aravind raghu, CRC press, 2011

Reference Books:

1. Sensors and Actuators, D. Patranabis, 2nd Ed., PHI, 2013.
2. Make sensors: Terokarvinen, kemo, karvinen and villey valtokari, 1st edition, maker media,2014.
3. Sensors handbook- Sabrie soloman, 2nd Ed. TMH, 2009

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Electronics & Communication Engineering

Course Code	ELECTRONIC INSTRUMENTATION	L	T	P	C
		3	0	0	3

Open Elective for non ECE Students

Course Objectives:

- To introduce various measuring instruments and their functionality
- To teach various measurement metrics for performance analysis
- To explain principles of operation and working of different electronic instruments
- To familiarize the characteristics, operations, calibrations and applications of the different oscilloscopes and signal generators.

Course Outcomes (CO):

- 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.
- Familiarize the dynamics of instrument systems, various passive, and active transducers
- Compare the various measuring techniques for measuring voltage

UNIT - I

Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. (Text 2)
Ammeters: 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)
Voltmeters and Multi-meters: 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)

UNIT - II

Digital Voltmeters: 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)
Digital Instruments: 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)

UNIT - III

Oscilloscopes: 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)
Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator, (Text 1)

UNIT - IV

Measuring Instruments: Field Strength Meter,Stroboscope, Phase Meter, Q Meter, Megger. (Text 1)
Bridges: Introduction, Wheatstone‘s bridge, Kelvin‘s Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell‘s bridge, Wien‘s bridge. (Text 1)

UNIT - V -

Transducers: 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)

Textbooks:

1. ‘H. S. Kalsi, “Electronic Instrumentation”, McGraw Hill, 3rd Edition, 2012, ISBN:9780070702066.
2. A. 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.

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Electronics & Communication Engineering

Course Code	PRINCIPLES OF SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

Open Elective for non ECE Students

Course Objectives:

- To describe discrete time signals and systems.
- To teach importance of FFT algorithm for computation of Discrete Fourier Transform.
- To expose various implementations of digital filter structures.
- To present FIR and IIR Filter design procedures.
- To outline need of Multi-rate Processing.

Course Outcomes (CO):

- Use the FFT algorithm for solving the DFT of a given signal
- Design a Digital filter (FIR&IIR) from the given specifications
- Realize the FIR and IIR structures from the designed digital filter.
- Use the Multirate Processing concepts in various applications
- Apply the Adaptive signal processing concepts to various signal processingapplications

UNIT - I

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.

UNIT - II

Structures of IIR filters – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation

UNIT - III

Structures of FIR filters – Linear phase FIR filter – Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques

UNIT - IV

Multirate signal processing: Basic building blocks of multirate DSP, Decimation, Interpolation, Sampling rate conversion by a rational factor, Multistage Sampling Rate Converters.

UNIT - V -

Adaptive Filters: Introduction, LMS and RLS Adaptation Algorithms, Applications of adaptive filtering to equalization, noise cancellation.

Textbooks:

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

Reference Books:

1. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling,Sandra L. Harris,Thomson, 2007.
2. Understanding Digital Signal Processing 2nd Edition by Richard G.Lyons

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Electronics & Communication Engineering

Course Code	EMBEDDED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

Open Elective for non ECE Students

Course Objectives:

The objectives of the course are to

- To introduce major components of an embedded system
- To expose role of firmware, operating systems in correlation with hardware systems.
- To explain interfacing of various communication and I/O devices to an embedded system
- To demonstrate implementation of embedded systems for different applications

Course Outcomes (CO):

- Identify hardware and software components of an embedded system
- Choose appropriate embedded system architecture for the given application
- Discuss quality attributes and characteristics of an embedded system
- Illustrate different Inter Process Communication (IPC) mechanisms used by tasks/process/tasks to communicate in multitasking environment
- Design simple embedded system-based applications

UNIT - I

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.

UNIT - II

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

UNIT - III

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.

UNIT - IV

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. .

UNIT - V -

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

Textbooks:

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

Reference Books:

1. Muhammad Ali Mazidi, Janice GillispieMazidi, 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, 3rdEdition Cengage Learning, 2012.
3. David. E. Simon, An Embedded Software Primer 1st Edition, Fifth Impression,Addison-Wesley Professional, 2007.

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Electronics & Communication Engineering

Course Code	INTRODUCTION TO IMAGE PROCESSING	L	T	P	C
		3	0	0	3

Open Elective for non ECE Students

Course Objectives:

- To interpret fundamental concepts of digital image processing.
- To exemplify image enhancement.
- To interpret fundamental concepts of color image processing.
- To assess image compression techniques for digital images.
- To summarize segmentation for digital images.

Course Outcomes (CO):

- Interpret fundamental concepts of digital and color image processing.
- Exemplify image enhancement.
- Analyze the various terminologies involved in image segmentation like edge, boundary detection etc. Assess image compression techniques for digital images.
- Summarize segmentation techniques for digital images.

UNIT - I	INTRODUCTION TO DIGITAL IMAGE PROCESSING	

Introduction: 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.
Applications: Medical imaging, Robot vision, Character recognition, Remote sensing.

UNIT - II	IMAGE ENHANCEMENT	

Need for image enhancement, Point processing, Histogram processing, Spatial filtering- Smoothing and Sharpening.

UNIT - III	COLOR IMAGE PROCESSING	

Colour fundamentals, Colour models, Color transformations, Pseudo colour image processing, Full colour image processing.

UNIT - IV	IMAGE COMPRESSION	

Redundancies, Fidelity criteria, Image compression model, Lossless compression: Huffman coding, Arithmetic coding. Lossy compression: Lossy Predictive Coding, JPEG Compression Standard.

UNIT - V	IMAGE SEGMENTATION	

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.

Textbooks:

1.Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2011.

Reference Books:

1. S Jayaraman, S Esakkirajan and T Veerakumar, "Digital Image Processing", TMH, 2011.

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Electronics & Communication Engineering

Course Code	INTRODUCTION TO INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Open Elective for non ECE Students

Course Objectives:

Students will be explored to the interconnection and integration of the physical world and thecyber space. They are also able to design & develop IOT Devices.

Course Outcomes (CO):

After completion of this course the students will be able to

- Understand the application areas of IOT
- Understand building blocks of Internet of Things and characteristics.
- Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks

UNIT - I

Overview: 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.

UNIT - II

Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle.

UNIT - III

Introduction to Sensor Interfacing, Microcontrollers, and Their Interfacing: 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

UNIT - IV

Protocols for IoT – Messaging and Transport Protocols: Introduction, Messaging Protocols, XMPP and DDS Protocols, Transport Protocols

Addressing and Identification: Introduction, Internet Protocol Version 4, Internet Protocol Version 6 (IPv6), Uniform Resource Identifier (URI)Packages.

UNIT - V

Application Building with IoT: 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

Textbooks:

1. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, 2nd Edition, Wiley Publications.
2. Vijay Madisetti, Arshdeep Bahga, Internet of Things A Hands-On- Approach‖,2014.

Reference Books:

1. Adrian McEwen, ―Designing the Internet of Things, Wiley Publishers, 2013.
2. Daniel Kellmereit, ―The Silent Intelligence: The Internet of Things, 2013.

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

Course Code	CONSUMER ELECTRONICS	L	T	P	C
		3	0	0	3

Open Elective for non ECE Students

Course Outcomes (CO):

- Understand the various type of microphones and loudspeakers.
- To identify the various digital and analog signal.
- Describe the basis of television and composite video signal.
- Describe the various kind of color TV standards and system.
- Compare the various types of digital TV system.

UNIT - I

Audio Systems: 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.

UNIT - II

Digital Audio Fundamentals:
Audio as Data and Signal, Digital Audio Processes Outlined, Time Compression and Expansion.

UNIT - III

Television: 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

UNIT - IV

Digital Transmission and Reception: 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

UNIT - V

Introduction to different type of domestic/commercial appliances: Operation of Micro-wave oven, Food Processors, Digital Electronic Lock, Vacuum cleaner, Xerox Machine, Scanner

Textbooks:

1. Modern Television Practice by R. R. Gulai; New Age International Publishers.
2. Audio Video Systems by R. G. Gupta; McGraw Hill Education System.
3. Audio Video Systems Principles Practices and Troubleshooting by Bali & Bali; KhannaPublishing Company
4. Consumer Electronics by S. P. Bali; Pearson Education, New Delhi

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Electronics & Communication Engineering

HONOURS IN ECE

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

Electronics & Communication Engineering

Honors Degree in ECE

S.No.	Course Code	Course Name	L	T	P	Credits
1.		FPGA Design and Implementation	3	1	0	4
2.		Low power VLSI Design.	3	1	0	4
3.		Advanced 3G and 4G Wireless Mobile Communications	3	1	0	4
4.		Micro Electromechanical Systems	3	1	0	4
5.		VLSI Design for Testability	3	1	0	4
6		Speech Processing	3	1	0	4
7		MOOC course (8 weeks duration) CMOS Digital VLSI Design				2
8		MOOC course (12 weeks duration) Pattern recognition and Application				2

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

Course Code	FPGA DESIGN AND IMPLEMENTATION	L	T	P	C
		3	1	0	4

HONOURS IN ECE

UNIT - I

Revision of basic Digital systems: Combinational Circuits, Sequential Circuits, Timing, Power Dissipation. Current state of the field. System Modeling, Hardware-Software Co-design, Device Technology and Application Domains.

UNIT - II

Digital system Design: Top down Approach to Design, Case study. Data Path, Control Path, Controller behavior and Design, Case study Mealy & Moore Machines, Timing of sequential circuits, Pipelining, Resource sharing, FSM issues (Starring state, Power on Reset, State diagram optimization, State Assignment,Asynchronous Inputs, Output Races, fault Tolerance.
.

UNIT - III

HDL for synthesis: Introduction, Behavioral, Data flow, Structural Models. Simulation Cycles. Process. Concurrent Statements. Sequential Statements. Loops. Delay Models. Sequential Circuits, FSM Coding. Library. Functions, Procedures. Test benches.

UNIT - IV

FPGA deisgn: Introduction, Logic Block Architecture, Routing Architecture, Programmable Interconnections, Design Flow, Xilinx Virtex-V (Architecture), Boundary Scan, Programming FPGA's, Constraint Editor, Static Timing Analysis. One hot encoding. Applications. Tools. Embedded System on Programmable Chip.Hardware-software co-simulation, Bus function models, BFM Simulation. Debugging FPGA Design.

UNIT - V

FPGA Implementation: Case studies: FPGA Implementation of Half adder and full adder.
Introduction to synthesis: Logic synthesis, RTL synthesis, High level Synthesis.

Books:

Textbooks:

1. ZainalabedinNavabi, Verilog, analysis and modeling of digital systems, McGraw-Hill.
2. D. Black, J. Donovan, SystemC: From the Ground Up, Springer, 2004.

References:

1. Jon F Wakerly, Digital Design: Principles and Practices, Prentice Hall.
2. G. De Micheli, Synthesis and Optimization of Digital Circuits, McGraw-Hill, 1994

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Electronics & Communication Engineering

Course Code	LOW POWER VLSI DESIGN	L	T	P	C
		3	1	0	4

HONOURS IN ECE

Course Objectives:

- To impart knowledge on different abstraction levels in VLSI Design and the impact of power reduction methods at higher levels
- To describe leakage control mechanisms to reduce static power consumption in DSM VLSI regime
- To explain technology independent and technology-dependent techniques for Dynamic power reduction in CMOS circuits
- To introduce various software power estimation and optimization techniques for low power VLSI system design
- To demonstrate low power circuit and architectural techniques for reducing power consumption in SRAM designs

Course Outcomes (CO):

- Distinguish impact of various power reduction techniques at different levels of VLSI Design
- Identify sources of power dissipation and apply leakage reduction techniques to reduce static power consumption in CMOS circuits
- Analyze different power reduction techniques for VLSI systems at Design time, Run-time and Stand-by modes
- Apply simple software power estimation and optimization techniques for low power VLSI system design
- Apply low power circuit and architectural techniques such as capacitance reduction, gated clocking, V_{DD} and V_{th} scaling, DVS etc in digital systems and SRAM designs

UNIT - I

Introduction to Low Power design: 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)
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 V_{TH} and dynamic V_{TH} techniques, Supply voltage scaling technique.

UNIT - II

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.

UNIT - III

Power Optimization Techniques – II: Low Power Very Fast Dynamic Logic Circuits, Low Power Arithmetic Operators, Energy Recovery Circuit Design, Adiabatic – Charging Principle and its implementation issues (Ref-2)
Software Design for Low Power: Sources of Software Power Dissipation, Software Power Estimation, Software Power Optimizations, Automated Low-Power Code Generation, Co-design for Low Power

UNIT - IV

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:
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 V_{DD} 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", 1st 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, 1st Edition, Springer Publications, 2010.

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Electronics & Communication Engineering

Course Code	ADVANCED3GAND4GWIRELESSMOBILECOMMUNICATIONS	L	T	P	C
		3	1	0	4

HONOURS IN ECE

Course Objectives:

- To understand the concepts of wireless communications and standards
- To apply a wireless technique to solve engineering problem
- To analyze working of wireless technologies
- To evaluate a wireless technique in a given situation
- To plan a wireless system for deployment

Course Outcomes (CO):

At the end of the course, the student should be able to

- Understand the concepts of wireless communications and standards
- Apply a wireless technique to solve engineering problem
- Analyze working of wireless technologies
- Evaluate a wireless technique in a given situation
- Plan a wireless system for deployment

UNIT - I

Introduction to 3G and 4G standards.

Teletraffic Theory:

Introduction to teletraffic theory, Cellular traffic modelling and blocking probability.

Large Scale Path Loss:

Introduction to wireless propagation models, Ground reflection model, Okumura model, Hata model, Link budget analysis,Log normal shadowing

UNIT - II

Small Scale Fading and Multipath:

Fading in wireless channel, Rayleigh fading, BER in wired and wireless channels. Wireless channel and delay spread, Coherence bandwidth of wireless channel, ISI and Doppler in wireless channel, Doppler spectrum and Jake's model.

Diversity Techniques:

Introduction to diversity techniques, MRC for multi-antenna system, BER with diversity, Spatial diversity and diversity order.

UNIT - III

Code Division Multiple Access

Introduction to CDMA, spread spectrum and LFSR. Generation and properties of PN sequences, Correlation of PN sequences and Jammer margin, CDMA advantages and RAKE receiver, Multiuser CDMA downlink, Multiuser CDMA uplink and asynchronous CDMA, CDMA near-far problem

UNIT - IV

Multiple Input Multiple Output Systems:

Introduction to MIMO, MIMO system model, Zero-forcing receiver, MIMO MMSE receiver, Introduction to SVD, SVD based optimal MIMO transmission and capacity, OSTBCs, V-blast receiver, MIMO beam forming.

Orthogonal Frequency Division Multiplexing:

Introduction to OFDM, Multicarrier modulation, IFFT sampling for OFDM, OFDM schematic, Cyclic prefix, OFDM based parallelization, OFDM examples.

UNIT - V

MIMO-OFDM:

Introduction to MIMO-OFDM, Impact of carrier frequency offset in OFDM, PAPR in OFDM systems, Introduction to SC-FDMA.

3G and 4G Standards:

WCDMA, LTE/ LTE Advanced and WiMAX.

Textbooks:

1. VijayMadisetti,ArshdeepBahga,"InternetofThingsAHands-On-Approach",2014.

Reference Books:

1. Matt Richardson & Shane Wallace, Getting Started with Rasperry Pi, O'Reilly (SPD),2014.
2. AdrianMcEwen,"DesigningtheInternetofThings",WileyPublishers,2013
3. DanielKellmereit,"TheSilent Intelligence:TheInternetofThings",2013

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Electronics & Communication Engineering

Course Code	MICRO ELECTROMECHANICAL SYSTEMS	L	T	P	C
		3	1	0	4

HONOURS IN ECE

Course Objectives:

- To provide knowledge of semiconductors and solid mechanics to fabricate mems devices.
- To educate on the rudiments of micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for mems.
- To educate on the applications of mems to disciplines beyond electrical and mechanical engineering.

Course Outcomes (CO):

- Explain electrical and mechanical principles of MEMS
- Describe working of electrostatic, thermal and magnetic sensors and actuators
- Demonstrate piezoelectric effect and its applications
- Categorize micromachining processes
- Describe operation of polymer and optical MEMS

UNIT - I

INTRODUCTION : Intrinsic Characteristics Of MEMS – Energy Domains And Transducers- Sensors And Actuators – Introduction To Micro Fabrication – Silicon Based MEMS Processes – New Materials – Review Of Electrical And Mechanical Concepts In MEMS – Semiconductor Devices – Stress And Strain Analysis – Flexural Beam Bending- Torsional Deflection

UNIT - II

SENSORS AND ACTUATORS-I: Electrostatic Sensors – Parallel Plate Capacitors – Applications – Interdigitated Finger Capacitor – Comb Drive Devices – Micro Grippers – Micro Motors – Thermal Sensing And Actuation – Thermal Expansion – Thermal Couples – Thermal Resistors – Thermal Bimorph – Applications – Magnetic Actuators – Micromagnetic Components – Case Studies Of MEMS In Magnetic Actuators- Actuation Using Shape Memory Alloys.

UNIT - III

SENSORS AND ACTUATORS-II: Piezoresistive Sensors – Piezoresistive Sensor Materials – Stress Analysis Of Mechanical Elements – Applications To Inertia, Pressure, Tactile And Flow Sensors – Piezoelectric Sensors And Actuators – Piezoelectric Effects – Piezoelectric Materials – Applications To Inertia , Acoustic, Tactile And Flow Sensors.

UNIT - IV

MICROMACHINING: Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching Of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case Studies – Basic Surface Micro Machining Processes – Structural And Sacrificial Materials – Acceleration Of Sacrificial Etch – Striction And Antistriction Methods – LIGA Process – Assembly Of 3D MEMS – Foundry Process.

UNIT - V

POLYMER AND OPTICAL MEMS: Polymers In MEMS– Polimide – SU-8 – Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon – Application To Acceleration, Pressure, Flow And Tactile Sensors- Optical MEMS – Lenses And Mirrors – Actuators For Active Optical MEMS.

Textbooks:

1. Chang Liu, 'Foundations Of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro Systems Design And Manufacture" Tata McGraw Hill, New Delhi, 2002.

Reference Books:

1. Nadim Maluf," An Introduction To Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-El-Hak, Editor, " The MEMS Handbook", CRC Press Baco Raton, 2001.
3. Julian W. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS And Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.

Course Code		L	T	P	C

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Electronics & Communication Engineering

	VLSI DESIGN FOR TESTABILITY	3	1	0	4

HONOURS IN ECE

Course Objectives:

- To impart knowledge on the basic faults that occur in digital systems
- To describe fault detection techniques in combinational circuits.
- To outline procedures to generate test patterns for detecting single stuck faults in combinational and sequential circuits.
- To explain design for testability techniques with improved fault coverage.
- To introduce BIST concepts and specific architectures.
- To give exposure to approaches for introducing BIST into logic circuits, memories and embedded cores...

Course Outcomes (CO):

- Model digital circuits at logic and RTL levels
- Simulate digital ICs in the presence of faults and evaluate the given test set for fault coverage
- Generate test patterns for detecting single stuck faults in combinational and sequential circuits
- Identify schemes for introducing testability into digital circuits with improved fault coverage
- Compare different approaches for introducing BIST into logic circuits, memories and embedded cores

UNIT - I

Introduction to Test and Design for Testability (DFT) Fundamentals. Modeling: Modeling digital circuits at logic level, register level and structural models. Levels of modeling. Logic Simulation: Types of simulation, Delay models, Element evaluation, Hazard detection, Gate level event driven simulation.

UNIT - II

Fault Modeling – Logic fault models, Fault detection and redundancy, Fault equivalence and fault location. Single stuck and multiple stuck – Fault models. Fault simulation applications, General techniques for Combinational circuits.

UNIT - III

Testing for single stuck faults (SSF), Automated test pattern generation (ATPG/ATG) for SSFs in combinational and sequential circuits, Functional testing with specific fault models, Vector simulation – ATPG vectors, formats, Compaction and compression, Selecting ATPG Tool.

UNIT - IV

Design for testability – testability trade-offs, techniques. Scan architectures and testing – controllability and Observability, generic boundary scan, full integrated scan, storage cells for scan design. Board level and system level DFT approaches. Boundary scan standards. Compression techniques – different techniques, syndrome test and signature analysis

UNIT - V

Built-in self-test (BIST): BIST Concepts and test pattern generation. Brief ideas on some advanced BIST concepts and design for self-test at board level. Memory BIST (MBIST): Memory test architectures and techniques – Introduction to memory test, Types of memories and integration, Embedded memory testing model. Memory test requirements for MBIST. Brief ideas on embedded core testing.

Textbooks:

1. MironAbramovici, Melvin A. Breur, Arthur D. Friedman, Digital Systems Testing and Testable Design, Jaico Publishing House, 2001.
2. Alfred Crouch., Design for Test for Digital ICs & Embedded Core Systems, Prentice Hall.

Reference Books:

1. Robert J. Feugate, Jr., Steven M. Mentyn, Introduction to VLSI Testing, Prentice Hall, Englehood Cliffs, 1998.
2. Bushnell, M., and Agrawal, Vishwani D, Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits, Kluwer Academic Publishers,2002

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Electronics & Communication Engineering

Course Code	SPEECH PROCESSING	L	T	P	C
		3	1	0	4

HONOURS IN ECE

Course Objectives:

- To impart knowledge on anatomy and physiology of Speech Production system and perception model.
- To instruct speech in time domain and extract various time domain parameters.
- To describe speech parameters in frequency domain for various applications like formant extraction, pitch extraction, etc.
- To explain speech features using LPC analysis and implement the techniques like Pitch Detection and formant analysis using LPC parameters.
- To introduce concept of homomorphic system and its use in extracting the vocal tract information from speech using cepstrum and study various Speech Processing applications

Course Outcomes (CO):

- Formulate vocal tract model based on the speech production mechanism (
- Solve features of speech in Time Domain
- Describe feature extraction techniques in frequency domain
- Use LPC coefficients for Pitch and Formant detection
- Analyze given speech using homomorphic system

UNIT - I

Fundamentals of Digital Speech Processing: 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.

UNIT - II

Time Domain Methods for Speech Processing: Time domain parameters of speech, methods for extracting the parameters: Zero crossings, Auto-correlation function, pitch estimation

UNIT - III

Frequency Domain Methods for Speech Processing: Short time Fourier analysis, Filter bank analysis, Spectrographic analysis, Formant extraction, Pitch extraction

UNIT - IV

Linear predictive Coding (LPC) for Speech: 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.

UNIT - V

Homomorphic Speech Processing: 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.

Textbooks:

1. L.R. Rabiner and S. W. Schafer, Digital Processing of Speech Signals, Pearson Education.
2. Douglas O' Shaughnessy, Speech Communications: Human & Machine, 2nd Ed., Wiley-IEEE Press.

Reference Books:

1. Thomas F. Quatieri, Discrete Time Speech Signal Processing: Principles and Practice, 1st Ed., Pearson Education.
2. Ben Gold & Nelson Morgan, Speech and Audio Signal Processing: Processing and Perception of Speech and Music , 1st Ed., Wiley.

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Electronics & Communication Engineering

MINOR IN

ECE

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

Electronics & Communication Engineering

Minors in ECE

Note

1.A student can opt any Four subjects @ 4 credits per subject
2.Concerned BoS can add or delete the subjects as per the decision of the board.
3.Prerequisites to be defined by the board for each course.
4.Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)

S.No	Course Code	CourseName	L	T	P	Credits
1.		Electronic Devices and Basic Circuits	3	1	0	4
2.		Digital Electronics	3	1	0	4
3.		Signal Analysis	3	1	0	4
4.		Principles of Communication	3	1	0	4
5		Microprocessors & Microcontroller Applications	3	1	0	4
6		MOOC Course (8 Weeks)				2
7		MOOC Course (8 Weeks)				2

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Electronics & Communication Engineering

Course Code	ELECTRONIC DEVICES & BASIC CIRCUITS	L	T	P	C
		3	1	0	4

Minors in ECE

Course Objectives:

- To understand the basic principles of all semiconductor devices.
- To be able to solve problems related to diode circuits, and amplifier circuits.
- To analyze diode circuits, various biasing and small signal equivalent circuits of amplifiers.
- To be able to compare the performance of BJTs and MOSFETs
- To design rectifier circuits and various amplifier circuits using BJTs and MOSFETs.

Course Outcomes (CO):

CO1: Understand principle of operation, characteristics and applications of Semiconductor diodes, Bipolar Junction Transistor and MOSFETs.
CO2: Applying the basic principles solving the problems related to Semiconductor diodes, BJTs, and MOSFETs.
CO3: Analyze diode circuits for different applications such as rectifiers, clippers and clampers also analyze biasing circuits of BJTs, and MOSFETs.
CO4: Design of diode circuits and amplifiers using BJTs, and MOSFETs.
CO5: Compare the performance of various semiconductor devices.

UNIT - I	**Review of Semiconductors and Diodes**	

Review of Semiconductors: Intrinsic semiconductors, Doped Semiconductors, Current Flow in Semiconductors, PN Junction with Open Circuit, PN Junction with Applied Voltage, Capacitive Effects in PN Junction.
Diodes: Introduction, The Ideal Diode – current voltage characteristic, rectifier, diode logic gates, Terminal Characteristics of Junction Diodes– forward bias,reversebias, and breakdown regions, Modeling the Diode Forward Characteristics- exponential model, graphical analysis and Iterative analysis using the exponential model, constant voltage drop model, the small signal model.

UNIT - II	**Zener Diodes and Bipolar Junction Transistors(BJTs)**	

Zener Diodes– Zenerdiode Characteristics, Voltage shunt regulator, Temperature Effects, Rectifier Circuits– half-wave, full-wave and bridge rectifier circuits, rectifier with a filter capacitor, C-L-C filter, Clipping and Clamping Circuits– limiter circuit, the clamped capacitor, voltage doubler, Special Diode Types– UJT, Schottkybarrier diode, Varactor diode, photo diode, light emitting diode(LED), Problem Solving.
Bipolar Junction Transistors(BJTs): Physical Operation - simplified structure and modes of operation, Operation of the npn, and pnp transistors: cutoff, active, andsaturation modes, V-ICharacteristics- of different configurations - graphical representation of transistor characteristics, dependence of collector current on collector voltage, the Early Effect.

UNIT - III	**BJT Amplifiers**	

BJT circuits at DC,Applying the BJT in Amplifier Design- Voltage Amplifier,Voltage Transfer Characteristic (VTC), Small-Signal Voltage Gain, determining the VTC by Graphical Analysis, Q-point, Small-signal operation and models- the transconductance, input resistance at the base, input resistance at the emitter, Voltage gain, separating the Signal and the DC Quantities, The Hybrid-π Model, the T Model, Basic BJT Amplifier Configurations - Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, Biasing in BJT Amplifier Circuits- Fixed bias, Self bias, voltage divider bias circuits, biasing using a Constant-Current Source,CE amplifier – Small signal analysis and design,Transistor breakdown and Temperature Effects, Problem solving.

UNIT - IV	**MOSFET's**	

MOS Field-Effect Transistors (MOSFETs)**:**Introduction, Device Structure and Physical Operation – device structure, operation with zero gate voltage, creating a channel for current flow, operation for different drain to source voltages, the P-channel MOSFET,CMOS, V-I characteristics–i_D - v_{DS}characteristics, i_D – v_{GS}characteristics, finite output resistance in saturation, characteristics of the p-Channel MOSFET, MOSFET Circuits at DC, Applying the MOSFET in Amplifier Design – voltage transfer characteristics, biasing the MOSFET to obtain linear amplification, the small signal voltage gain, graphical analysis, the Q-point. Problem solving.

UNIT - V	**MOSFET Amplifiers**	

MOSFET Small Signal Operation Models– the dc bias, separating the DC analysis and the signal analysis, Small signal equivalent circuit models, the transconductance, the T equivalent circuit model, Basic MOSFET Amplifier Configurations– three basic configurations, characterizing amplifiers, common source(CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, the amplifier frequency response,Biasing in MOSFET Amplifier Circuits– biasing by fixing V_{GS} with and without source resistance, biasing using drain to gate feedback resistor, biasing using constant current source, Common Source Amplifier using MOSFETs – Small signal analysis and design, Body Effect, Problem Solving

Textbooks:

1. Adel. S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits," 6th Edition, Oxford University Press, 2011.
2. J. Millman, C Chalkias, "Integrated Electronics", 4thEdition, McGraw Hill Education (India) Private Ltd., 2015.
3. Millman and Taub, "Pulse,Digital and Switching Waveforms", 3rd Edition, Tata McGraw- Hill Education, 2011.

Reference Books:

1. Behzad Razavi, "Fundamentals of Micro Electronics", Wiley, 2010.
2. Donald A Neamen, "Electronic Circuits – Analysis and Design," 3rdEdition, McGraw Hill (India), 2019.
3. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory", 9th Edition, Pearson/Prentice Hall, 2006.
4. K.Lal Kishore, "Electronic Circuit Analysis", 2ndEdition, B S Publications, 2008.

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Electronics & Communication Engineering

Course Code	DIGITAL ELECTRONICS	L	T	P	C
		3	1	0	4
Minors in ECE					

Course Objectives:

- To familiarize with the concepts of different number systems and Boolean algebra.
- To introduce the design techniques of combinational, sequential logic circuits.
- To model combinational and sequential circuits using HDLs.

Course Outcomes (CO):

CO1: Understand the properties of Boolean algebra, other logic operations, and minimization of Boolean functions using Karnaugh map.
CO2: Make use of the concepts to solve the problems related to the logic circuits.
CO3: Analyze the combinational and sequential logic circuits.
CO4: Develop digital circuits using HDL, and Compare various Programmable logic devices
CO5: Design various logic circuits using Boolean algebra, combinational and sequential logic circuits.

UNIT - I	**Number Systems, Boolean algebra and Logic Gates**

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.

UNIT - II	**Minimization of Boolean functions and Combinational Logic Circuits**

The Karnaugh map method (up to five variables), product of sums simplifications, don't care conditions, Tabular method, Introduction, Combinational circuits, design procedure, adders, subtractors, 4-bit binary adder/ subtractor circuit, BCD adder, carry look- a-head adder, binary multiplier, magnitude comparator, decoders and encoders, multiplexers, demultiplexers,

UNIT - III	**Sequential Logic Circuits**

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

UNIT - IV	**Finite State Machines and Programmable Logic Devices**

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.

UNIT - V	**Hardware Description Language**

Types of PLD's: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs, Design of sequential circuits using ROMs, PLAs, CPLDs and FPGAs

Textbooks:

1. M. Morris Mano, "Digital Design", 3rd Edition, PHI. (Unit I to IV)
2. Stephen Brown and ZvonkoVranesic, "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. ZviKohavi 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", 2nd Edition, Prentice Hall PTR.
4. D.P. Leach, A.P. Malvino, "Digital Principles and Applications", TMH, 7th Edition.

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Electronics & Communication Engineering

Course Code	SIGNALS ANALYSIS	L	T	P	C
		3	1	0	4

Minors in ECE

Course Objectives:

- To introduce students to the basic idea of signal and system analysis and its characterization in time and frequency domains.
- To present Fourier tools through the analogy between vectors and signals.
- To teach concept of sampling and reconstruction of signals.
- To analyze characteristics of linear systems in time and frequency domains.
- To understand Laplace and z-transforms as mathematical tool to analyze continuous and discrete-time signals and systems.

Course Outcomes (CO):

CO1: Understand the mathematical description and representation of continuous-time and discrete-time signals and systems. Also understand the concepts of various transform techniques.
CO2: 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.
CO3: Analyze the frequency spectra of various continuous-time and discrete-time signals using different transform methods.
CO4: Classify the systems based on their properties and determine the response of them.

UNIT - I	**Signals and Systems**

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.

UNIT - II	**Fourier Series and Fourier Transform**

Fourier series: Trigonometric & Exponential, Properties of Fourier series, concept of discrete spectrum, Illustrative Problems.
Continuous Time Fourier Transform: Definition, Computation and properties of Fourier transform for different types of signals and systems, Inverse Fourier transform. Statement and proof of sampling theorem of low pass signals, Illustrative Problems.

UNIT - III	**Laplace Transform**

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.

UNIT - IV	**Signal Transmission through LTI systems**

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.

UNIT - V	**DTFT & Z-Transform**

Discrete Time Fourier Transform: Definition, Computation and properties of Discrete Time Fourier transform for different types of signals and systems.
Z–Transform: Definition, ROC, Properties, Poles and Zeros in Z-plane, The inverse Z-Transform, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions. Illustrative Problems.

Textbooks:
3. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, "Signals and Systems", 2nd Edition, PHI, 2009. 4. Simon Haykin and Van Veen, "Signals & Systems", 2nd Edition, Wiley, 2005.
Reference Books:
4. BP Lathi, "Principles of Linear Systems and Signals", 2nd Edition, Oxford University Press, 015. 5. Matthew Sadiku and Warsame H. Ali, "Signals and Systems A primer with MATLAB", CRC Press, 2016. 6. Hwei Hsu, "Schaum's Outline of Signals and Systems", 4thEdition, TMH, 2019.

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Electronics & Communication Engineering

Course Code	PRINCIPLES OF COMMUNICATION	L	T	P	C
		3	1	0	4

Minors in ECE

Course Objectives:

- To introduce various modulation and demodulation techniques of analog communication systems.
- To analyze different parameters of analog communication techniques.
- To Know Noise Figure in AM & FM receiver systems.

Course Outcomes (CO):

CO1: Recognize/List the basic terminology used in analog communication techniques for transmission of information/data.
CO2: Explain/Discuss the basic operation of different analog communication systems at baseband and passband level.
CO3: Analyze/Investigate the performance of different modulation & demodulation techniques to solve complex problems in the presence of noise.

UNIT - I **INTRODUCTION TO COMMNICATION SYSTEMS**

Communication process, Elements of Communication Systems; Modulation: Need for Modulation, Forms of Modulation: AM, FM, PM, Advantages,Disadvantages and Applications.

UNIT - II **AMPLITUDE MODULATION AND DEMODULATION**

Introduction,Mathematical Representation of AM, Modulation Factors, Percentage of Modulation, Power Relationships, Virtues and imitations of AM.DSB AM: Analog Message Conventions, AM Signals and Spectra, DSB signals and spectra.SSB AM: SSB Signals and Spectra, SSB generation, VSB Generation, Demodulation of AM, Square law detector

UNIT - III **FREQUENCY, PHASE MODULATION AND DEMODULATION**

FM:Introduction,Mathematical Representation of FM, Modulation Index, Deviation Sensitivity, Deviation Ratio, Bandwidth of FM (Carson's rule), Narrow band FM, Wide band FM, Voltage and Power for FM, Pre-emphasis and Deemphasis,Illustrative Problems.PM: Introduction, Narrow Band PM, Phase Modulation and Indirect FM; FM demodulators, Slope detector, Balanced slope discriminators, Phase difference discriminators, Ratio detector,PLL Detectors, Distortion and Transmission estimates

UNIT - IV **TRANSMITTERS AND RECEIVERS:**

AM Transmitters: Balanced Modulator, Square Law Modulator, and Product Modulator.
Receivers: Super Heterodyne Receiver, Double Conversion Receiver and Independent Sideband Receiver.FM Transmitters: Direct FM and VCO's, Mixer, Divider, Multiplier. Receivers: Local Oscillator, Slope Detector,Phase Locked Loop, Introduction to IC 565 applications, FM demodulator

UNIT - V **PULSE MODULATION TECHNIQUES**

Definition, Types: PAM, PWM, PPM, Sampling,Nyquist rate, Flat top sampling, Generation and Detection of PAM, PWM, PPM.

Textbooks:

1. A.Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", McGraw-Hill International Edition, 5th Edition, 2010.
2. "Electronic Communications systems" Modulation and Transmission-Robert Schoenbeck, UBS Publications, New Delhi.

Reference Books:

3. Simon Haykin, "Communication Systems", Wiley-India edition, 3rd edition, 2010
4. Sham Shanmugam, "Digital and Analog Communication Systems", Wiley-India edition, 2006.
5. B.P. Lathi, &Zhi Ding, "Modern Digital & Analog Communication Systems", Oxford University Press, International 4th edition, 2010.
6. Linear Integrated Circuits – D. Roy Chowdhury, New Age International (p) Ltd, 2nd Edition

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Electronics & Communication Engineering

Course Code	MICROPROCESSORS AND MICROCONTROLLERS APPLICATIONS	L	T	P	C
		3	1	0	4

Minors in ECE

Course Objectives:

- To introduce fundamental architectural concepts of Microprocessors and Microcontrollers.
- To impart knowledge on addressing modes and instruction set of 8086 and 8051
- To introduce assembly language programming concepts
- To explain memory and I/O interfacing with 8086 and 8051

Course Outcomes (CO):

- Distinguish between microprocessors & microcontrollers
- Develop assembly language programming
- Describe interfacing of 8086 with peripheral devices
- Design applications using microcontrollers

UNIT - I **8086 MICROPROCESSOR**:

Evaluation of microprocessors. Overview of 8085. Register organization of 8086,architecture, signal description of 8086, physical memory organization, general bus operations, I/O addressing capability, special processor activities, 8086-Minimum mode and maximum mode of operation, Timing diagram.

UNIT - II **8086 INSTRUCTION SET AND ASSEMBLER DIRECTIVES**:

Addressing modes of 8086, Instruction set of 8086, Assembler Directives and operators.8086 Assembly language programs involving logical,branch and call instructions, sorting, evaluation of arithmetic expressions, string manipulation.

UNIT - III **PROGRAMMABLE PERIPHERAL DEVICES AND THEIR INTERFACING**:

Memory interfacing to 8086 (static RAM and EPROM). 8255 PPI-various modes of operation and interfacing to 8086. D/A and A/D converter interfacing, Stepper motor interfacing. Interrupt structure of 8086, Vector interrupt table. Interrupt service routines.8259 PIC architecture and interfacing cascading of interrupt controller and its importance

UNIT - IV **8051 MICROCONTROLLER**:

Architecture of 8051 microcontroller. Pin Diagram of 8051, and external memories, counters and timers, serial communication, interrupts.

UNIT - V **-8051 ASSEMBLY LANGUAGE PROGRAMMING**:

Instruction set of 8051, Addressing modes of 8051,Assembly Language Programming examples using 8051.Interfacing to LCD,Keyboard,ADC& DAC.

Textbooks:

1. Microprocessor Architecture, Programming and Applications with8085 By Ramesh S Gaonkar.
2. Advanced microprocessor and peripherals-A.K. Ray and K.M.Bhurchandi, 2nd edition, TMH, 2000.
3. 8051 microcontroller and embedded systems by mazidi and mazidi ,pearson education 2000

Reference Books:

1. Microprocessors Interfacing-Douglas V.Hall, Revised 2nd edition, 2007.
2. The 8088 and 8086 Microprocessors- Walter A. Triebel, Avtar Singh, PHI, 4th Edition, 2003.
3. 8051 Microcontroller-Internals, Instructions, Programming and Interfacing by SubrataGhoshal,