JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY:: KAKINADA
UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ACADEMIC REGULATIONS (R20)

B.Tech FOUR YEAR DEGREE Programme

(*Applicable for the batches admitted from the **A.Y. 2020-21***)

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA(A)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

KAKINADA – 533003, ANDHRA PRADESH, INDIA

College: https://www.jntucek.ac.in/University :https://www.jntuk.edu.in/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY:: KAKINADA
UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ACADEMIC REGULATIONS (R20) FOR B. TECH. (REGULAR)

Applicable for the students of B. Tech. (Regular) from the Academic Year 2020-21 onwards

1. Award of B. Tech.Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfils the following academic regulations:

1. A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academicyears
2. Thecandidateshall registerfor160creditsandsecureallthe160credits.
3. A student will be eligible to get Under Graduate degree with ***Honors or additional Minor Engineering***, if he/she completes an additional 20 credits. These could be acquired through the courses recommended by the respective Board of Studies. To award Honors / Minor Engineering degree, student should not have any **backlog history**with otherrequirements.

2. Courses ofstudy

The following courses of study are offered at present as specializations for the B. Tech. Courses:

S. No	**Branch**
01	Civil Engineering
02	Electrical and Electronics Engineering
03	Mechanical Engineering
04	Electronics and Communication Engineering
05	Computer Science and Engineering
06	Petroleum Engineering
07	Chemical Engineering

3. Distribution and Weightage ofMarks

(i) The performance of a student in each semester shall be evaluated subject – wise with a maximum of **100 marks for theory and practical subject/courses**. The project work shall be evaluated for 200marks.

(ii) For theory subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End -Examinations.

(iii) For theory subjects, during the semester there shall be 2 tests/assessments. The weightage of Internal marks for 30 consists of Descriptive – 15, Assignment - 05 (Theory,Design,Analysis,Simulation,Algorithms,Drawing,etc.asthecasemaybeandfor Physics Virtual Labs to be consider as Assignments) Objective -10. The objective examinationisfor20minutesduration.Thesubjectiveexaminationisfor90minutes duration conducted for 15 marks. Each subjective type test question paper shall contain **3 questions** and all questions need to be answered. The Objective examination conducted for 10 marks and subjective examination conducted for 15 marks are to be added to the assignment marks of 5 for finalizing internal marksfor 30. **Internal Marks** can be calculated with 80% weightage for best of the two Mids and20% weightage for other Mid Exam. ***As the syllabus is framed for5 units, the 1st mid examination (both Objective and Subjective) is conducted in 1-2½ units and second test in 2½-5 units of each subject in asemester***.

(iv) Thesemesterendexamination/assessmentisconductedcoveringthetopicsofallUnits for 70 marks. **End Exam Paper containing FIVE mandatory questions** (one question from one unit) with internal choice, each carrying 14 marks gives for 70 marks.

(v) For **practical courses there shall be continuous evaluation during the semester for 30 internal marks and 70 end examination marks**. The internal 30 marks shall be awarded as follows: day to day work and record-10 marks and the remaining 20 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examineras follows:

	Procedure	*Experimentation*	*Result*	*Viva-voce*	*Total*
Marks	15	30	10	15	70

(vi) For the courses / subjects having design and / or drawing (such as Engineering Graphics, Engineering Drawing, Machine Drawing), *Computer Workshop* and estimation, the distribution shall be 30 marks for internal evaluation (20 marks for day-to-day work, and 10 marks for internal tests) and 70 marks for end examination. *There shall be two internal tests in a Semester and the Marks for 10 can be calculated with 80% weightage for best of the two tests and 20% weightage for other test and these are to be added to the marks obtained in day to day work*. SEE Question paper pattern also reflects the course handled procedure and different with regularcourse

(vii) For the seminar, each student has to be evaluated based on the presentationof any latest topic with report of 10-15 pages and a presentation (viz., ppt or any of min 10 slides). The student shall collect the information on a specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the department, which shall be evaluated by the Departmental committee consisting of Head of the department, seminar supervisor and a senior faculty member. *The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar*.

(viii) There shall be 05 skill-oriented courses (*maximum of 2 credits each*) 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. 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 concernedBoS

(ix) Students shall undergo *mandatory summer internships* for a minimum of six weeks duration at the end of second and third year of the Programme. *Evaluation ofthe 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% weightagesrespectively

(x) In the final semester, the student should mandatorily undergo internship (*full internship in the final semester*) and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. *A student shall also be permittedto submit project report on the work carried out during the internship*. The project report shall be evaluated with an external examiner

(xi) Out of a total of 200 marks for the project work, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination. The End Semester Examination (Viva-Voce) shall be conducted by the committee. *The committee consists of an external examiner, Head of the Department and Supervisor of the Project*. The evaluation of project work shall be conducted at the end of the IV year. *The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project and evaluated by an internal committee*.

4. AttendanceRequirements

1. A student is eligible to write the External examinations if he acquires a minimum of 75% of attendance in aggregate of all thesubjects.
2. 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, ***and one is eligible for condonation a maximum of THREE times during the entire coursework*.**
3. Shortage of Attendance below 65% in aggregateshall not be condoned.
4. A student who is short of attendance in semester may seek re-admission into that semester when offered within 4 weeks from the date of the commencement of class work.
5. Students whose shortage of attendance is not condoned in any semester are not eligibletowritetheirendsemesterexaminationofthatclass.
6. A stipulated fee shall be payable towards condonation of shortage of attendance.
(a) AstudentiseligibletowritetheUniversityexaminationsifheacquiresaminimumof 50% **in each subject/course including laboratories** and 75% of attendance in aggregate of all thesubjects.
7. A student will be promoted to the next semester if he satisfies the (i) attendance requirement ofthepresentsemesterand(ii)minimumrequiredcredits.
8. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the sameclass.

5. Minimum AcademicRequirements

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.4.

5.1 A student is deemed to have satisfied the minimum academic requirements if he has **earned the credits allotted to each theory/practical design/drawing subject/project and securesnotlessthan35%ofmarksintheendsemesterexam,andminimum40%of marksinthesumtotaloftheinternalmarksandendsemesterexaminationmarks.**

5.2 A student shall be promoted from first year to second year if he fulfills the minimum attendancerequirement.

5.3 Astudent willbe**promotedfromIIyeartoIIIyear**ifhefulfillstheacademicrequirement **of 50% of the credits from all the examinations up to II year I semester (i.e., including).**

5.4 A student shall be **promoted from III year to IV year** if he fulfils the academic requirements of **50% of the credits from all the examinations up to III year I semester (i.e.,including).**

5.5**A student shall register and put up minimum attendance in all 160 credits and earn all 160credits.**

6. CoursePattern

1. The entire course of study is for four academic years,all the years are on semester pattern.
2. A student eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conductednext.
3. When a student is detained for lack of credits / shortage of attendance, he may be re- admitted into the same semester / year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable tohim.

4. Gap Year – concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I year/II year/III year to pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at university level shall be constituted to evaluate the proposal submitted by the student and the committeeshalldecideonpermittingthestudentforavailingtheGapYear.

7. Cumulative Grade Point Average(CGPA)

After each subject is evaluated for 100 marks, the marks obtained in each subject will be convertedtoacorrespondinglettergradeasgivenbelow,dependingontherangeinwhichthe marks obtained by the studentfall

Marks Range	**Level**	**Letter Grade**	**Grade Point**
≥ 90	Outstanding	A+	10
80-89	Excellent	A	9
70-79	Very Good	B	8
60-69	Good	C	7
50-59	Fair	D	6
40-49	Satisfactory	E	5
< 40	Fail	F	0
-	Absent	Ab	0

Computation of SGPA

The following procedure is to be adopted to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average(CGPA):

The **SGPA** is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

$$SGPA\ (Si) = \sum (Ci\ X\ Gi) / \sum Ci$$

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

Computation of CGPA

The **CGPA** is also calculated in the same manner taking into account all the courses undergone by a student over all the semester of a programme, i.e.

$$CGPA = \sum (Ci\ X\ Si) / \sum Ci$$

Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester. The SGPA and CGPA shall be rounded off to TWO decimal points and reported in the transcripts. While computing the SGPA/CGPA, the subjects in which the student is awarded Zero grade points will also beincluded

Conversion of CGPA into equivalent percentage as follows:

Equivalent Percentage = (CGPA –0.75) x 10 (as per AICTE)

8. ward ofClass

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 to be Secured**	
First Class with Distinction	≥ 7.5 without backlog history	From the CGPA secured from 160 Credits.
First Class	≥ 6.5 < 7.5 without backlog history ≥ 6.5 with backlog history	
Second Class	≥ 5.5 < 6.5	
Pass Class	≥ 4.0 < 5.5	

9. ***Honors Degree***: A student should complete an **additional 20 credits**by doing Board of Studies recommended courses and meet criteria asfollows:
   i. A student shall be permitted to register for Honors program at the beginning of 3rd / 4th semester provided that the student must have acquired a minimumof 8.0 SGPA upto the end of 2nd semester without any **backlog history**. In case of the declaration of the 3rdsemester results after the commencement of the 4thsemester and if a student fails to score the required minimum of 8.0 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regularProgramme.
   ii. 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 MechanicalEngineering.
   iii. 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. 160credits).
   iv. Of the 20 additional Credits to be acquired, 16/15 credits shall be earned by undergoing specified courses listed as pools, with four/five courses, each carrying 4/3 credits. The remaining 4/5 credits must be acquired through two MOOCs, which shall be domain specific, with 2/3 credits and with a minimum duration of 8/12weeks as recommended by the Board ofstudies.
   v. 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 advancedcourses
   vi. 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 MOOC courses as approved by the concerned Head of the department in consultation withBoS**.
   vii. 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 dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in thetranscript.
   viii. 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 bythem.
   ix. Honors must be completed simultaneously with a major degree program. A studentcannotearnHonorsafterhe/shehasalreadyearnedbachelor'sdegree.

10. ***Minor Engineering***: A student should complete an **additional 20 credits**by doing respective Board of Studies recommended courses and asfollows:
   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 bya 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 CivilEngineering
   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 tracketc.

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, VLSIetc.

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

v. There shall be no limit on the number of programs offered under Minor, 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 theprogram.

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 MOOC courses 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 3rd / 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) upto the end of 2ndsemester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4thsemester. *If a student fails to acquire 8 SGPA upto 3rdsemester or failed in any of the courses, his registration for Minors program shall stand cancelled*. An SGPA of 8.0 has to be maintained in the subsequent semesters without any backlogs 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. 160credits).

ix. Of the 20 additional Credits to be acquired, 16/15 credits shall be earned by undergoing specified courses listed as pools, with four/five courses, each carrying 4/3 credits. The remaining 4/5 credits must be acquired through two MOOCs, which shall be domain specific, with 2/3 credits and with a minimum duration of 8/12weeks as recommended by the Board ofstudies.

x. 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. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academiccouncil.

xi. 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 thetranscript.

xii. 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 withMinors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed bythem.

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

11. Minimum Instruction Days: The minimum instruction days for each semester shall be 90 workingdays.

12. Thereshallbenobranchtransfersafterthecompletionoftheadmissionprocess.

13. ThereshallbenotransferfromonecollegeorstreamtoanotherwithintheConstituentColleges and Units of Jawaharlal Nehru Technological UniversityKakinada.

14. WITHHOLDING OFRESULTS

If the student has not paid the dues, if any, to the university or if any case of indiscipline is pendingagainst him,theresult ofthestudentwillbewithheld.Hisdegreewillbewithheldin suchcases.

15. TRANSITORYREGULATIONS

1. Discontinued or detained candidates are eligible for readmission as and when next offered.
2. The readmitted students will be governed by the regulations under which the candidate has been admitted or as per University/Institutenorms.

16. General

1. Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her","hers".
2. The academic regulation should be read as a whole for the purpose of any interpretation.
3. In case of any doubt or ambiguity in the interpretation of the above rules, University R20regulationscanbefollowedand/orthedecisionoftheVice-Chancellorisfinal.
4. The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by theUniversity.

ACADEMIC REGULATIONS (R20) FOR B. TECH. (LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. from the Academic Year **2020-21**onwards

1 Award of B. Tech.Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfils the following academic regulations:

1.1 A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course ofstudy in not less than three academic years and not more than six academicyears.

1.2 The candidate shall register for**121 CREDITS**and secure all thecredits.

2. TheattendanceregulationsofB.Tech.(Regular)shallbeapplicabletoB.Tech.

3. **PromotionRule**

A student shall be promoted from second year to third year if he fulfills the minimum attendancerequirement.

A student shall be promoted from III year to IV year if he fulfils the academic requirements of 50% of the credits from all the examinations up to III year I semester.

4. **Award ofClass**

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

Class Awarded	CGPA to be Secured	
First Class with Distinction	≥ 7.5 without backlog history	From the CGPA secured from 121 Credits from IIYear to IVYear
First Class	≥ 6.5 < 7.5 without backlog history ≥ 6.5 with backlog history	
Second Class	≥ 5.5 < 6.5	
Pass Class	≥ 4.0 < 5.5	

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5. All the other regulations as applicable to **B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral EntryScheme)**.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	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.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and 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 two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the

		course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his 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. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges 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. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.

10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
   - (i) A show cause notice shall be issued to the college.
   - **(ii)** Impose a suitable fine on the college.
   - **(iii)** Shifting the examination centre from the college to another college for a specific period of not less than one year.

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Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	2 Years		Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months		Rs. 50,000/-

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ABSOLUTELY NO TO RAGGING

1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.

2. Ragging entails heavy fines and/or imprisonment.

3. Ragging invokes suspension and dismissal from the College.

4. Outsiders are prohibited from entering the College and Hostel without permission.

5. Girl students must be in their hostel rooms by 7.00 p.m.

6. All the students must carry their Identity Cards and show them when demanded

7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.

Jawaharlal Nehru Technological University Kakinada

For Constituent Colleges and Affiliated Colleges of JNTUK

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

VISION
MISSION
PROGRAM EDUCATIONAL OBJECTIVES

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY:: KAKINADA
UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Vision:

To remain a symbol of pride in the fields of Electronics and Communication Engineering by producing holistic and diligent Engineers for industrial and societal needs.

Mission:

1. To produce high quality learners who are globally competitive and professionally challenged in the field of electronics and communication engineering.
2. To offer educational programmes that imparts inventive knowledge with high levels of ethical and human values.
3. To provide a platform to acquire and implement innovative ideas in research and development.
4. To build up the state of art laboratories and centres of excellence in different areas of electronics and communication engineering.
5. To train the students and faculty to update their knowledge in pioneering technologies to meet industrial requirements.

Program Educational Objectives:

PEO 1	Do extremely well in professional career and higher education by attaining knowledge in mathematical, computing and engineering principles.
PEO 2	Analyze real life problems, design systems appropriate to its solutions in the field of electronics and communication engineering that ate technically sound, economically feasible and socially acceptable.
PEO 3	Possess good communication skills and ethical attitude with ability to work in teams and adapt to current trends by engaging in lifelong learning.

PROGRAM OUTCOMES

PO1: Engineering knowledge: Apply the knowledge of Mathematics, Science, Engineering Fundamentals, and an Engineering Specialization to the solution of Complex Engineering Problems.

PO2: Problem analysis: Identify, Formulate, Review Research Literature, and analyze complex Engineering Problems reaching substantiated conclusions using first principles of Mathematics, Natural Sciences, and Engineering Sciences

PO3: Design/development of solutions: Design solutions for complex Engineering Problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, Societal, and Environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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PROGRAM SPECIFIC OUTCOMES

PSO1 :To improve the quality of human existence, analyse and create electronic electrical circuits and communication systems.

PSO2: To develop cutting-edge, environmentally mindful technologies to ensure human survival.

PSO3:To train students for the design and testing of Electronic systems devices.

PSO4:To analyze, design, simulate and implement computer hardware / software and use basic analog/digital circuits, VLSI design electronic systems for various computing and communication system. Intra and inter disciplinary applications

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R20 COURSE STRUCTURE

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I B.Tech I Semester

S.No	Course Name	Category	L	T	P	Credits
1	Mathematics - I	BSC	3	0	0	3
2	Applied Chemistry	BSC	3	0	0	3
3	Communicative English	HSMC	3	0	0	3
4	Programming For Problem Solving Using C	ESC	3	0	0	3
5	Network Analysis	ESC	3	0	0	3
6	English Communications Skills Lab	HSMC	0	0	3	1.5
7	Applied Chemistry Lab	BSC	0	0	3	1.5
8	Programming For Problem Solving using C LAB	ESC	0	0	3	1.5
9	Physical Fitness Activities	MC	0	0	2	0
		Total				19.5

I B.Tech II Semester

S.No	Course Name	Category	L	T	P	Credits
1	Mathematics – II	BSC	3	0	0	3
2	Applied Physics	BSC	3	0	0	3
3	Object Oriented Design &Programming using java	ESC	3	0	0	3
4	Engineering Drawing	ESC	3	0	0	3
5	Basic Electrical Engineering	ESC	3	0	0	3
6	Electronic workshop Lab	ESC	0	0	3	1.5
7	Applied Physics Laboratory	BSC	0	0	3	1.5
8	Basic Electrical Engineering lab	ESC	0	0	3	1.5
9	Applied Physics Virtual Laboratory	BSC	0	0	2	0
10	Constitution of India	MC	2	0	0	0
11	Engineering Exploration Project- Design Thinking	MC	0	0	1	0
		Total				19.5

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II B.Tech I Semester

S.No	Course Name	Category	L	T	P	Credits
1	Mathematics III	BS	3	0	0	3
2	Electronics Devices and Circuits	BS	3	0	0	3
3	Switching Theory and Logic Design	HS	3	0	0	3
4	Signals and Systems	ES	3	0	0	3
5	Random Variables and Stochastic Process	ES	3	0	0	3
6	Electronics Devices and Circuits - Lab	HS	0	0	3	1.5
7	Switching Theory and Logic Design - Lab	BS	0	0	3	1.5
8	Object Oriented Design & Programming using Java lab	ES	0	0	3	1.5
9	Skill oriented course*		1	0	2	2
10	Indian Traditional Knowledge		2	0	0	0
		Total				21.5

.

SKILL ORIENTED COURSES
Python Programming.

II B.Tech II Semester

S.No	Course Name	Category	L	T	P	Credits
1	Mathematics -4	BS	3	0	0	3
2	Linear I C Applications	ES	3	0	0	3
3	Electronics Circuit Analysis	PC	3	0	0	3
4	Analog Communications	PC	3	0	0	3
5	Managerial Economics & Financial Analysis	HS	3	0	0	3
6	Linear I C Applications Lab	ES	0	0	3	1.5
7	Analog Communications - Lab	PC	0	0	3	1.5
8	Electronics Circuit Analysis - Lab	PC	0	0	3	1.5
9	Skill oriented course*		1	0	2	2
		Total				21.5
Internship 2 Months (Mandatory) during summer vacation						
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			**4**	**0**	**0**	**4**

Honor Courses	Minor Courses	Skill Oriented Course
Artificial Neural Networks	Electronics Devices and Circuits	Scientific Computing
Nano Electronics	Signals and Systems	

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III B.Tech I Semester

S No	**Course Name**	Category	**L**	**T**	**P**	Credits
1	Digital I C Applications	PC	3	0	0	3
2	Micro Processors & Micro Controllers	PC	3	0	0	3
3	Electromagnetic Waves and Transmission Lines	PC	3	0	0	3
4	Professional Elective courses (PE1)	PE	3	0	0	3
5	Open Elective (OE1)	OE	2	0	2	3
6	Microprocessor and Microcontrollers - Lab	LC	0	0	3	1.5
7	Digital I C Applications Lab	LC	0	0	3	1.5
8	Skill advanced course/ soft skill course*		**1**	**0**	**2**	**2**
9	Environmental Science	MC	2	0	0	0
Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester			0	0	0	1.5
		Total credits				21.5
	Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)	MC	4	0	0	4

PE1: 1.Control Systems 2.Electronic Measurements and Instrumentation 3.Intetnet of Things	**OE1:** 1.Principles of Electronics 2.EMI/EMC 3.Principles of Communications	**HONOR COURSES** 1.Computer Networks 2.Artificial Intelligence
SKILL ADVANCED COURSES 1.SCILAB 2.Machine learning using Scikit		**MINOR COURSES** 1.Switching Theory and Logic Design 2.Analog Communications

III B.Tech II Sem

S.No	**Course Name**	Category	L	T	P	Credits
1	VLSI Design	PC	3	0	0	3
2	Digital Signal Processing	PC	3	0	0	3
3	Digital Communications	PC	3	0	0	3
4	Professional Elective courses(PE2)	PE	3	0	0	3
5	Open Elective (OE2)	OE	2	0	2	3
6	VLSI Design Lab	LC	0	0	3	1.5
7	Digital Signal Processing Lab	LC	0	0	3	1.5
8	Digital Communications Lab	LC	0	0	3	1.5
9	Skill advanced course/ soft skill course*		**1**	**0**	**2**	**2**
10	Research Methodology	MC	2	0	0	0
Total credits						**21.5**
	Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)		**4**	0	0	**4**
Industrial/Research Internship (Mandatory) 2 Months during summer vacation						

PE2: 1.Antenna and Wave Propagation 2.Computer Architecture and Organization 3.Soft computing techniques	**OE2:** 1.Biomedical Instrumentation 2.Electronic Measurements and Instrumentation 3.Display Devices	**HONOR COURSES** 1.Machine Learning 2.Digital Control Systems	**MINOR COURSES** 1.Electronic Circuits 2.Linear Integrated Circuits

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IV B.Tech ISemester

S.No	**Course Name**	Category	L	T	P	Credits
1	Professional Elective courses(PE3)	PE	3	0	0	3
2	Professional Elective courses(PE4)	PE	3	0	0	3
3	Professional Elective courses(PE5)	PE	3	0	0	3
4	Open Elective (OE3)	OE	2	0	2	3
5	Open Elective (OE4)	OE	2	0	2	3
6.	Universal Human Values 2: Understanding Harmony	MC	3	0	0	3
7.	Skill advanced course/ soft skill course*		1	0	2	2
Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester			0	0	0	3
					Total credits	**23**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)			**4**		**0**	**4**

***There is a provision for the Universities/Institutions to implement AICTE mandatory course "Universal Human Values 2: Understanding Harmony" under Humanities and social science Elective in seventh semester for 3 credits.**

PE3: 1.Analog IC Design 2.Microwave Engineering 3.Information Theory & Coding	OE3: 1.VLSI Technology 2.Software Defined Radio 3.Biomedical signal processing	SKILL ADVANCED COURSES/ SOFT SKILL COURSES 1.Introduction to Data Analytics 2.Interfacing with Arduino
PE4: 1.Data Communications & Computer Networks 2.Low power VLSI Design 3.Digital Image Processing	OE4: 1.Principles of Sensors 2. Consumer Electronics 3.Basics of IC Technology	Minor Courses 1.Digital Signal Processing 2.Digital Communications
PE5: 1.DSP processors and Architectures 2.Radar Engineering 3.Embedded Systems	HONOR COURSES 1.Pattern Recognition 2.Image and Video Processing	

IV B.Tech II semester

S.No.	Category	Code	Course Title	Hours per week			Credits
1	Major Project	PROJ	Project Project work, seminar and internship in industry	-	-	-	12
	INTERNSHIP (6 MONTHS)						
			Total credits				**12**

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DETAILED SYLLABUS

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I YEAR I SEM

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I B.Tech I Semester

MATHEMATICS-I (Calculus)

(Common to ALL branches of First Year B.Tech.)

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

- utilize mean value theorems to real life problems (L3)
- solve the differential equations related to various engineering fields (L3)
- familiarize with functions of several variables which is useful in optimization (L3)
- apply double integration techniques in evaluating areas bounded by region (L3)
- students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional coordinate systems (L5)
- conclude the use of special function in multiple integrals (L4)

UNIT – I: Sequences, Series and Mean value theorems: (10 hrs)

Sequences and Series: Convergences and divergence – Ratio test – Comparison tests – Integral test – Cauchy's root test – Alternate series – Leibnitz's rule.

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

UNIT – II: Differential equations of first order and first degree: (10 hrs)

Linear differential equations – Bernoulli's equations – Exact equations and equations reducible to exact form – Homogeneous and Non-homogeneous differential equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, sin ax, cos ax, polynomials in x^n, $e^{ax}V(x)$ and $x^nV(x)$ – Method of Variation of parameters – Euler-Cauchy equation and Legender's equation.
Applications: Orthogonal trajectories – Electrical circuits (RL, RC, RLC) – Simple Harmonic motion.

UNIT – III: Partial differentiation: (10 hrs)

Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain rule – Jacobian – Functional dependence – Taylor's and MacLaurin's series expansion of functions of two variables.
Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

UNIT – IV: Multiple integrals: (8 hrs)

Double integrals – Change of order of integration – Double integrals in polar coordinates – Change of variables to polar coordinates – Areas enclosed by plane curves – Triple integrals – Volume of solids – Change of variables to spherical and cylindrical co-ordinates.

UNIT – V: Beta and Gamma functions: (5 hrs)

Introduction to Improper Integrals –Beta and Gamma functions – Properties – Relation between Beta and Gamma functions – Evaluation of improper integrals.

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B. V. Ramana,**Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig,**Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Joel Hass, Christopher Heil and Maurice D. Weir,** Thomas calculus, 14th Edition, Pearson.
3. **Lawrence Turyn,**Advanced Engineering Mathematics, CRC Press, 2013.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.

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I B.Tech I Semester

APPLIED CHEMISTRY

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

COURSE OBJECTIVES

- ***Importance*** of usage of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
- ***Outline*** the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.
- ***Explain*** the preparation of semiconductors and nanomaterials, engineering applications of nanomaterials, superconductors and liquid crystals.
- ***Recall*** the increase in demand for power and hence alternative sources of power are studied due to depleting sources of fossil fuels. Advanced instrumental techniques are introduced.
- ***Outline*** the basics of computational chemistry and molecular switches

UNIT I: POLYMER TECHNOLOGY 8 hrs

Polymerisation:-Introduction, methods of polymerization (emulsion and suspension), mechanical properties.

Plastics: Compounding, fabrication (compression, injection, blown film and extrusion), preparation, properties and applications (PVC, polycarbonates and Bakelite), mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste (waste to wealth).

Elastomers:- Introduction, preparation, properties and applications (Buna S, thiokol and polyurethanes).

Composite materials: Fiber reinforced plastics, conducting polymers, biodegradable polymers, biopolymers, biomedical polymers.

Course Outcomes: ***At the end of this unit, the students will be able to***

- ***Analyze*** the different types of composite plastic materials and ***interpret***the mechanism of conduction in conducting polymers.

UNIT II: ELECTROCHEMICAL CELLS AND CORROSION 10 hrs

Single electrode potential, electrochemical series and uses of series, standard hydrogen electrode, calomel electrode, construction of glass electrode, batteries (Dry cell, Li ion battery and zinc air cells), fuel cells (H_2-O_2, CH_3OH-O_2, phosphoric acid and molten carbonate).

Corrosion:-Definition, theories of corrosion (chemical and electrochemical), galvanic corrosion, differential aeration corrosion, stress corrosion, galvanic series, factors influencing rate of corrosion, corrosion control (proper designing and cathodic protection), Protective coatings (surface preparation, cathodic coatings, anodic coatings, electroplating and electroless plating [nickel]), Paints (constituents, functions and special paints).

Course Outcomes: ***At the end of this unit, the students will be able to***

- ***Utilize*** the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and c***ategorize*** the reasons for corrosion and study methods to control corrosion.

UNIT III: MATERIAL CHEMISTRY **10 hrs**

Part I ***: Non-elementalsemiconducting materials****:-* Stoichiometric, controlled valency & chalcogen photo/semiconductors-preparation of semiconductors (distillation, zone refining, Czochralski crystal pulling, epitaxy, diffusion, ion implantation) - Semiconductor devices (p-n junction diode as rectifier, junction transistor).

Insulators &magnetic materials: electrical insulators - ferro and ferri magnetism-Hall effect and its applications.

Part II:

Nano materials:- Introduction, sol-gel method, characterization by (Brunauer Emmet Teller [BET]), (scanning electron microscopy [SEM]) and (transmission electron microscopy [TEM]), applications of graphene and fullerenes, carbon nanotubes (types, preparation and applications)

Liquid crystals:- Introduction-types-applications.

Super conductors:-Type –I, Type II-characteristics and applications

Course Outcomes: ***At the end of this unit, the students will be able to***

- ***Synthesize*** nanomaterials for modern advances of engineering technology.
- ***Summarize the*** preparation of semiconductors; analyze the applications of liquid crystals and superconductors.

UNIT IV:SPECTROSCOPIC TECHNIQUES &NON-CONVENTIONAL ENERGY SOURCES **10 hrs**

Part A: **SPECTROSCOPIC TECHNIQUES**

Electromagnetic spectrum-UV (laws of absorption, instrumentation, theory of electronic spectroscopy, Frank-condon principle, chromophores and auxochromes, intensity shifts, applications), FT-IR [instrumentation and differentiation of sp, sp^2, sp^3 and IR stretching of functional groups (alcohols, carbonyls, amines) applications], magnetic resonance imaging and CT scan (procedure & applications).

Part B*:* NON-CONVENTIONAL ENERGY SOURCES

Design, working, schematic diagram, advantages and disadvantages of photovoltaic cell, hydropower, geothermal power, tidal and wave power, ocean thermal energy conversion.

Course Outcomes: ***At the end of this unit, the students will be able to***

- ***Analyze*** the principles of different analytical instruments and their applications.
- ***Design*** models for energy by different natural sources.

UNIT V: ADVANCED CONCEPTS/TOPICS IN CHEMISTRY **8 hrs**

Computational chemistry: Introduction to computational chemistry, Ab-initio studies, molecular modelling and docking studies

Molecular switches**:** characteristics of molecular motors and machines, Rotaxanes and Catenanes as artificial molecular machines, prototypes – linear motions in rotaxanes, an acid-base controlled molecular shuttle, a molecular elevator, an autonomous light-powered molecular motor

Course Outcomes: ***At the end of this unit, the students will be able to***

- ***Obtain*** the knowledge of computational chemistry and molecular machines

Standard Books:

1. P.C. Jain and M. Jain "**Engineering Chemistry**", 15/e, Dhanpat Rai & Sons, Delhi, (Latest edition).
2. Shikha Agarwal, "**Engineering Chemistry**", Cambridge University Press, New Delhi, (2019).
3. S.S. Dara, "**A Textbook of Engineering Chemistry**", S.Chand & Co, (2010).
4. Shashi Chawla, "Engineering Chemistry", Dhanpat Rai Publicating Co. (Latest edition).

Reference:

1. K. Sesha Maheshwaramma and Mridula Chugh, "**Engineering Chemistry**", Pearson India Edn.
2. O.G. Palana, "**Engineering Chemistry**", Tata McGraw Hill Education Private Limited, (2009).
3. CNR Rao and JM Honig (Eds) "**Preparation and characterization of materials**" Academic press, New York (latest edition)
4. B. S. Murthy, P. Shankar and others, "**Textbook of Nanoscience and Nanotechnology**", University press (latest edition)

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I B.Tech I Semester

Communicative English

L	T	P	C
3	0	0	3

Introduction

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

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

Learning Outcomes

At the end of the module, the learners will be able to

- understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- form sentences using proper grammatical structures and correct word forms

Unit 1:

Lesson-1: A Drawer full of happiness from "**Infotech English**", Maruthi Publications
Lesson-2: Deliverance by Premchand from "**The Individual Society",** Pearson Publications. (Non-detailed)

Listening: Listening to short audio texts and identifying the topic.Listening to prose, prose and conversation.

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

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

Reading for Writing: Paragraph writing (specific topics) using suitable cohesive devices; linkers, sign posts and transition signals; mechanics of writing - punctuation, capital letters.

Vocabulary: Technical vocabulary from across technical branches (20) GRE Vocabulary (20) (Antonyms and Synonyms, Word applications) Verbal reasoning and sequencing of words.

Grammar: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural basic sentence structures; simple question form - wh-questions; word order in sentences.

Pronunciation: Vowels, Consonants, Plural markers and their realizations

Unit 2:

Lesson-1: Nehru's letter to his daughter Indira on her birthday from "**Infotech English**", Maruthi Publications

Lesson-2: Bosom Friend by Hira Bansode from "**The Individual Society",** Pearson Publications. (Non-detailed)

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts, both in speaking and writing.

Speaking: Discussion in pairs/ small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings.**Reading**: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary Anlogies (20 words) (Antonyms and Synonyms, Word applications)

Grammar: Use of articles and zero article; prepositions.

Pronunciation: Past tense markers, word stress-di-syllabic words

Unit 3:

Lesson-1: Stephen Hawking-Positivity 'Benchmark' from "**Infotech English**", Maruthi Publications

Lesson-2: Shakespeare's Sister by Virginia Woolf from "**The Individual Society",** Pearson Publications. (Non-detailed**)**

Listening: Listening for global comprehension and summarizing what is listened to, both in speaking and writing.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed. Functional English: Complaining and Apologizing.

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Critical reading.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. Letter writing-types, format and principles of letter writing. E-mail etiquette, Writing CV's.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Association, sequencing of words

Grammar: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

Pronunciation: word stress-poly-syllabic words.

Unit 4:

Lesson-1: Liking a Tree, Unbowed: Wangari Maathai-biography from "**Infotech English**", Maruthi Publications

Lesson-2: Telephone Conversation-Wole Soyinka from "**The Individual Society",** Pearson Publications**.** (Non-detailed)

Listening: Making predictions while listening to conversations/ transactional dialogues without video (only audio); listening to audio-visual texts.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Functional English: Permissions, Requesting, Inviting.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicative process or display complicated data.

Reading for Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. Writing SOP, writing for media.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Cloze Encounters.

Grammar: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

Pronunciation: Contrastive Stress

Unit 5:

Lesson-1: Stay Hungry-Stay foolish from "**Infotech English**", Maruthi Publications

Lesson-2: Still I Rise by Maya Angelou from "**The Individual Society",** Pearson Publications. (Non-detailed)

Listening: Identifying key terms, understanding concepts and interpreting the concepts both in speaking and writing.

Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. Functional English: Suggesting/Opinion giving.

Reading: Reading for comprehension. RAP Strategy Intensive reading and Extensive reading techniques.

Reading for Writing: Writing academic proposals- writing research articles: format and style.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Coherence, matching emotions.

Grammar: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Pronunciation: Stress in compound words

Prescribed text books for theory for Semester-I:

1. "**Infotech English**", Maruthi Publications. (Detailed)
2. "**The Individual Society",** Pearson Publications. (Non-detailed)

Prescribed text book for Laboratory for Semesters-I & II:

1. "**Infotech English**", Maruthi Publications. (with Compact Disc)

Reference Books

- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
- Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2).* CUP, 2012.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY:: KAKINADA
UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

I Year - I Semester

L	T	P	C
3	0	0	3

PROGRAMMING FOR PROBLEM SOLVING USING C

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

		Knowledge Level (K)#
CO1	To write algorithms and to draw flowcharts for solving problems	K2
CO2	To convert flowcharts/algorithms to C Programs, compile and debug programs	K2
CO3	To use different operators, data types and write programs that use two-way/ multi-way selection	K4
CO4	To select the best loop construct for a given problem	K1
CO5	To design and implement programs to analyze the different pointer applications	K1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**											**M**				
CO2				**M**									**M**			
CO3														**H**	**H**	
CO4		**M**									**L**					**L**
CO5					**H**											

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction to Computers:** Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers, **Introduction to the C Language:** Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers. Pre-Processor Statements, Header Files **Structure of a C Program:** Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.	12
UNIT - 2	**Bitwise Operators:** Exact Size Integer Types, Logical Bitwise Operators, Shift Operators. **Selection & Making Decisions:** Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions **Repetition:** Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, and Programming Examples.	12
UNIT - 3	**Arrays:** Concepts, Using Array in C, Array Application,Two Dimensional Arrays,Multidimensional Arrays, Programming Example – Calculate Averages **Strings:** String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code **Enumerated, Structure, and Union:** The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application **Pointers:** Introduction, Pointers to pointers, Compatibility, L value and R value	12

UNIT - 4	**Pointer Applications:** Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application **Processor Commands**: Processor Commands	12
UNIT - 5	**Functions:** Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers toFunctions, Recursion **Text Input / Output:** Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions **Binary Input / Output:** Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.	12
	Total	60

Text Books:

1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE
2. The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson

Reference Books:

1. Computer Fundamentals and Programming, Sumithabha Das, McGraw Hill
2. Programming in C, Ashok N. Kamthane, AmitKamthane, Pearson
3. Computer Fundamentals and Programming in C, PradipDey, ManasGhosh, OXFORD

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

I Year - I Semester

L	T	P	C
3	0	0	3

NETWORK ANALYSIS

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

		Knowledge Level (K)#
CO1	Gain the knowledge on basic network elements	K5
CO2	Will analyze the RLC circuits behavior in detailed	K3
CO3	Analyze the performance of periodic waveforms	K3
CO4	Gain the knowledge in characteristics of two port network parameters (Z, Y, ABCD, h & g).	K5
CO5	Analyze the filter design concepts in real world applications	K3

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	L															
CO2				M									M			
CO3	M		M											H	H	
CO4		M														L
CO5	H				H											

UNIT	CONTENTS	Hours
UNIT – 1	**Introduction to Electrical Circuits** : Network elements classification, Electric charge and current, Electric energy and potential, Resistance parameter – series and parallel combination, Inductance parameter – series and parallel combination, Capacitance parameter – series and parallel combination. Energy sources: Ideal, Non-ideal, Independent and dependent sources, Source transformation, Kirchoff's laws, Mesh analysis and Nodal analysis problem solving with resistances only including dependent sources also. (Text Books: 1,2,3, Reference Books: 3) **A.C Fundamentals and Network Topology**: Definitions of terms associated with periodic functions: Time period, Angular velocity and frequency, RMS value, Average value, Form factor and peak factor- problem solving, Phase angle, Phasor representation, Addition and subtraction of phasors, mathematical representation of sinusoidal quantities, explanation with relevant theory, problem solving. Principal of Duality with examples. **Network Topology:** Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, basic tie set schedule, basic cut set schedule. (Text Books: 2,3, Reference Books: 3)	12
UNIT – 2	**Transients:** First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, Evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots. Solutions using Laplace transform method. (Text Books: 1,2,3, Reference Books: 1,3)	12
UNIT – 3	**Steady State Analysis of A.C Circuits:** Impedance concept, phase angle, series R-L, R-C, R-L-C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving. (Text Books: 1,2, Reference Books: 3) **Coupled Circuits:** Coupled Circuits: Self inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Natural current, Dot rule of coupled circuits, Conductively coupled equivalent circuits- problem solving.	12
UNIT – 4	**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. (Text Books:2,3, Reference Books: 3) **Network Theorems:** Thevinin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution,	12

	Superposition, Max Power Transfer, Tellegens- problem solving using dependent sources also. (Text Books: 1,2,3, Reference Books: 2)	
UNIT – 5	**Two-port Networks**: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h-parameters, Inverse h-parameters, Inverse Transmission line parameters, Relationship between parameter sets, Parallel connection of two port networks, Cascading of two port networks, series connection of two port networks, problem solving including dependent sources also. (Text Books: 1,2, Reference Books: 1,3)	12
	Total	60

TEXT BOOKS:

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

REFERENCES:

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

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I Year - I Semester	L	T	P	C
	0	0	3	1.5

PROGRAMMING FOR PROBLEM SOLVING USING C Lab

Exercise 1

a. Write a C program to calculate the area of a triangle.

b. Write a C program to find the largest of three numbers using ternary operator.

c. Write a C program to swap two numbers without using temporary variable.

Exercise 2

a. Write a C program to find the 2's complement of a binary number.

b. Write a C program to find the roots of a quadratic equation.

c. Write a C program to implement simple calculator using switch statement.

Exercise 3

a. Write a C program to find the sum of individual digits of a positive integer and alsofind the reverse of the given number.

b. Write a C program to generate the first n terms of the Fibonacci sequence.

c. Write a C program to generate all the prime numbers between 1 and n,where n is avalue supplied by the user.

Exercise 4

a. Write a C program to print the Multiplication table of a given number.

b. Write a C program to read a decimal number and find it's equivalent binary number.

c. Write a C program to check whether the given number is Armstrong number or not.

Exercise 5

a. Write a C program to interchange the largest and smallest numbers in the givenarray.

b. Write a C program to implement Towers of Hanoi.

Exercise 6

a. Write a C program to implement sorting an array of elements.

b. Write a C program to implement matrix addition and multiplication.

c. Write a C program to print the upper case matrix using Arrays.

Exercise 7

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

a. To insert a sub string into given main string at a given position.

b. To delete n characters from a given position in a given string.

c. To replace a character of a string either from beginning or ending or at a Specified location

Exercise 8

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

a. Reading a complex number

b. Writing a complex number

c. Addition of two complex numbers

d. Multiplication of two complex numbers

Exercise 9

Write a C program for the following string operations without using the built-in functions.

a. To concatenate two strings

b. To append a string to another string

c. To compare two strings

Exercise 10

a. Write a C program to find the number of characters in a given string including andexcluding spaces.

b. Write a C program to copy the contents of one string to another string without usingstring handling functions.

c. Write a C program to find whether a given string is palindrome or not.

Exercise 11

Write a C program using recursion for the following:

a. To display sum of digits of a given number

b. To find the factorial of a given integer

c.To find the GCD (Greatest Common Divisor) of two given integers

d.To find Fibonacci sequence.

Exercise 12

a. Write a C program to reverse a string using pointers.

b. Write a C program to compare two 2D arrays using pointers.

c. Write a C program consisting of Pointer based function to exchange value of two integers using passing by address .

Exercise 13

a. Write a C program to find both the largest and smallest number of an array ofintegers using call by value and call by reference.

b. Write a C program to implement student details using Structures.

Exercise 14

a. Write a C program which copies one file to another.

b. Write a C program to count the number of characters and number of lines in a file.

c. Write a C program to merge two files into a third file. The names of the files must beentered using command line arguments.

Exercise 15

Write a C program to implement Different Storage classes.

a. Auto

b. Static

c. Register

d. External

COURSE OUTCOMES:

CO	Course Outcomes	Knowledge Level (K)#
CO1	Examine C syntax, structure and be fluent in the use of C keywords and looping.	K4
CO2	Demonstrate proficiency in handling Strings and File Systems.	K2
CO3	Construct Matrixes creation and operations Programs using Arrays, structures like Dynamic programming.	K3
CO4	Interpret the concepts of Recursion Programming as used in C.	K2
CO5	Construct C programs using Pointers and Functions, various call by reference.	K3

Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**	L														L
CO2			L	**M**									**M**			
CO3	M													**H**	**H**	
CO4		**M**		L									**L**			**L**
CO5			M		**H**									L		

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I YEAR II SEM

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I B.Tech II Semester

MATHEMATICS-II
(Linear algebra and Numerical Methods)

Course Objectives:

- To instruct the concept of Matrices in solving linear algebraic equations
- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

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

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel (L3)
- evaluate the approximate roots of polynomial and transcendental equations by different algorithms (L5)
- apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)
- apply numerical integral techniques to different Engineering problems (L3)
- apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3)

UNIT – I: Solving systems of linear equations, Eigen values and Eigen vectors: (10hrs)

Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss Eliminationmethod – Eigen values and Eigen vectors and properties (article-2.14 in text book-1).
Applications: Fee vibration of two mass system.

Unit – II: Cayley–Hamilton theorem and Quadratic forms: (10hrs)

Cayley-Hamilton theorem (without proof) – Applications – Finding the inverse and power of a matrix by Cayley-Hamilton theorem – Reduction to Diagonal form – Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation.Singular values of a matrix, singular value decomposition (text book-3).

UNIT – III: Iterative methods: (8 hrs)

Introduction – Solutions of algebraic and transcendental equations: Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations)
Solutions of system of equations –Jacobi and Gauss-Seidel methods
Evaluation of largest eigenvalue –eigen vector using Power Method .

UNIT – IV: Interpolation: (10 hrs)

Introduction– Errors in polynomial interpolation – Finite differences– Forward differences– Backward differences –Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula– Newton's divide difference formula.

UNIT – V: Numerical differentiation and integration, Solution of ordinary differential equations with initial conditions: (10 hrs)

Numerical differentiation using interpolating polynomial – Trapezoidal rule– Simpson's $1/3^{rd}$ and $3/8^{th}$ rule– Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method – Runge-Kutta method (second and fourth order) – Milne's Predictor and Corrector Method.

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44^{th} Edition, Khanna Publishers.
2. **B. V. Ramana,**Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
3. **David Poole,** Linear Algebra- A modern introduction, 4^{th} Edition, Cengage.

Reference Books:

1. **Steven C. Chapra,** Applied Numerical Methods with MATLAB for Engineering and Science,Tata Mc. Graw Hill Education.
2. **M. K. Jain, S.R.K. Iyengar and R.K. Jain,** Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
3. **Lawrence Turyn,**Advanced Engineering Mathematics, CRC Press.

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I B.Tech II Semester

APPLIED PHYSICS

Unit-I: Wave Optics 10hrs

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

Diffraction: Introduction - Fresnel and Fraunhofer diffraction - Fraunhofer diffraction due to single slit, double slit - N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

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

Unit Outcomes:

The students will be able to

Explain the need of coherent sources and the conditions for sustained interference (L2)
Identify engineering applications of interference (L3)
Analyze the differences between interference and diffraction with applications (L4)
Illustrate the concept of polarization of light and its applications (L2)
Classify ordinary polarized light and extraordinary polarized light (L2)

Unit-II: Lasers and Fiber optics 8hrs

Lasers: Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation – Einstein's coefficients – Population inversion – Lasing action - Pumping Schemes – Ruby laser – He-Ne laser - Applications of lasers.

Fiber optics: Introduction –Principle of optical fiber- Acceptance Angle - Numerical Aperture - Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fiber - Applications.

Unit Outcomes:

The students will be able to

Understand the basic concepts of LASER light Sources (L2)
Apply the concepts to learn the types of lasers (L3)
Identifies the Engineering applications of lasers (L2)
Explain the working principle of optical fibers (L2)
Classify optical fibers based on refractive index profile and mode of propagation (L2)
Identify the applications of optical fibers in various fields (L2)

Unit-III: Dielectric and Magnetic Materials 8hrs

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

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

Unit Outcomes:

The students will be able to

Explain the concept of dielectric constant and polarization in dielectric materials (L2)

Summarize various types of polarization of dielectrics (L2)

Interpret Lorentz field and Claussius- Mosotti relation in dielectrics(L2)

Classify the magnetic materials based on susceptibility and their temperature dependence (L2)

Explain the applications of dielectric and magnetic materials (L2)

Apply the concept of magnetism to magnetic data storage devices (L3)

Unit IV: Quantum Mechanics, Free Electron Theory and Band theory 10hrs

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

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory– Equation for electrical conductivity based on quantum free electron theory- Fermi-Dirac distribution- Density of states (3D) - Fermi energy.

Band theory of Solids: Bloch's Theorem (Qualitative) - Kronig - Penney model (Qualitative)- E vs K diagram - v vs K diagram - effective mass of electron – Classification of crystalline solids–concept of hole.

Unit Outcomes:

The students will be able to

Explain the concept of dual nature of matter (L2)

Understand the significance of wave function (L2)

Interpret the concepts of classical and quantum free electron theories (L2)

Explain the importance of K-P model

Classify the materials based on band theory (L2)

Apply the concept of effective mass of electron (L3)

Unit – V: Semiconductors and Superconductors 12hrs

Semiconductors: Introduction- Intrinsic semiconductors – Density of charge carriers – Electrical conductivity – Fermi level – extrinsic semiconductors – density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation - Hall effect – Hall coefficient –Applications of Hall effect.

Superconductors: Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory (Qualitative) – Josephson effects (AC and DC) – SQUIDs
– High Tc superconductors – Applications of superconductors.

Unit Outcomes:

The students will be able to

Classify the energy bands of semiconductors (L2)
Interpret the direct and indirect band gap semiconductors (L2)
Identify the type of semiconductor using Hall effect (L2)
Identify applications of semiconductors in electronic devices (L2)
Classify superconductors based on Meissner's effect (L2)
Explain Meissner's effect, BCS theory & Josephson effect in superconductors (L2)

Text books:

1. Engineering Physics by M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy S.Chand Publications, 11th Edition 2019.
2. Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press (2018).
3. Applied Physics by P.K.Palanisamy ,SciTech publications (2018)

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons, 11th Edition (2018)
2. Engineering Physics by M.R.Srinivasan, New Age international publishers (2014).
3. Engineering Physics by Shatendra Sharma, Jyotsna Sharma, "",Pearson Education(2018)
4. Engineering Physics by Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press(2016)
5. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill(2014)
6. Engineering Physics by B.K. Pandey and S. Chaturvedi, , Cengage Learning(2018)
7. University Physics by H.D.Young and R.A. Freedman,Pearson(2017)

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

I Year - II Semester

L	T	P	C
3	0	0	3

OBJECT ORIENTED DESIGN & PROGRAMMING USING JAVA

Course Objectives:

- To learn the object oriented programming concepts.
- To introduce the principles of inheritance and polymorphism and demonstrate how they are related to the design of abstract classes
- To introduce the implementation of packages and interfaces
- To introduce the concept of multithreading and exception handling
- To introduce the design of Graphical User Interface using applets and swing controls

UNIT I: Basics of Object Oriented Programming (OOP): Need for OO paradigm, Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of OOP concepts, coping with complexity, abstraction mechanisms.

Java Basics: Data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, simple Java program,

UNIT II: classes and objects – concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

UNIT III: Inheritance: Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism, abstract classes.

Packages and Interfaces: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

UNIT IV: Exception handling and Multithreading: Concepts of exception handling, benefits of exception handling, Termination or presumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. Differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

UNIT V:

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scroll pane, dialogs, menu bar, graphics, layout manager – layout manager types – boarder, grid, flow, card and grid bag, limitations of AWT.

Applets: Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets. Applet to applet communication, secure applet

Text Books:

1. Java: The Complete Reference, Eleventh Edition 11th Edition, Herbert Schildt
2. JAVA: How to program, 8/e, Dietal , Dietal,PHI
3. Introduction of programming with JAVA,S.Dean,TMH
4. Introduction to Java programming, 6/e, Y.Daniel Liang, Pearson

Reference Books:

1. Core Java 2, Vol 1(Vol 2) Fundamentals(Advanced), 7/e, Cay.S.Horstmann, Gary Cornell, Pearson
2. Big Java2,3/e, Cay.S. Horstmann, Wiley

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

- Understands the use of OOP concepts
- Apply OOP concepts to solve real world problems
- Develop multithreaded programs using synchronization concept.
- Understands the concept of packages and exception handling mechanism.
- Design GUI based applications using AWT

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**	L														L
CO2			L	**M**									**M**			
CO3	M													**H**	**H**	
CO4		**M**		L	H								**L**			**L**
CO5			M											L		

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

I B.Tech II Semester

BASIC ELECTRICAL ENGINEERING	**L-T-P**	**C**
	3-0-0	**3**

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Explain the operation of DC generator and analyze the characteristics of DC generator.	
CO2	Explain the principle of operation of DC motor and analyze their characteristics. Acquire the skills to analyze the starting and speed control methods of DC motors.	
CO3	Ability to analyze the performance and speed- torque characteristics of a 3-phase induction motor of 3phase induction motor.	
CO4	Able to explain the operation of synchronous machines.	
CO5	Capability to understand the operation of various special machines.	

#Based on suggested Revised BTL

UNIT **CONTENTS**

UNIT - 1 **DC Machines**

Principle of operation of DC generator – EMF equation – types of DC machines – Magnetization characteristics of DC shunt generator – Principle of operation of DC motor – torque equation of DC motor– applications ofDC Machines – three point starter – losses and efficiency- swinburne's test-speed control methods – Brake test on DC shunt motor – simple numerical problems.

UNIT - 2 **Transformers**

Construction and Principle of operation of single phase transformer – EMF equation – Losses –OC & SC tests –Equivalent circuit – predetermination of efficiency and regulations- simple numerical problems.

UNIT - 3 **Synchronous generators**

Construction and Principle of operation of alternators- EMF equation – types of alternators – regulation of alternator by synchronous impedance method – simple numerical problems.

Synchronous motors

Construction and Principle of operation of three phase synchronous motor.

UNIT - 4 **Three Phase Induction Motor**

Production of Rotating Magnetic field – Construction and Principle of operation of three phase induction motor – Types: slip ring and squirrel cage motors – slip torque characteristics – efficiency – brake test on 3-phase induction motor – simple numerical problems.

Special Machines:

UNIT - 5 Construction and Principle of operation of single phase induction motor- Types: capacitor start motor, capacitor start &run motor and shaded pole motor. Servomotors: Principle of operation of DC and AC servomotors.

Text Books:

1. Theory & performance of Electrical Machines by J.B.Guptha, S.K.Kataria& Sons
2. Electrical Machinery by P.S.Bhimbra, Khanna publications, 2nd edition

Reference Books:

1. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah,TMH Publications
2. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2nd edition
3. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2nd edition.
4. Principles of Electrical Machines by V.K. Mehta &Rohit Mehta, S.Chand publications

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UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

I Year - II Semester		L	T	P	C
		0	0	3	1.5
ELECTRONIC WORKSHOP Lab					

I. Identification of components
II. Laboratory equipment
III. Soldering practice
IV. PCB Layout
V. Testing of Components
VI. CRO

I. **Identification of components:**

- Resistors:- Types of Resistors, Value of Resistance using color code, DRBS.
- Capacitors:- Types of capacitors, value of capacitance using color code, DCBS.
- Inductors:- Types of Inductors, DLB
- Rheostats:- Types of Rheostats, Types of potentiometers, Relays.
- Switches:- Types of Switches.
- Cables: Types of Cables.
- Types of Instruments used.

  Identification of active elements.

  (Two Terminal, Three Terminal Devices)
- (SC diode, Zener diode, D.AC)
- Three Terminal Devices: BJT, UJT, SCR, FET, MOSFET, TRIAC.
- Digital and Analog ICs. (TO and Flat packages) IC regulators types.
- Testing of above components using Multi metros.

II. **Laboratory Equipment:**

A) Meters:-

- Types of Voltmeters, Types of Ammeters both Analog and Digital.
- Types of Multi meters (Analog & Digital)
- AVO Meters.
- FET input Voltmeter.

B) Laboratory Function Generators and Audio Oscillators.
C) Power Supplies.
D) RF generators.
E) Different Types of Transformers.
(Power, AF, RF, etc..)

III. Soldering practice

Tools kit including soldering iron
Tools Kit:

- Insulated nose player
- Insulated cutting player
- Screw driver kit
- Electrical tester
- Soldering iron, Lead, Flex

IV. PCB layout and Design.
Materials required, centimeter graph sheets, marker.

V. Testing of Components.
Active and Passive Components

VI. CRO
Acquaintance with CRO
Measurements on CRO

Course Outcomes:

		Knowledge Level (K)#
CO1	Analyse various electronic components	K3
CO2	Understand operation of different meters	K2
CO3	Analyse the processs of Soldering	K3
CO4	Design PCB layouts for small applications	K5
CO5	Identify the components and understand the testing of components	K2
Co6	Know the performance of CRO	K2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**	L														L
CO2			L	**M**									**M**			
CO3	M													**H**	**H**	
CO4		**M**		L	H								**L**			**L**
CO5			M											L		

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I Year - II Semester

Applied Physics Laboratory

(Any 10 of the following listed experiments)

List of Applied Physics Experiments

1. Determination of thickness of thin object by wedge method.
2. Determination of radius of curvature of a given plano convex lens by Newton's rings.
3. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
4. Determination of Resolving power of telescope.
5. Determination of dielectric constant using charging and discharging method.
6. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
7. Determination of numerical aperture and acceptance angle of an optical fiber.
8. Determination of wavelength of Laser light using diffraction grating.
9. Estimation of Planck's constant using photoelectric effect.
10. Determination of the Resistivity of semiconductor by four probe method.
11. Determination of the energy gap of a semiconductor using p-n junction diode.
12. Magnetic field along the axis of a current carrying circular coil by Stewart & Gee's Method
13. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.
14. Determination of the temperature coefficients of a given thermistor.
15. Determination of Acceleration due to gravity and Radius of gyration using Compound pendulum.

References:

1. S. Balasubramanian, M.N. Srinivasan "A Text Book of Practical Physics"- S Chand

Publishers, 2017.

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I B.Tech II Semester

COURSE CODE – R2011XXYY	BASIC ELECTRICAL ENGINEERING LAB (ECE)	CATEGORY ESC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Determine the performance of DC machines	
CO2	Control the speed of DC motor.	
CO3	Compute the performance of 1-phase transformer.	
CO4	Determine the performance characteristics on 3-phase induction motor.	
CO5	Determine the regulation of Alternator.	

#Based on suggested Revised BTL

CONTENTS

Any 10 of the following experiments are to be conducted

1. Magnetization characteristics of DC shunt generator.
2. Speed control of DC shunt motor using Armature voltage control method
3. Speed control of DC shunt motor using Field flux control method
4. Brake test on DC shunt motor.
5. Swinburne's test on DC machine.
6. Equivalent circuit of single phase transformer
7. Regulation and efficiency of single phase transformer
8. Brake test on 3-phase Induction motor.
9. Regulation of alternator by synchronous impedance method.
10. Load test on DC shunt generator.
11. Separation of losses in DC shunt motor.
12. Load test on DC series generator.

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APPLIED PHYSICS - VIRTUAL LAB – ASSIGNMENTS

(Any 5 of the following listed 10 experiments)

P C
2 0

LIST OF EXPERIMENTS

1. Hall Effect
2. Brewster's angle
3. Numerical Aperture of Optical fiber
4. Photoelectric Effect
5. Michelson's interferometer
6. Newton's rings –Refractive index of liquid
7. Dispersive power of a prism
8. Resolving power of the prism
9. Magnetic susceptibility by Quincke's method
10. AC Sonometer

URL: www.vlab.co.in

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Constitution of India

L-T-P-C
3-0-0-0

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.

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.

Learning outcomes:

After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

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, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

Learning outcomes:-After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

UNIT-III

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

Learning outcomes:-After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariat

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: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning outcomes:-After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Myer and elected representatives of Municipalities
- Evaluate Zillapanchayat block level organisation

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

Learning outcomes:-After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissiononerate
- Analyze role of state election commission
- Evaluate various commissions of viz SC/ST/OBC and women

References:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. SubashKashyap, 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 andPolitics Hans
7. J. Raj IndianGovernment 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

E-resources:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

Course Outcomes:

- 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.
    1. Know the sources, features and principles of Indian Constitution.
    2. Learn about Union Government, State government and its administration.
    3. Get acquainted with Local administration and Pachayati Raj.
    4. Be aware of basic concepts and developments of Human Rights.
    5. Gain knowledge on roles and functioning of Election Commission

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Engineering Exploration Project – DesignThinking

(Common for CE, EEE, ME, ECE, & CSE)

(15 Hrs per Sem.)

COURSE OBJECTIVES:

- Build mindsets & foundations essential for designers
- Learn about the Human-Centered Design methodology and understand their real-world applications
- Use Design Thinking for problem solving methodology for investigating illdefined problems.
- Undergo several design challenges and work towards the final design challenge

Apply Design Thinking on the following Streams to

- Project Stream 1: Electronics, Robotics, IOT and Sensors
- Project Stream 2: Computer Science and IT Applications
- Project Stream 3: Mechanical and Electrical tools
- Project Stream4: Eco-friendly solutions for waste management, infrastructure, safety, alternative energy sources, Agriculture, Environmental science and other fields of engineering.

HOW TO PURSUE THE PROJECT WORK?

- The first part will be learning-based-masking students to embrace the methodology by exploring all the phases of design thinking through thewallet/ bag challenge and podcasts.
- The second part will be more discussion-based and will focus on building somenecessary skills as designers and learning about complementary material for human- centered design.
- The class will then divide into teams and they will be working with one another for about 2 – 3 weeks. These teams and design challenges will be the basis for the final project and final presentation to be presented.
- The teams start with **Design Challenge** and go through all thephases more in depth from coming up with the right question to empathizing to ideating toprototyping and to testing.
- Outside of class, students will also be gathering the requirements, identifying the challenges, usability, importance etc
- At the end, Students are required to submit the final reports, and will be evaluated by the faculty.

TASKS TO BE DONE:

Task 1: Everyone is a Designer

- Understand class objectives & harness the designer mindset

Task 2: The Wallet/Bag Challenge and Podcast

- Gain a quick introduction to the design thinking methodology
- Go through all stages of the methodology through a simple design challenge
- Podcast: Observe, Listen and Engage with the surrounding environment and identify a design challenge.

Task 3: Teams & Problems

- Start Design Challenge and learn about teams & problems through this
- Foster team collaboration, find inspiration from the environment and learn how to identify problems

Task 4: Empathizing

- Continue Design Challenge and learn empathy
- Learn techniques on how to empathize with users
- Go to the field and interview people in their environments
- Submit Activity Card

Task 5: Ideating
- Continue Design Challenge and learn how to brainstorm effectively
- Encourage exploration and foster spaces for brainstorming
- Submit Activity Card

Task 6: Prototyping
- Continue Design Challenge and learn how to create effective prototypes
- Build tangible models and use them as communication tools
- Start giving constructive feedback to classmates and teammates
- Submit Activity Card

Task 7: Testing
- Finish Design Challenge and iterate prototypes and ideas through user feedback
- Evolve ideas and prototypes through user feedback and constructive criticism
- Get peer feedback on individual and group performance
- Submit Activity Card

Task 8:
- Final Report Submission and Presentation

Note: The colleges may arrange for Guest Speakers from Various Design Fields: Graphic Design, Industrial Design, Architecture, Product Design, Organizational Design, etc to enrich the students with Design Thinking Concept.

REFERENCES:

1. Tom Kelly, *The Art of Innovation: Lessons in Creativity From IDEO, America's Leading Design Firm* (Profile Books, 2002)
2. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (HarperBusiness, 2009)
3. Jeanne Liedtka, Randy Salzman, and Daisy Azer, Design Thinking for the Greater Good: Innovation in the Social Sector (Columbia Business School Publishing, 2017)

OTHER USEFUL DESIGN THINKING FRAMEWORKS AND METHODOLOGIES:

- Human-Centered Design Toolkit (IDEO); https://www.ideo.com/post/design-kit
- Design Thinking Boot Camp Bootleg (Stanford D-School); https://dschool.stanford.edu/resources/the-bootcamp-bootleg
- Collective Action Toolkit (frogdesign); https://www.frogdesign.com/wpcontent/
  - uploads/2016/03/CAT_2.0_English.pdf
- Design Thinking for Educators (IDEO); https://designthinkingforeducators.com/

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II YEAR I SEM

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

		L	T	P	C
II Year - I Semester		**3**	**0**	**0**	**3**
ELECTRONIC DEVICES AND CIRCUITS					

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

		Knowledge Level (K)#
CO1	Apply the basic concepts of semiconductor physics.	K4
CO2	Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation.	K5
CO3	Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons..	K1
CO4	Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.	K1
CO5	Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions &small signal low frequency transistor amplifier circuits using BJT and FET in different configurations	K6

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	M	H														M
CO2			M													
CO3	L				M								L			
CO4				L										M		
CO5	M		M												H	

UNIT	CONTENTS	Contact Hours
UNIT – 1	**Review of Semiconductor Physics:** Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors **Junction Diode Characteristics :** energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.	12
UNIT – 2	**Special Semiconductor Devices**: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode, Tunnel Diode, UJT, PNPN Diode, SCR. Construction, operation and V-I characteristics. **Rectifiers and Filters:** Basic Rectifier setup**,** half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter(Series inductor), Capacitor filter(Stunt inductor), π-Filter, comparison of various filter circuits in terms of ripple factors.	12
UNIT – 3	**Transistor Characteristics: BJT:** Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.**FET:** FET types, construction, operation, characteristicsμ, g_m $r_d$parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.	12
UNIT – 4	**Transistor Biasing and Thermal Stabilization :** Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in V_{BE}, Ic, and β Stability factors, (S,S',S''), Bias compensation, Thermal runaway, Thermal stability.FET Biasing- methods and stabilization.	12
UNIT – 5	**Small Signal Low Frequency Transistor Amplifier Models: BJT:** Two port network, Transistor hybrid model determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.**FET:** Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.	12
	Total	60

Text Books:

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

References:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, SecondEdition,2007
2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016.
3. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, 4th Edition,2008.

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II Year - I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
SWITCHING THEORY and LOGIC DESIGN					

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

		Knowledge Level (K)#
CO1	Classify different number systems and apply to generate various codes.	K3
CO2	Design different types of combinational logic circuits.	K1
CO3	Apply knowledge of flip-flops in designing of Registers and counters	K4
CO4	The operation and design methodology for synchronous sequential circuits and algorithmic state machines.	K1
CO5	Produce innovative designs by modifying the traditional design techniques&concept of Boolean algebra in minimization of switching functions	K1

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**M**		M											M		
CO2				**H**									M			
CO3		**L**												H		
CO4			L												H	
CO5	M				**H**								M			L

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	**REVIEW OF NUMBER SYSTEMS &CODES:** Representation of numbers of different radix, conversation from one radix to another radix, r-1's compliments and r's compliments of signed members. Gray code ,4 bit codes; BCD, Excess-3, 2421, 84-2-1 code etc. Error detection & correction codes: parity checking, even parity, odd parity, Hamming code. **BOOLEAN THEOREMS AND LOGIC OPERATIONS:** Boolean theorems, principle of complementation & duality, De-morgan theorems. Logic operations ; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EX-NOR operations. Standard SOP and POS Forms, NAND-NAND and NOR-NOR realizations, Realization of three level logic circuits. Study the pin diagram and obtain truth table for the following relevant ICs 7400,7402,7404,7408,7432,7486	12
UNIT – 2	**MINIMIZATION TECHNIQUES:** Minimization and realization of switching functions using Boolean theorems, K-Map (up to 6 variables)and tabular method(Quine-mcCluskey method) with only four variables and single function **COMBINATIONAL LOGIC CIRCUITS DESIGN:** Design of Half adder, full adder, half subtractor, full subtractor applications of full adders; 4-bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit and carry look-a-head adder circuit, Design code converts using Karnaugh method and draw the complete circuit diagrams.	12
UNIT – 3	**COMBINATIONAL LOGIC CIRCUITS DESIGN USING MSI &LSI :**Design of encoder ,decoder, multiplexer and de multiplexers, Implementation of higher order circuits using lower order circuits .Realization of Boolean functions using decoders and multiplexers. Design of Priority encoder, 4-bit digital comparator and seven segment decoder. . Study the relevant ICs pin diagrams and their functions 7442,7447,7485,74154.**INTRODUCTION OF PLD's :**PLDs: PROM, PAL PLA -Basics structures, realization of Boolean functions, Programming table.	12
UNIT – 4	**SEQUENTIAL CIRCUITS I:**Classification of sequential circuits (synchronous and asynchronous) , operation of NAND & NOR Latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with rese and clear terminals. Conversion from one flip-flop to another flip-flop. Design of 5ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift, register. Study the following relevant ICs and their relevant functions 7474,7475,7476,7490,7493,74121.	12
UNIT – 5	**SEQUENTIAL CIRCUITS II :**Finite state machine; state diagrams, state tables, reduction of state tables. Analysis of clocked sequential circuits Mealy to Moore conversion and vice-versa. Realization of sequence generator, Design of Clocked Sequential Circuit to detect the given sequence (with overlapping or without overlapping).	12
	Tota	60

TEXT BOOKS:

1. Switching and finite automata theory Zvi.KOHAVI, Niraj.K.Jha 3rd Edition, Cambridge University Press,2009
2. Digital Design by M.MorrisMano,Michael D Ciletti,4th edition PHI publication,2008
3. Switching theory and logic design by Hill and Peterson**,**Mc-Graw Hill TMH edition, 2012.

REFERENCES:

1. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers,2006
2. Digital electronics by R S Sedha.S.Chand& company limited,2010
3. Switching Theory and Logic Design by A. AnandKumar,PHI Learning pvt ltd,2016.

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II Year - I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
SIGNALS and SYSTEMS					

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

		Knowledge Level (K)#
CO1	Differentiate the various classifications of signals and systems	K2
CO2	Analyze the frequency domain representation of signals using Fourier concepts	K3
CO3	Classify the systems based on their properties and determine the response of LTI Systems	K3
CO4	Know the sampling process and various types of sampling techniques.	K5
CO5	Apply Laplace and z-transforms to analyze signals and Systems (continuous & discrete).	K4

	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO4**
CO1	**L**												L			
CO2			**L**												H	
CO3		**M**												M		L
CO4					**M**											
CO5																

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	**INTRODUCTION:** Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function. Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complexfunctions. Related Problems.	12
UNIT – 2	**FOURIER SERIES AND FOURIERTRANSFORM:**Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Relation between Trigonometric and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform.Related Problems.	12
UNIT – 3	**ANALYSIS OF LINEAR SYSTEMS:** Introduction**,** Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system, Related problems. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and risetime	12
UNIT – 4	**CORRELATION:** Auto-correlation and cross-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between Convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering. **SAMPLING THEOREM :** Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Passsampling, Related problems.	12
UNIT – 5	**LAPLACE TRANSFORMS:** Introduction**,** Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Inverse Laplace transform, Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveformsynthesis.**Z–TRANSFORMS:** Concept of Z- Transform of a discrete sequence. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms. Distinction between Laplace, Fourier and Z transforms.	12
	Total	60

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

II Year - I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

RANDOM VARIABLES and STOCHASTIC PROCESSES

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

		Knowledge Level (K)#
CO1	Mathematically model the random phenomena and solve simple probabilistic problems.	K3
CO2	Identify different types of random variables	K5
CO3	Characterize the random processes in the time and frequency domains.	K3
CO4	Analyze the LTI systems with random inputs.	K4
CO5	Identify different types of statistical averages of therandom variables.	K6

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		**M**											**L**			
CO2				**L**										**M**		**H**
CO3	**L**														**M**	
CO4					**H**											
CO5															**M**	

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	**THE RANDOM VARIABLE:** Introduction, Review of Probability Theory, Definition of a Random Variable Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh Conditional Distribution, Conditional Density, Properties.	12
UNIT – 2	**OPERATION ON ONE RANDOM VARIABLE - EXPECTATIONS:** Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable.	12
UNIT – 3	**MULTIPLE RANDOM VARIABLES:** Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem Unequal Distribution, Equal Distributions.**OPERATIONS ON MULTIPLE RANDOM VARIABLES**: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.	12
UNIT – 4	**RANDOM PROCESSES – TEMPORAL CHARACTERISTICS:** The Random Process Concept Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-order and Wide-Sense Stationarity, N^{th}-order and Strict -Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.	12
UNIT – 5	**RANDOM PROCESSES - SPECTRAL CHARACTERISTICS:** The Power Density Spectrum: Properties Relationship between Power Density Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Density Spectrum and Cross-Correlation Function.**LINEAR SYSTEMS WITH RANDOM INPUTS:** Random Signal Response of Linear Systems System Response – Convolution, Mean and Mean-squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output, Band pass, Band-Limited and Narrowband Processes, Properties.	12
	Tota	60

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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II Year - I Semester		L	T	P	C
		0	0	3	1.5
ELECTRONIC DEVICES AND CIRCUITS LAB					

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

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

1. P-N Junction DiodeCharacteristics
   Part A: Germanium Diode (Forward bias& Reverse bias)

   Part B: Silicon Diode (Forward Bias only)

2. Zener Diode Characteristics
   Part A: V-ICharacteristics
   Part B: Zener Diode as Voltage Regulator

3. Rectifiers (without and with c-filter)
   Part A: Half-waveRectifier
   Part B: Full-wave Rectifier

4. BJT Characteristics(CE Configuration)
   Part A: Input Characteristics
   Part B: Output Characteristics

5. FET Characteristics(CS Configuration) Part A: DrainCharacteristics
   Part B: Transfer Characteristics

6. SCRCharacteristics
7. UJTCharacteristics
8. TransistorBiasing
9. CRO Operation and itsMeasurements
10. BJT-CEAmplifier
11. Emitter Follower-CCAmplifier
12. FET-CSAmplifier

Equipment required:

1. Regulated Powersupplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital FunctionGenerators
4. DigitalMulti-meters
5. Decade RésistanceBoxes/Rheostats
6. Decade CapacitanceBoxes
7. Ammeters (Analog orDigital)
8. Voltmeters (Analog orDigital)
9. Active & Passive ElectronicComponents

COURSE OUTCOMES:

- Design the amplifier circuits using various biasing methods.
- Analyze the single stage and multistage BJT amplifiers using small signal equivalent model.
- Analyze JFET amplifiers using small signal equivalent model.
- Analyze MOSFET amplifiers using small signal equivalent model.
- Determine the frequency response of single stage and multistage amplifiers.
- Design and fault analyze dc power supplies.

CO-PO MAPPING

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	L	M	L	H	H	L	-	-	-	-	L	M	M	H	H	H
2	L	H	M	H	H	M	-	-	-	-	L	M	M	M	M	H
3	L	H	H	H	M	L	-	-	-	-	L	L	H	M	H	H
4	L	M	M	H	M	M	-	-	-	-	L	L	M	M	H	M
5	L	M	M	H	M	M					L	M	H	M	H	H
6	L	H	M	H	H	L					L	L	M	H	M	H

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II Year - I Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

SWITCHING THEORY and LOGIC DESIGN LAB

List of Experiments: (Minimum of Twelve Experiments has to be performed)

1. Verification of truth tables of Logic gates
   Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive OR (vi) Exclusive NOR
2. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit
3. Verification of functional table of 3 to 8 line Decoder / De-multiplexer
4. 4 variable logic function verification using 8 to 1 multiplexer.
5. Design full adder circuit and verify its functional table.
6. Verification of functional tables of
   (i) J K Edge triggered Flip – Flop
   (ii) J K Master Slave Flip – Flop
   (iii) D Flip - Flop
7. Design a four bit ring counter using D Flip – Flops / JK Flip Flop and verify output
8. Design a four bit Johnson's counter using D Flip-Flops / JK Flip Flops and verify output
9. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.
10. Draw the circuit diagram of MOD-8 ripple counter and construct 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 and 7 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.

Course Outcomes:

		Knowledge Level (K)#
CO1	Understanding working and importance Basic Logic Gates and Boolean functions using Gates	K2
CO2	Implementation of Combinational Circuits with Four Variables	K3
CO3	Analyze the concept of realization of functions with Decoders, Multiplexers etc	K4
CO4	Understand the concept of Flip-Flop and their realization using Gates	K2
CO5	Designing of Shift Registers Counters	K6
CO6	Evaluate & Draw Logic Diagrams for different MOD Counters	K5
CO7	Develop Real time application using Digital Electronics	K6

Mapping of course outcomes with program outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	L			M	L								L			L
CO2	M		M		M									M		L
CO3		M	M		L											L
CO4		L		M	L								L			L
CO5			H		L									M	M	L
CO6	M		M		L								L			L
CO7			M		L										H	M

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II Year - I Semester		L	T	P	C
		0	0	3	1.5

OBJECT ORIENTED DESIGN & PROGRAMMING USING JAVA LAB

List of programs to be executed:

1. The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1, 1. Every subsequent value is the sum of the 2 values preceding it. Write a Java Program that uses both recursive and non-recursive functions to print the nth value of the Fibonacci sequence.
2. Write a Java Program that prompts the user for an integer and then prints out all the prime numbers up to that integer.
3. Write a java program to implement call by value and call by reference mechanisms.
4. Write a Java Program that checks whether a given string is a palindrome or not.
5. Write a Java Program to check the compatibility for multiplication, if compatible multiply two matrices and find its transpose.
6. Write a Java program to implement constructor overloading and method overloading.
7. Write a Java Program that illustrates how runtime polymorphism is achieved.
8. Write a Java Program that illustrates the use of super keyword.
9. Write a Java Program to create and demonstrate packages.
10. Write a Java Program, using StringTokenizer class, which reads a line of integers and then displays each integer and the sum of all integers.
11. Write a Java Program that reads on file name form the user then displays information about whether the file exists, whether the file is readable/ writable, the type of file and the length of the file in bytes and display the content of the using FileInputStream class.
12. Write a Java Program that displays the number of characters, lines and words in a text/text file.
13. Write a Java Program to implement a Queue, using user defined Exception Handling (also make use of throw, throws).
14. Write a Java Program that creates 3 threads by extending Thread class. First thread displays “Good Morning” every 1 sec, the second thread displays “Hello” every 2 seconds and the third displays “Welcome” every 3 seconds. (Repeat the same by implementing Runnable).
15. Write a Java Program demonstrating the life cycle of a thread.
16. Write an Applet that displays the content of a file.
17. Write a Java Program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +-*?% operations. Add a text field to display the result
18. Write a Java Program for handling mouse events, keyboard events.
19. Write a Java Program that allows user to draw lines, rectangles and ovals.
20. Write a Java Program that lets users create Pie charts. Design your own user interface (with Swings & AWT).

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

CO	Course Outcomes	Knowledge Level (K)#
CO1	Explain what constitutes an object-oriented approach to programming and identify potential benefits of object-oriented programming over other approaches.	**K5**
CO2	Analyze simple programs using classes and objects in C++.	**K4**
CO3	Experiment with programs involving constructors, destructors and reuse of code using inheritance.	**K3**
CO4	Examine Object Oriented Programs using templates and exceptional handling concepts.	**K4**
CO5	Apply an object-oriented approach to developing applications of varying complexity.	**K3**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**												L			
CO2			**L**												H	
CO3		**M**												M		L
CO4					**M**											
CO5																

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II Year - I Semester		**L**	**T**	**P**	**C**
		1	**0**	**2**	**2**
PYTHON PROGRAMMING (SKILL ORIENTED COURSE)					

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

		Knowledge Level (K)#
CO1	To acquire programming skills in core Python.	K1
CO2	To acquire Object Oriented Skills in Python	K5
CO3	To develop the skill of designing Graphical user Interfaces in Python	K1
CO4	To develop the ability to write database applications in Python	K2
CO5	Ability write algorithms and draw flow charts for solving problems	K4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**L**					**H**							**L**		**M**	
CO2				**M**										**M**		
CO3			**L**													**H**
CO4		**M**							**H**						**M**	
Co5						**M**										

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	Introduction:History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output Indentation. Types - Integers, Strings, Booleans;.	12
UNIT – 2	Operators and Expressions: Operators- Arithmetic Operators, Comparison (Relational) Operators Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators Expressions and order of evaluations. Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets Dictionaries, Sequences. Comprehensions	12
UNIT – 3	Control Flow - if, if-elif-else, for, while, break, continue, pass Functions - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments Anonymous Functions, Fruitful Functions(Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.	12
UNIT – 4	Usage of Numpy for numerical Data, Usage of Pandas for Data Analysis, Matplotlib for Python plotting	12
UNIT – 5	Seaborn for Statical plots, interactive Dynamic visualizations, SciKit for Machine learning.	12
	Tota	60

TEXT BOOKS

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Learning Python, Mark Lutz, Orielly

Reference Books:

1. Think Python, Allen Downey, Green Tea Press
2. Core Python Programming, W.Chun, Pearson.
3. Introduction to Python, Kenneth A. Lambert, Cengage
4. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
5. Haltermanpythonhttps://github.com/halterman/PythonBook-SourceCode
6. Charles Severance et al, Python for Everybody: Exploring Data in Python 3

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II YEAR II SEM

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

II Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
LINEAR IC APPLICATIONS					

Pre-requisite: Network Theory, Electronic Devices and Circuits, Electronic Circuit Analysis
Course Outcomes: At the end of the course, student will be able to

		Knowledge Level (K)#
CO1	Analyse the Differential Amplifier with Discrete components	K4
CO2	Describe the Op-Amp and internal Circuitry: 555 Timer, PLL	K1
CO3	Discuss the Applications of Operational amplifier: 555 Timer, PLL	K2
CO4	Design the Active filters using Operational Amplifier	K5
CO5	Use the Op-Amp in A to D & D to A Converters	K3

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1					**H**										**L**	**L**
CO2			**L**												**H**	**M**
CO3				**M**											**M**	**M**
CO4				**M**											**H**	**M**
CO5					**M**										**M**	**H**

UNIT	CONTENTS	**Hours**
UNIT – 1	**Integrated Circuits:** **Differential Amplifier**- DC and AC analysis of (i) Dual input Balanced output Configuration, (ii) Dual Input Unbalanced Output, (iii)Single Ended Input – Balanced Output (iv) Single Ended Input – un Balanced Output, Cascade Differential Amplifier Stages, Level translator. (Text Book: Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1993) **Operational Amplifier:** Introduction, Basic information of Op-Amp, Ideal Operational Amplifier,Op-Amp internal Circuit, Examples of IC Op-Amps, FET Operational Amplifier (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003).Block Diagram Representation of Typical Op-Amp, Analysis of Typical Op-Amp Equivalent Circuit(only MC1435)(Text Book: Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1993).OP-Amps Characteristics: Introduction, DC and AC characteristics,741 op-amp & its features.	12
UNIT – 2	**OP-AMPS Applications:** Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator. (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003) **Comparators and Waveform Generators:** Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators. (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003)	12
UNIT – 3	**Active Filters:** Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and all pass filters. (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003)	12
UNIT – 4	**Timer**s: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger. **Phase Locked Loops:** Introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation, AM, FM & FSK demodulators. Applications of VCO (566) (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003)	12
UNIT – 5	**Digital To Analog And Analog To Digital Converters:** Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC.DAC and ADC Specifications. (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003)	12
	Tota	60

Text Books:

1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition 2003.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1993.

References:

1. Operational Amplifiers & Linear Integrated Circuits –Sanjay Sharma ;SK Kataria&Sons;2nd Edition,2010
2. Design with Operational Amplifiers & Analog Integrated Circuits – Sergio Franco, McGraw Hill, 1988.
3. OP AMPS and Linear Integrated Circuits concepts and Applications, James M Fiore, Cenage Learning India
4. Operational Amplifiers & Linear Integrated Circuits–R.F.Coughlin& Fredrick Driscoll, PHI,6th Edition.
5. Operational Amplifiers & Linear ICs – David A Bell, Oxford Uni. Press, 3rd Edition.
6. Operational Amplifiers–C.G. Clayton, Butterworth & Company Publ. Ltd./Elsevier, 1971.

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II Year-II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
ELECTRONIC CIRCUIT ANALYSIS					

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

		Knowledge Level (K)#
CO1	Design and analysis of small signal high frequency transistor amplifier using BJT and FET.	K4
CO2	Design and analysis of multi stage amplifiers using BJT and FET and Differential amplifier using BJT.	K3&K4
CO3	Derive the expressions for frequency of oscillation and condition for oscillation of RC and LC oscillators and their amplitude and frequency stability concept.	K3
CO4	Know the characteristics of feedback amplifiers and design feedback amplifier based on the given specifications	K4
CO5	Know the importance of power amplifiers and tuned amplifiers	K3

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	M		H	M									H		H	M
CO2	M		H	M											M	H
CO3	M		M	H									H			M
CO4	L		H	M											H	H
CO5	L		M	H									M			M

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	**Small Signal High Frequency Transistor Amplifier models:BJT:** Transistor at high frequencies Hybrid- π common emitter transistor model, Hybrid π conductance, Hybrid π capacitances, validity of hybrid π model, determination of high-frequency parameters in terms of low-frequency parameters , CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product.**FET:** Analysis of common Source and common drain Amplifier circuits at high frequencies.	12
UNIT – 2	**Multistage Amplifiers:** Classification of amplifiers, methods of coupling**, c**ascaded transistor amplifier and its analysis, analysis of two stage RC coupled amplifier, high input resistance transistor amplifier circuits and their analysis-Darlington pair amplifier, Cascode amplifier, Boot-strap emitter follower Differential amplifier using BJT.	12
UNIT – 3	**Feedback Amplifiers :** Feedback principle and concept, types of feedback, classification of amplifiers feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Performance comparison of feedback amplifiers, Method of analysis of feedback amplifiers.	12
UNIT – 4	**Oscillators:** Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and Wien bridge oscillators with BJT and FET and their analysis, Generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators using BJT, Frequency and amplitude stability of oscillators.	12
UNIT – 5	**Power Amplifiers:** Classification of amplifiers(A to H), Class A power Amplifiers, Class B Push-pull amplifiers, Complementary symmetry push pull amplifier, Class AB power amplifier, Class-C power amplifier, Thermal stability and Heat sinks.**Tuned Amplifiers**: Introduction, Q-Factor, small signal tuned amplifier, capacitance single tuned amplifier, double tuned amplifiers, , staggered tuned amplifiers	12
	Tota	60

Text Books:

1. Integrated Electronics- J. Millman and C.C. Halkias, Tata McGraw-Hill, 1972.
2. Electronic Devices and Circuits Theory – Robert L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, Tenth Edition, 2009.
3. Electronic Devices and Integrated Circuits – B.P. Singh,Rekha , Pearson publications, 2006

References:

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

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

II Year-II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
ANALOG COMMUNICATIONS					

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

		Knowledge Level (K)#
CO1	Describe various Analog modulation and demodulation schemes and their spectral characteristics	K2
CO2	Analyze noise characteristics of various analog modulation methods	K4
CO3	Discuss various functional blocks of radio transmitters andreceivers	K1
CO4	Design simple analog systems for various modulation techniques.	K5
CO5	Apply basic methods of probability and random variables to signal-to-noise ratios	K3

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1				**M**									H		H	M
CO2	**L**		**M**												M	H
CO3						**M**							H			M
CO4							**H**								H	H
CO5				M												

UNIT	CONTENTS	**Contact Hours**
UNIT - 1	**AMPLITUDE MODULATION :** Introduction to communication system, Need for modulation, Frequency Division Multiplexing , Amplitude Modulation, Definition, Time domain and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves, square law Modulator, Switching modulator, Detection of AM Waves; Square law detector, Envelope detector.	12
UNIT - 2	**DSB & SSB MODULATION:** Double side band suppressed carrier modulators, time domain and frequency domain description, Generation of DSBSC Waves, Balanced Modulators, Ring Modulator, Coherent detection of DSB-SC Modulated waves, COSTAS Loop. Frequency domain description, Frequency discrimination method for generation of AM SSB Modulated Wave, Time domain description, Phase discrimination method for generating AM SSB Modulated waves. Demodulation of SSB Waves, Vestigial side band modulation: Frequency description, Generation of VSB Modulated wave, Time domain description, Envelope detection of a VSB Wave pulse Carrier, Comparison of AM Techniques, Applications of different AMSystems, FDM.	12
UNIT - 3	**ANGLE MODULATION**: Basic concepts, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop. Comparison of FM & AM.	12
UNIT - 4	**TRANSMITTERS & RECEIVERS: Radio Transmitter** - Classification of Transmitter, AM Transmitter, Effect of feedback on performance of AM Transmitter, FM Transmitter – Variable reactance type and phase modulated FM Transmitter, frequency stability in FM Transmitter. **Radio Receiver** - Receiver Types - Tuned radio frequency receiver, Super hetro dyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Comparison with AM Receiver, Amplitude limiting. Communication Receivers, extensions of super heterodyne principle and additionalcircuits.	12
UNIT - 5	**NOISE:** Review of noise and noise sources, noise figure**,** Noise in Analog communication Systems, Noise in DSB& SSB System, Noise in AM System, Noise in Angle Modulation Systems, Threshold effect in Angle Modulation System, Pre-emphasis & de-emphasis **PULSE MODULATION:** Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation & demodulation of PWM, PPM, Generation and demodulation of PPM, Time Division Multiplexing, TDM Vs FDM	12
	Total	60

TEXT BOOKS:

1. Principles of Communication Systems – H Taub& D. Schilling, GautamSahe, TMH, 3rdEdition, 2007.
2. Principles of Communication Systems - Simon Haykin, John Wiley, 2ndEdition, 2007.

REFERENCES:

1. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004
2. Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH,2007.
3. Electronic Communication systems – Tomasi,Pearson, fourth Edition, 2007.

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UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

IIYear-II Semester		L	T	P	C
		0	0	3	1.5
LINEAR ICAPPLICATIONSLAB					

MinimumTwelveExperimentstobeconducted:

1. Studyof ICs–IC741,IC555, IC565, IC566, IC1496functioning,parametersandSpecifications.
2. OPAMPApplications –Adder,Subtractor,Comparator Circuits.
3. IntegratorandDifferentiatorCircuitsusingIC741.
4. ActiveFilterApplications – LPF,HPF(firstorder)
5. ActiveFilterApplications –BPF, BandReject(Wideband)andNotch Filters.
6. IC741OscillatorCircuits–PhaseShiftandWienBridgeOscillators.
7. FunctionGeneratorusingOPAMPs.
8. IC555Timer–MonostableOperationCircuit.
9. IC555Timer– AstableOperationCircuit.
10. SchmittTriggerCircuits–usingIC741 andIC555.
11. IC565–PLLApplications.
12. IC566–VCOApplications.
13. 4bit DAC usingOPAMP.

Course Outcomes:

CO1: Design and analyze the various linear application of op-amp.
CO2 : Design and analyze the various non-linear application of op-amp.
CO3 : Design and analyze filter circuits using op-amp
CO4 : Design and analyze oscillators and multivibrator circuits using op-amp
CO5: Design and analyze the various application of 555 timer.
CO6 : Analyze the performance of oscillators and multivibrators using trainer kits.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H		H	H									M		H	
CO2	H		H	H												L
CO3	M	M	M	H	M									M		
CO4	M		M	H											L	
CO5	M		M	H												L
CO6	H	M	M	H	M								H	L		H

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II Year-II Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

ANALOG COMMUNICATIONS LAB

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

A. Amplitude Modulation - Modulation &Demodulation
B. AM - DSB SC - Modulation &Demodulation
C. Diode Detector
D. Pre-emphasis &De-emphasis
E. Frequency Modulation - Modulation &Demodulation
F. AGC Circuits
G. Verification of Sampling Theorem
H. Pulse Amplitude Modulation &Demodulation
I. PWM, PPM – Modulation &Demodulation
J. PLL IC-565 as FM demodulator
K. Radio receiver characteristics
L. Radio Receiver/TV Receiver Demo kits or Trainees.

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

Equipment& Software required:

Software :

i) Computer Systems with latest specifications
ii) Connected in LAN(Optional)
iii) Operating system (Windows/Linux software)
iv) Simulations software (Simulink &MATLAB)

Equipment:

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

Course Outcomes

Upon successful completion of the course, the student will be able to
CO1: Analyse different parameters of Analog modulation techniques
CO2 :Analyse different parameters of pulse modulation techniques
CO3 :Study various parameters of Radio Receivers.
CO4 :Design and Construct Radio Receivers on their own

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**L**															
CO2				**M**									**M**			
CO3														**H**	**H**	
CO4		**M**														**L**
CO5					**H**											

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II Year-II Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
ELECTRONIC CIRCUIT ANALYSIS LAB					

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

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

1. Determination of f_T of a giventransistor.
2. Voltage-Series FeedbackAmplifier
3. Current-Shunt FeedbackAmplifier
4. RC Phase Shift/Wien BridgeOscillator
5. Hartley/ Colpitt'sOscillator
6. Two Stage RC CoupledAmplifier
7. Darlington Pair Amplifier
8. Bootstrapped Emitter Follower
9. Class A Series-fed PowerAmplifier
10. Transformer-coupled Class A PowerAmplifier
11. Complementary Symmetry Class B Push-Pull PowerAmplifier
12. Single Tuned VoltageAmplifier
13. Double Tuned VoltageAmplifier

Equipment required:

Software:

i. Multisim/ Equivalent Industrial Standard Licensed simulation softwaretool.
ii. Computer Systems with requiredspecifications

Hardware Required:

2. Regulated Powersupplies
3. Analog/Digital Storage Oscilloscopes
4. Analog/Digital FunctionGenerators
5. DigitalMultimeters
6. Decade RésistanceBoxes/Rheostats
7. Decade CapacitanceBoxes
8. Ammeters (Analog orDigital)
9. Voltmeters (Analog orDigital)
10. Active & Passive ElectronicComponents

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Course Outcomes:

After learning the course, the student will be able to perform simulation using Multisim software and verify with relevant hardware components:

CO1 : Find the threshold frequency 'f_t' of a given transistor.

CO2 : Design voltage series and current shunt feedback amplifiers and obtained its frequency responses.

CO3 : Design RC oscillators (Phase shift/Wien bridge) and LC oscillators (Hartley/Colpitt's) and find its oscillation frequency.

CO4 : Design two stage RC Coupled amplifier and obtain its frequency responses.

CO5 : Find voltage gain, current gain and input impedance of Darlington pair and bootstrap emitter follower.

CO6 : Construct and Calculate efficiency of power amplifiers (Class-A and Class-B).

CO7 : Design Tuned Voltage amplifiers and find its resonant frequency.

Mapping of course outcomes with program outcomes

1=LOW 2=MODERATE 3=HIGH													***PSO's***			
CO	***PO1***	***PO2***	***PO3***	***PO4***	***PO5***	***PO6***	***PO7***	***PO8***	***PO9***	***PO10***	***P11***	***P12***	***PSO1***	***PSO2***	***PSO3***	***PSO4***
CO1	M		L		M								M		L	H
CO2		L													M	
CO3	M			H									M		H	
CO4	H		H		M									M		M
CO5		L			M										L	
CO6			H		M								M	H		H
CO7	M			L	H									L	H	

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II Year - II Semester		L	T	P	C
		1	0	2	2

SCIENTIFIC COMPUTING(SKILL ORIENTED COURSE)

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

		Knowledge Level (K)#
CO1	Translate mathematical methods to MATLAB code	K4
CO2	Generalize results and represent data visually	K3
CO3	Apply computer methods for solving a wide range of engineering problems.	K3
CO4	Utilize computer skills to enhance learning and performance in other engineeringand science courses	K4
CO5	Acquire knowledge of Advanced MATLAB programming methods and Simulink	K3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1			**M**										H		H	M
CO2		**M**													M	H
CO3	**L**												H			M
CO4															H	H
CO5			H										H		L	

UNIT	CONTENTS	Contact Hours
UNIT – 1	Introduction to MATLAB The Advantages of MATLAB, Disadvantages of MATLAB, MATLAB Environment,Using MATLAB as a Scratch Pad Variables and Arrays,Initializing Variables in MATLAB,Multidimensional Arrays,Sub arrays, Special Values,Displaying Output Data,Data Files, Scalar and Array Operations, Hierarchy of Operations, Introduction to Plotting, Examples, Debugging MATLAB Programs	12
UNIT – 2	Branching Statements and Program Design Use of Pseudo code,The Logical Data Type, Branches, Additional Plotting Features, More on Debugging MATLAB Programs The while Loop,The for Loop,Logical Arrays and Vectorization,The MATLAB Profiler,Additional Examples	12
UNIT – 3	User-Defined Functions Introduction to MATLAB Functions,Variable Passing in MATLAB: The Pass-by-Value Scheme, Optional Arguments, Sharing Data Using Global Memory, Preserving Data Between Calls to a Function, Function Functions, Sub functions, Private Functions, and Nested Functions.	12
UNIT – 4	Graphical User Interfaces How a Graphical User Interface Works, Creating and Displaying a Graphical User Interface,Object Properties,Graphical User Interface Components, Additional Containers: Panels and Button Groups,Dialog Boxes,Menus,Tips for Creating Efficient GUIs	12
UNIT – 5	SIMULINK Introduction, Importance, Model Based Design, Tools, Mathematical Modeling, Converting Mathematical Model into Simulink Model, Running Simulink Models, Importing Exporting Data, Solver Configuration, Masking Block/Model.	12
	Tota	60

TEXT BOOKS:

1. MATLAB® Programming For Engineers, Fourth edition by Stephen J. Chapman
2. MATLAB Programming by Y. Kirani Singh, B.B. Chaudhuri, PHI Publication.

REFERENCE BOOKS:

1. Getting Started WithMatlab: A Quick Introduction For Scientists And Engineers (English) by Rudra Pratap, OXFORD University Press.
2. Applied Numerical Methods Using MATLAB1st Edition by Won Y. Yang ,Wenwu Cao, Tae-Sang Chung, John Morris

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III YEAR I SEM

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III Year-I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Digital IC Applications					

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

		Knowledge Level (K)#
CO1	Extend the digital operations to any width by connecting the ICs and can also design, simulate their results using hardware description language.	K4
CO2	Analyze the Synthesis process and develop experiments using tools	K4
CO3	Illustrate the process of memory design and understand the concept of memory	K3
CO4	Understand the concepts of different logics and implementations using Integrated Circuits	K4
CO5	Design and analyze any Digital design in real time applications.	K5

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1					**H**								**H**		**H**	**H**
CO2				**M**											**M**	**M**
CO3		**L**											**H**			**H**
CO4			**M**												**H**	**M**
CO5				**M**												

UNIT	**CONTENTS**	**Contact Hours**
UNIT – 1	Digital Design Using HDL: Design flow, program structure, History of VHDL, VHDL requirements, Levels of Abstraction, Elements of VHDL, Concurrent and Sequential Statements, Packages, Libraries and Bindings, Objects and Classes, Subprograms, Comparison of VHDL and Verilog HDL.	12
UNIT – 2	VHDL Modeling : Simulation, Logic Synthesis, Inside a logic Synthesizer, Constraints, Technology Libraries, VHDL and Logic Synthesis, Functional Gate-Level verification, Place and Route, Post Layout Timing Simulation, Static Timing, Major Netlist formats for design representation, VHDL Synthesis-Programming Approach.	12
UNIT – 3	Combinational Logic Design: Adders & Subtractors, Ripple Adder, Look Ahead Carry Generator, Binary Parallel Adder, Binary Adder-Subtractor, ALU, Decoders, encoders, three state devices, multiplexers and de-multiplexers, Code Converters, parity circuits, comparators, multipliers, Barrel Shifter, Simple Floating-Point Encoder, Cascading Comparators, Dual Priority Encoder, Design considerations with relevant Digital ICs, modeling of Circuits by using VHDL.	12
UNIT – 4	Sequential Logic Design: SSI Latches and Flip-Flops, Counters, Design of Counters using Digital ICs, Ring Counter, Johnson Counter, Asynchronous counters, Modulus N Synchronous Counters, MSI Registers, Shift Registers, Modes of Operation of Shift Registers, Universal Shift Registers, MSI Shift Registers, Design considerations with relevant Digital ICs, modeling of circuits by using VHDL, UART and PIC Controller modeling.	12
UNIT – 5	Digital Logic Families and Interfacing: Introduction to logic families, CMOS logic, CMOS logic families. Bipolar logic, transistor-transistor logic, Emitter coupled logic. Programmable Logic Devices (PLDs) & Memories: Programmable Read Only Memory, Programmable Logic Array, Programmable Array Logic Devices, ROM: Internal structure, Static RAM: Internal structure, SRAM timing, standard, synchronous SRAMS, Dynamic RAM: Internal structure, timing, synchronous DRAMs. Design considerations of PLDs with relevant Digital ICs, Internal architecture of NOR flash and NAND flash. Introduction to FPGA, CPLD Architecture.	12
	Total	60

Text Books:

1. Digital Design Principles & Practices – John F.Wakerly, PHI/ Pearson Education Asia, 3rd Edition, 2005.
2. Designing with TTL Integrated Circuits: Robert L. / John R. Morris & Miller.
3. VHDL Programming by Example-Douglas L.Perry**,** McGraw-Hill,4th Edition

References:

1. "Fundamentals of Digital logic design with VHDL". Stephen Brown &ZvonkoVranesic, Tata McGraw Hill, 2nd edition.
2. VHDL Primer – J. Bhasker, Pearson Education/ PHI, 3rd Edition.

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III Year - I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
MICRO PROCESSORS AND MICRO CONTROLLERS					

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

		Knowledge Level (K)#
CO1	Develop programs for different addressing modes.	K4
CO2	8086 interfacing with different peripherals and implement programs	K3
CO3	Describe the key features of serial and parallel communication	K6
CO4	Design a microcontroller for simple applications	K1
CO5	Illustrate how the different peripherals are interfaced with microprocessor	K4

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1																
CO2																
CO3			**M**											**L**		
CO4				**M**	**H**								**H**		**L**	**L**
CO5		**M**														

UNIT	CONTENTS	**Hours**
UNIT – 1	8086/8088 MICROPROCESSORS: Register organization of 8086, Architecture, signal description of 8086 physical memory organization, general bus operation, I/O addressing capability, special purpose activities Minimum mode, maximum mode of 8086 system and timings, machine language instruction formats addressing mode of 8086, instruction set of 8086,assembler directives and operators.	12
UNIT – 2	PROGRAMMING WITH 8086 MICROPROCESSOR: Machine level programs, programming with an assembler, Assembly language programs, introduction to stack, stack structure of 8086/8088, interrupts and interrupt service routines, interrupt cycle of 8086, non-mask able interrupt and mask able interrupts, interrup programming.	12
UNIT – 3	BASIC AND SPECIAL PURPOSE PROGRAMMABLE PERIPHERALS AND THEIR INTERFACING WITH 8086. Semiconductor memory interfacing, dynamic RAM interfacing, interfacing i/o ports, PIO 8255 modes of operation of 8255,interfacing to D/A and A/D converters, stepper motor interfacing. Block diagram and functional aspects of 8254 PIT, 8259A, PIC, 8279 keyboard/display controller, 8251 USART, 8257 DMA Controller	12
UNIT – 4	ADVANCED MICRO PROCESSORS: Salient features of 0386DX, architecture and signal description of 80386, register organization of 80386 and addressing modes, data types of 80386, real address mode of 80386, protected mode of 80386, segmentation and Paging, virtual 8086 mode and enhanced mode Instruction set of 80386.The coprocessor 80387.	12
UNIT – 5	8051 MICROCONTROLLER: Introduction to microcontrollers, 8051Microcontrollers, 8051pin description connections, I/O ports and memory organization, MCS51addressing modes and instructions, assembly language programming tools.Introduction to RISC, processor design tradeoffs, Introduction to 16/32 bi processors, ARM architecture and organization, ARM family, Thumb instructions, programming models of ARM 7, Register set, CPSR, SPSR	12
	Tota	60

TEXT BOOKS:

1. Douglas V Hall, “Microprocessors and Interfacing Programming and Hardware” , New Delhi Tata McGrawHill Publishing Company Limited
2. A.K.Ray, K.M.Bhurchandi ,”Advanced Microprocessors and Peripherals”, Tata McGraw Hill Publications,2000.
3. Steve Furber, “ARM System on Chip Architecture”, second edition, Pearson publications, 2009.
4. Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.McKinlay, “The 8051 microcontroller and embedded systems” second edition, Pearson publications.

REFERENCES:

1. Ajay V Deshmukh, ”Microcontrollers”, TATA McGraw Hill publications,2012.
2. Krishna Kant, “Microprocessors and Microcontrollers”, PHI Publications, 2010.
3. N.Sentil Kumar, M.Saravanan, S.Jeevananthan, “Microprocessors and Microcontrollers”, Oxford University Press, 2010.

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III Year-I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
ELECTROMAGNETIC WAVES and TRANSMISSION LINES					

Pre-requisite: Understanding of Cartesian co-ordinates, spherical & cylindrical systems
Course Outcomes: At the end of the course, student will be able to

		Knowledge Level (K)#
CO1	Obtain knowledge in different types of transmission lines and calculate characteristics impedance and propagation constant	K1
CO2	Calculate input impedance of a transmission lines, apply Smith chart for analysis of transmission lines	K2
CO3	Determine electric field and capacitance using various Laws	K3
CO4	Calculate magnetic field inductance using various laws and apply the Maxwell equations to analyze the time varying behavior of EM Waves	K4
CO5	Analyze the wave propagation in different media, calculate reflection coefficient, average power	K3

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	L															
CO2		L											H		H	M
CO3				**M**											M	
CO4				**M**									H			M
CO5															H	

Mapping of course outcomes with program outcomes

UNIT	CONTENTS	**Hours**
UNIT – 1	**Transmission Lines - I**: Types, Parameters, T&π Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Illustrative Problems	12
UNIT – 2	**Transmission Lines – II:** Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. Low loss radio frequency lines and UHF Transmission lines, UHF Lines as Circuit Elements, Impedance Transformations, λ/8,λ/4 and λ /2 Lines –. Smith Chart – Construction and Applications, Quarter wave transformer, Single Stub Matching, Illustrative Problems.	12
UNIT – 3	Review of Co-ordinate Systems, **Electrostatics:**, Coulomb's Law, Electric Field Intensity, Electric Flux Density Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems	12
UNIT – 4	**MagnetoStatics:**Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to MagneticFields, Ampere's Force Law, Inductances and Magnetic Energy. Illustrative Problems **Maxwell's Equations (Time Varying Fields):** Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface. Illustrative Problems	12
UNIT – 5	**EM Wave Characteristics :**Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types, Illustrative Problems. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance. Poynting Vector and Poynting Theorem. Illustrative Problems.	12
	Total	60

TEXT BOOKS:

1. Elements of Electromagnetic – Matthew N.O. Sadiku, Oxford Univ. Press, 3rd ed., 2001.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000

REFERENCE BOOKS:

1. Electromagnetic Field Theory and Transmission Lines –GSN Raju, Pearson Education 2006
2. Engineering Electromagnetic – William H. Hayt Jr. and John A. Buck, TMH, 7th ed., 2006.
3. Electromagnetic Field Theory and Transmission Lines: G SasiBhushanaRao,Wiley India 2013.

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III Year-I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
CONTROL SYSTEMS(PE1)					

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

		Knowledge Level (K)#
CO1	This course introduces the concepts of feedback and its advantages to various control systems	K4
CO2	The performance metrics to design the control system in time-domain and frequency domain are introduced.	K3
CO3	Control systems for various applications can be designed using time-domain and frequency domain analysis	K3
CO4	In addition to the conventional approach, the state space approach for the analysis of control systems is also introduced	K4
CO5	Categorize different types of system and identify a set of algebraic equation to represent and model a complicated system into a more simplified form	K3

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**L**	**H**	**M**												**L**	
CO2	**M**	**H**	**L**	**M**	**L**										**M**	**H**
CO3	**M**	**M**	**M**	**H**									**H**		**L**	**L**
CO4	**M**	**M**	**L**	**M**	**L**								**L**		**M**	**M**
CO5				**M**												

UNIT	CONTENTS	**Hours**
UNIT – 1	**INTRODUCTION** Concepts of System, Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems	12
UNIT – 2	**TRANSFER FUNCTION REPRESENTATION** Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra- Representation by Signal flow graph - Reduction using mason's gain formula. **TIME RESPONSE ANALYSIS** Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants.	12
UNIT – 3	**STABILITY ANALYSIS IN S-DOMAIN** The concept of stability – Routh-Hurwitz stability criterion – qualitative stability and conditional stability – limitations of Routh's stability **Root Locus Technique:** The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.	12
UNIT – 4	**Frequency response analysis:** Introduction, Correlation between time and frequency response, Polar Plots Bode Plots, Nyquist Stability Criterion	12
UNIT – 5	**CLASSICAL CONTROL DESIGN TECHNIQUES** Compensation techniques – Lag, Lead, Lead-Lag Controllers design infrequency Domain, PID Controllers State Space Analysis of Continuous Systems Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties –Concepts of Controllability and Observability.	12
	Total	60

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Control Systems by A.Nagoorkani, RBA publications,3 edition, 2017.
2. Control Systems by A.Anandkumar, PHI, 2nd Edition, 2014.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

III Year - I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
ELECTRONIC MEASUREMENTS AND INSTRUMENTATION(PE1)					

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

		Knowledge Level (K)#
CO1	Select the instrument to be used based on the requirements.	K1
CO2	Understand and analyze different signal generators and analyzers.	K2
CO3	Understand the design of oscilloscopes for different applications	K6
CO4	Design different transducers for measurement of different parameters.	K6
CO5	Analyse the concept of AC Bridges design for different application	K4

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**L**															
CO2																
CO3													**H**		**M**	**M**
CO4					**L**										**L**	**H**
CO5				**M**												

UNIT	CONTENTS	**Hours**
UNIT – 1	Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity, Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error, DC Voltmeters- Multi-range, Range extension/Solid state and differential voltmeters, AC voltmeters- multi range, range extension, shunt. Thermocouple type RF ammeter, Ohmmeters series type, shunt type.	12
UNIT – 2	Signal Generator- fixed and variable, AF oscillators, Standard and AF sine and square wave signa generators, Function Generators, Square pulse, sweep, Arbitrary waveform. Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers, Digital Fourier Analyzers.	12
UNIT – 3	Oscilloscopes CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, Dual beam CRO, . Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital readout oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement, standard specifications of CRO, probes for CRO- Active & Passive, attenuator type.	12
UNIT – 4	AC Bridges Measurement of inductance- Maxwell's bridge, Anderson bridge, Measurement o capacitance -Schearing Bridge. Wheat stone bridge, Wien Bridge, Errors and precautions in using bridges Q-meter.	12
UNIT – 5	Transducers- active & passive transducers : Resistance, Capacitance, inductance; Strain gauges, LVDT Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors. Measurement of physical parameters force, pressure, velocity and calculations.	12
	Tota	60

TEXTBOOKS:

1. Electronic instrumentation, second edition - H.S.Kalsi, Tata McGraw Hill, 2004.

2. Modern Electronic Instrumentation and Measurement Techniques – A.D.Helfrick & W.D.Cooper,PHI,5th Edition, 2002.

REFERENCES:

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 2nd Edition, 2003.

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III Year - I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
INTERNET OF THINGS(PE1)					

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

		Knowledge Level (K)#
CO1	Understand internet of Things and its hardware and software components	K2
CO2	Interface I/O devices, sensors &communication modules	K3
CO3	Remotely monitor data and control devices	K4
CO4	Design real time IoT based applications	K1
CO5	Able to realize revolution of Internet in mobile devices, cloud& sensor Networks	K2

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	M												L			L
CO2	L	M		M	L										H	M
CO3	L	M	H		L										H	H
CO4	M		H	M									L	M		L
CO5			M													

UNIT	CONTENTS	**Hours**
UNIT – 1	**Introduction to IoT:** Introduction to IoT, Architectural Overview, Design principles and needed capabilities, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.	12
UNIT – 2	**Elements of IoT:** Hardware Components- Computing- Arduino, Raspberry Pi, ARM Cortex-A class processor, Embedded Devices – ARM Cortex-M class processor, Arm Cortex-M0 Processor Architecture Block Diagram, Cortex-M0 Processor Instruction Set, ARM and Thumb Instruction Set.	12
UNIT – 3	**IoT Application Development:** Communication, IoT Applications, Sensing, Actuation, I/O interfaces Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, CoAP, UDP, TCP, Bluetooth. **Bluetooth Smart Connectivity:** Bluetooth overview, Bluetooth Key Versions, Bluetooth Low Energy (BLE) Protocol, Bluetooth, Low Energy Architecture, PSoC4 BLE architecture and Component Overview.	12
UNIT – 4	**Solution framework for IoT applications:** Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication authorization of devices	12
UNIT – 5	**IoT Case Studies:** IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.	12
	Total	60

Text Books:

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education,2017.
2. The Definitive Guide to the ARM Cortex-M0 by JosephYiu,2011
3. Vijay Madisetti, ArshdeepBahga, Internet of Things, "A Hands on Approach", University Press,2015.

References:

1. Cypress Semiconductor/PSoC4 BLE (Bluetooth Low Energy) Product TrainingModules.
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: EnablingTechnologies, Platforms, and Use Cases", CRC Press,2017.

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III Year - I Semester		**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**
PRINCIPLES OF ELECTRONICS (OE-1)					

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

		Knowledge Level (K)#
CO1	Acquire basic knowledge on the working of various semi-conductor devices	K1
CO2	Develop anaysis capability in BJT and FET Amplifier Circuits	K4
CO3	Develop competence in frequency response analysis of discrete amplifiers	K3
CO4	Develop design competence in signal and power amplifiers using BJT and FET	K6
CO5	Develop knowledge on design trade-offs in various digital electronic families with a view towards reduced power consumption	K1

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		**H**														
CO2	**L**												**L**		**H**	**H**
CO3			**M**												**M**	**L**
CO4		**M**											**H**			**M**
CO5															**M**	**H**

UNIT	CONTENTS	**Hours**
UNIT – 1	Junction Diode Characteristics : Open circuited p-n junction, Biased p-n junction, p-n junction diode current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence or V-I characteristics, Diode resistance, Diode capacitance.	12
UNIT – 2	**Special Semiconductor Devices**: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode, Tunnel Diode, UJT, PNPN Diode, SCR. Construction, operation and V-I characteristics	12
UNIT – 3	**Rectifiers and Filters:** Basic Rectifier setup**,** half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter(Series inductor), Capacitor filter(Stunt inductor), π-Filter, comparison of various filter circuits in terms of ripple factors.	12
UNIT – 4	**Transistor Characteristics: BJT:** Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values	12
UNIT – 5	**FET:** FET types, construction, operation, characteristicsμ, g_m, $r_d$parameters, MOSFET-types, construction operation, characteristics, comparison between JFET and MOSFET, CMOS.	12
	Tota	60

Text Books:

1. Integrated Electronics-J. Millman, C. Halkias,TataMc-Graw Hill, Second Edition,2009
2. Electronic Devices and Circuits by David A. Bell, Oxford University Press
3. Electronics devices & circuit theory- Robert L.Boylestad and LouiNashelsky, Pearson/Prentice hall, tenthedition,2009

References:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, SecondEdition,2007
2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016.
3. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, 4th Edition,2008.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

III Year - I Semester		**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**
ELECTROMAGNETIC INTERFERENCE & COMPATIBILITY (OE-1)					

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

		Knowledge Level (K)#
CO1	Discuss effects of EMI and counter measures by EMC-techniques.	K4
CO2	Apply the knowledge gained in selecting proper gadget/device/appliance/system, as per EMC- norms specified by regulating authorities.	K3
CO3	Students shall choose career in the fields of EMI/EMC as an Engineer/Researcher/Entrepreneur in India/abroad.	K6
CO4	Understand the various aspects of shielding & PCB Tracing ,termination & Implementation	K2
CO5	Identifying of EMI Hotspot and various techniques like grounding filtering soldering etc	K5

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		**M**														
CO2	**L**												**L**		**M**	**H**
CO3			**L**												**M**	**L**
CO4		**M**											**H**			**M**
CO5															**M**	**H**

UNIT	CONTENTS	**Hours**
UNIT – 1	**Natural and Nuclear sources of EMI / EMC**: Introduction, Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations. An overview of EMI/ EMC, Natural and Nuclear sources of EMI	12
UNIT – 2	**EMI from apparatus, circuits and open area test sites**: Electromagnetic emissions, noise from relays and switches, non-linearity in circuits, passive inter-modulation, cross talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.	12
UNIT – 3	**Radiated and conducted interference measurements**: Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents / voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI detectors and measurements.	12
UNIT – 4	**ESD, Grounding, shielding, bonding and EMI filters**: Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design. ESD, Electrical fast transients / bursts, electrical surges.	12
UNIT – 5	**Cables, connectors, components**: Introduction, EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, Transient and Surge Suppression Devices. **EMC standards- National / International**: Introduction, Standards for EMI and EMC, MIL-Standards IEEE/ANSI standards, CISPR/IEC standards, FCC regulations, EMI/EMC standards in JAPAN, Conclusions.	12
	Tota	60

Text Books:

1. Engineering Electromagnetic Compatibility by **Dr. V.P. Kodali, IEEE Publication**, Printed in India by ***S. Chand & Co. Ltd., New Delhi, 2000***.

References:

1. Introduction to Electromagnetic Compatibility, NY, **John Wiley, 1992, by C.R. Pal.**

2. Electromagnetic Interference and Compatibility **IMPACT series, IIT – Delhi.**

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III Year - I Semester		**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**
PRINCIPLES OF COMMUNICATIONS (OE-1)					

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

		Knowledge Level (K)#
CO1	Analyze and design amplitude modulation systems at the sub-system level. .	K4
CO2	Design angle modulation systems at the sub-system level.	K6
CO3	Classifye and design pulse modulation systems at the sub-system level.	K4
CO4	Apply basic methods of probability and random variables to signal-to-noise ratios	K3
CO5	Design simple analog systems for various modulation techniques.	K6

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**L**											**L**				
CO2				**M**									**M**			
CO3														**H**	**H**	
CO4		**M**														**L**
CO5					**H**											

UNIT	CONTENTS	**Hours**
UNIT – 1	AMPLITUDE MODULATION : Introduction and overview of basic communication system, Need for Modulation, Amplitude Modulation, Modulation Index, Spectrum of AM Signal, Power Calculations in AM Systems, Modulators and Demodulators (Diode detector),DSB-SC Signal, SSB Signal, Comparison of AM Techniques.	12
UNIT – 2	ANGLE MODULATION: Angle Modulation, Narrow Band and Wideband FM, Spectrum of an FM Signal. Indirect method of Frequency Modulation (Armstrong Method), FM Demodulation: Balanced Slope Detector, Ratio Detector, Pre – emphasis and De – emphasis, Comparison of FM and AM.	12
UNIT – 3	PULSE ANALOG MODULATION: Time Division Multiplexing, Types of Pulse modulation, PAM (Single polarity, double polarity), Generation & demodulation of PWM, Generation and demodulation of PPM, Comparison of PAM, PWM and PPM systems.	12
UNIT – 4	PULSE DIGITAL MODULATION: Elements of Digital Communication System, Comparison of Digital and Analog Communication Systems. Pulse Code Modulation (PCM): Quantization and Encoding, Differential Pulse Code Modulation, Delta Modulation.	12
UNIT – 5	DIGITAL MODULATION TECHNIQUES: Introduction, Amplitude Shift Keying, Binary Frequency Shift Keying, Binary Phase Shift Keying, Differential PSK (DPSK), Quadrature Phase Shift keying (QPSK), Comparison of Digital Modulation Techniques.	12
	Tota	60

TEXT BOOKS:

1. Simon Haykins, “Communication Systems”, 2nd Edition, Reprint, John Wiley and Sons, 2008.
2. H. Taub and D. L. Schilling, “Principles of Communication Systems”, Tata McGraw-Hill, 3rd print, 2008.

REFERENCES:

1. R.P. Singh and S. Sapre, “Communication Systems: Analog and Digital”, 3rd edition, Tata McGraw-Hill, 2017.
2. Digital Communication, Bernard Sklar, 2nd Edn. Pearson Education.

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IIIYear-I Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
MICROPROCESSORSandMICROCONTROLLERSLAB					

The students are required to develop the necessary Algorithm, Flowchart and Assembly Language ProgramSource Code for executing the following functions using MASM/TASM software and to verify the results withnecessaryHardwareKits.

PART-I:MICROPROCESSOR8086

1. IntroductiontoMASM/TASM.
2. Arithmeticoperation-MultibyteAdditionandSubtraction,MultiplicationandDivision-SignedandunsignedArithmeticoperation, ASCII-Arithmetic operation.
3. Logicoperations-Shiftandrotate-ConvertingpackedBCDtounpackedBCD,BCDtoASCIIconversion.
4. Byusingstringoperationand Instructionprefix:MoveBlock,Reversestring,Sorting,Inserting,Deleting,Lengthofthe string, Stringcomparison.
5. DOS/BIOSprogramming:Readingkeyboard(Bufferedwithandwithoutecho)-Displaycharacters,Strings.

PART-II:INTERFACINGWITHMICROPROCESSOR

1. 8259– InterruptController-Generateaninterruptusing8259timer.
2. 8279– Keyboard Display-Writeaprogramto displayastringofcharacters.
3. 8255–PPI-WriteALPtogeneratesinusoidalwaveusingPPI.
4. 8251–USART-WriteaprograminALPtoestablishCommunicationbetweentwoprocessors.

PART-III:MICROCONTROLLER8051

1. Readingand Writingon aparallel port.
2. Timerindifferentmodes.
3. Serialcommunicationimplementation.

PART-IV:INTERFACINGWITHMICROCONTROLLER

WriteCprogramstointerface8051chiptoInterfacingmodulestoDevelopsinglechipsolutions.

1. SimpleCalculatorusing6 digitsevensegmentdisplayandHexKeyboardinterfaceto 8051.
2. AlphanumericLCDpanelandHexkeypadinputinterfaceto8051.
3. ExternalADCandTemperaturecontrolinterfaceto8051.
4. GeneratedifferentwaveformsSine,Square,Triangular,andRampetc.usingDACinterfaceto8051;changethe frequencyandAmplitude.

EQUIPMENTREQUIREDFORLABORATORY

1. MASM/TASMsoftware
2. 8086Microprocessor Kits
3. 8051Micro Controllerkits
4. Interfaces/peripheralsubsystems
   - i) 8259PIC
   - ii) 8279-KB/Display
   - iii) 8255PPI
   - iv) 8251USART
5. A/DandD/ACInterface

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CO	Description	Knowledge Level
CO1	Understand the fundamentals of assembly level programming of microprocessors & microcontrollers	K2
CO 2	Apply the programing knowledge for arithmetic and logical operations in 8086 & 8051	K4
CO **3**	Apply the programing knowledge for arithmetic and logical operations in 8051	K4
CO4	Develop the programs for sorting	K4
CO 5	Develop the programs for string manipulation programs	K4
CO 6	Contrast how different I/O devices can be interfaced to processor and will explore several techniques of interfacing.	K3
CO 7	Apply the programing knowledge for understanding of communication standards in 8086	K2
CO8	Apply the programing knowledge for understanding of communication standards in 8051	K2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1		**M**														
CO2	**L**			M									**L**		**M**	**H**
CO3			**L**		M										**M**	**L**
CO4		**M**											**H**			**M**
CO5					H										**M**	**H**
CO6	L			M									**M**			
CO7		M														
CO8			M												**M**	

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III Year-I Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
DIGITAL IC APPLICATIONS LAB					

The students are required to design and draw the internal structure of the following Digital Integrated Circuits and to develop VHDL source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary synthesizer. Further, it is required to verify the logic with necessary hardware.

List of Experiments:

1. Realization of Logic Gates
2. 3 to 8 Decoder- 74138
3. 8*1 Multiplexer-74151 and 2*1 De-multiplexer-74155
4. 4-Bit Comparator-7485.
5. D Flip-Flop- 7474
6. Decade Counter- 7490
7. 4 Bit Counter-7493
8. Shift Register-7495
9. Universal shift register-74194/195
10. Ram (16*4)-74189 (read and write operations)
11. ALU

Equipment Required:

1.Xilinix ISE software-latest version
2. Personal computer with necessary pheripherals
3.Hardware kits- Various FPGA families.

Course Outcomes:

		Knowledge Level (K)#
CO1	Develop a HDL code for combinational circuits	K6
CO2	Implementation of high level combinational circuits with ICs using low level building blocks	K3
CO3	Analyze and Implement Combinational Logic Circuits on FPGAs	K4
CO4	Construct high level sequential circuits with ICs using low level building blocks	K6
CO5	Designing of Shift Registers Counters with HDL	K6
CO6	Evaluate & Draw Logic Diagrams for different MOD Counters	K5
CO7	Understand and Implement Sequential Logic Circuits on FPGAs	K6
CO8	Develop HDL codes for Real time application	K2

Mapping of course outcomes with program outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	L	L		L									L			L
CO2	M		M		M									M		L
CO3		M			L											L
CO4		L		M									L			L
CO5	L		H		L									M	M	L
CO6	M		M	L									L			L
CO7		L	M		L										H	M
C08	L		L	L	L								L	L	L	L

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III Year - I Semester		**L**	**T**	**P**	**C**
		1	**0**	**2**	**2**
SCILAB (SKILL ADVANCED COURSES/SOFT SKILL COURSES)					

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

		Knowledge Level (K)#
CO1	Understand the need for simulation/implementation for the verification of mathematical functions	K2
CO2	Understand the main features of the SCILAB program development environment to enable their usage in the higher learning.	K2
CO3	Implement simple mathematical functions/equations in numerical computing environment such as SCILAB	K5
CO4	Interpret and visualize simple mathematical functions and operations thereon using plots/display	K3
CO5	Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using SCILAB tools	K4

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**L**							**M**					**L**		**M**	**M**
CO2															**H**	**H**
CO3			**M**				**H**						**M**	**H**		**M**
CO4					**H**										**H**	**H**
CO5		**M**												**M**		

UNIT	**CONTENTS**	**Hours**
UNIT – 1	**MATRICES AND ARRAYS IN SCILAB** About SCILAB, SCILAB System, How to start SCILAB, Entering Matrices sum and transpose, subscripts, Colon Operator, magic Function, Variables and constants: Definition, naming (identifiers or labels for different entities, initialization and accessing of variables. Constants and their representation.	12
UNIT – 2	**WORKING WITH MATRICES** Generating Matrices, The load Function, Concatenation, Deleting Rows and Columns, Linear Algebra, Arrays Multivariate Data, Scalar Expansion, Logical Subscripting, find Function. Variables Numbers, Operators Functions, Expressions.	12
UNIT – 3	**GRAPHICS & COMMAND WINDOW** The format Function, Suppressing Output, Entering Long Statements, Command Line Editing. Plotting Process, Editing Process, Preparing Graphs, Basic Plotting Functions, Mesh & Surface Plot, and Image Reading &Writing, Printing graphics, Simple programs.	12
UNIT – 4	**DATA STRUCTURE & FLOW CONTROL** If, else and elseif , switch and case, for, while, continue, break, try-catch, return. Multidimensional Arrays, Cell Arrays, Characters and Text, Structures, Simple programs.	12
UNIT – 5	**SCRIPTS & FUNCTIONS** Scripts, Functions, Global Variables, Passing String, Arguments to Functions, eval Function, Function Handles, Vectorization, Preallocation, Simple programs.	12
	Total	60

TEXT BOOKS:

1. Introduction to SCILAB by Rachna Verma and Arvind Verma

REFERENCE BOOKS:

1. SCILAB - A Beginner‟s Approach by Anil Kumar Verma

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III YEAR II SEM

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III Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
VLSI DESIGN					

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

		Knowledge Level (K)#
CO1	Apply the Concept of design rules during the layout of a circuit.	K3
CO2	Model and simulate digital VLSI systems using hardware design language.	K1
CO3	Synthesize digital VLSI systems from register-transfer or higher level descriptions	K5
CO4	Understand current trends in semiconductor technology, and how it impacts scaling and performance.	K2
C05	Differentiate various FPGA CPLD Architectures	K4

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**M**			**M**									**H**		**M**	**M**
CO2			M		M									**L**	**H**	**H**
CO3		**L**											**M**			**M**
CO4	M				M										**L**	**H**
CO5		L		M									**L**			**L**

UNIT	CONTENTS	**Hours**
UNIT – 1	**Introduction :**Introduction to IC Technology, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, IC production process, MOS and CMOS Fabrication processes, Bi-CMOS Technology, Comparison between CMOS and Bipolar technologies. **Basic Electrical Properties Of MOS and Bi-CMOS Circuits:** I_{ds} versus V_{ds} Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. The Pass transistor, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter. Alternative forms of pull-up, The CMOS Inverter, MOS transistor circuit model, Bi-CMOS Inverter, Latch-up in CMOS circuits and BiCMOS Latch-up Susceptibility.	12
UNIT – 2	**MOS and Bi-CMOS Circuit Design Processes:** MOS Layers, Stick Diagrams, Design Rules and Layout, General observations on the Design rules, 2µm Double Metal, Double Poly, CMOS/BiCMOS rules, 1.2µm Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams-Translation to Mask Form.	12
UNIT – 3	**Basic Circuit Concepts:** Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Fan-in and fan-out characteristics, Transistor switches, Realization of gates using NMOS, PMOS and CMOS technologies. **Scaling Of MOS Circuits:** Scaling models, Scaling factors for device parameters, Limits due to sub threshold currents, current density limits on logic levels and supply voltage due to noise.	12
UNIT – 4	**Subsystem Design:** Architectural issues, switch logic, Gate logic, examples of structured design, clocked sequential circuits.	12
UNIT – 5	**VLSI Design Issues:** VLSI Design issues and design trends, design process, design for testability, technology options, power calculations, package selection, clock mechanisms, Introduction to mixed signal design, ASIC design flow, FPGA design flow, introduction to SoC design. Basic CPLD architecture, typical CPLD design flow **FPGA Design:** Basic FPGA architecture, , FPGA configuration, configuration modes, FPGA design process-FPGA design flow, FPGA families.	12
	Tota	60

Text Books:

1. Essentials of VLSI Circuits and Systems By Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Prentice-Hall of India Private Limited,2005 Edition.

References:

1. VLSI Design By A.Albert Raj &T.Latha,PHI Learning Private Limited,2010.
2.VLSI Design-A.Shanthi and A.Kavita, New Age International Private Limited, 2006 First Edition.

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III Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
DIGITAL SIGNAL PROCESSING					

Pre-requisite: Signals & Systems
Course Outcomes: At the end of the course, student will be able to

		Knowledge Level (K)#
CO1	Discuss Signals and Systems in Discrete Domain; z-Transforms and its applications to the analysis of LTI systems	K2
CO2	Explain the analysis of signals in frequency domain and calculation of DFT using FFT Algorithms	K2
CO3	Identify the FIR and IIR structures for the required digital filter and study of various filter structures	K1, K2
CO4	Analyze and Design a Digital filter (FIR&IIR) from the given specifications.	K4,K5
CO5	Describe the Architecture of DSP Processor	K1

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**H**												**H**			**M**
CO2	**H**				**L**								**M**			**H**
CO3	**M**		**M**	**H**												**H**
CO4	**M**	**M**	**H**		**L**										**M**	**H**
CO5	**M**			**H**									**M**			**H**

UNIT	CONTENTS	**Hours**
Unit - 1	**Introduction:** Signals, Systems, and Signal Processing, Classification of Signals, The Concept of Frequency in Continuous Time and Discrete Time Signals **Discrete Time Signals and Systems**: Discrete Time Signals, Discrete Time Systems, Analysis of Discrete Time Linear Time Invariant Systems, Discrete Time Systems Described by Difference Equations, Implementation of Discrete Time Systems, Correlation of Discrete Time Signals **The z-Transform and Its Applications to the Analysis of LTI Systems**: The z-Transform, Properties, Rational z Transforms, Inversion of the z-Transform, Analysis of Linear Time Invariant Systems in the z-Domain, The One sided z-Transform.	9
Unit-2	**Frequency Analysis of Signals**: Frequency Analysis of Continuous Time Signals, Frequency Analysis of Discrete Time Signals, Frequency Domain and Time Domain Signal Properties, Properties of the Fourier Transform for Discrete Time Signals. **The Discrete Fourier Transform: Its Properties and Applications**: Frequency Domain Sampling: The Discrete Fourier Transform, Properties of the DFT, Linear Filtering Methods Based on the DFT, Frequency Analysis of Signals Using DFT, The Discrete Cosine Transform. **Efficient Computation of the DFT: Fast Fourier Transform Algorithms**: Direct Computation of the DFT, Radix-2 FFT Algorithms.	9
Unit-3	**Implementation of Discrete Time Systems**: Structures for the Realization of Discrete Time Systems, **Structures for FIR Systems**: Direct Form Structure, Cascade Form Structures, Frequency Sampling Structures **Structures for IIR Systems**: Discrete Form Structures Signal Flow Graphs and Transposed Structures, Cascade Form Structures, Parallel Form Structures.	9
Unit-4	**Design of Digital Filters**: General Considerations: Causality and Its Implications, Characteristics of Practical Frequency Selective Filters. **Design of FIR Filters**: Symmetric and Antisymmetric FIR Filters, Design of Linear Phase FIR Filters Using Windows, Design of Linear Phase FIR Filters by the Frequency Sampling Method. **Design of IIR Filters From Analog Filters**: IIR Filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation, Characteristics of Commonly Used Analog Filters. **Frequency Transformations**: Frequency Transformations in the Analog Domain, Frequency Transformations in the Digital Domain.	9
Unit-5	**Introduction to programmable DSPs**: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs ,Multiple Access Memory, Multiported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals. **Architecture of TMS320C5X:** Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Auxiliary Register Compare Register, Block Move Address Register, Block Repeat Registers, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.TMS320C5X Assembly Language Instructions.	9
	Total	45

TEXT BOOKS:

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

Reference Books:

1. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, 3rd Edition, Pearson, 2014.
2. Digital Signal Processing-A. Nagoor Kani, 2nd Edition, McGrawHill Education.

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III Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
DIGITAL COMMUNICATIONS					

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

		Knowledge Level (K)#
CO1	Determine the performance of different waveform coding techniques for the generation and digital representation of the signals	K3
CO2	Determine the probability of error for various digital modulation schemes	K4
CO3	Analyse different source coding techniques	K3
CO4	Compute and analyse different error control coding schemes for the reliable transmission of digital information over the channel	K3
CO5	Analyze the performance of a Base Band ,Pass Band digital communication Systems in terms of error rate and spectral efficiency	K2

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**M**			**M**									**H**			**M**
CO2		**L**			**L**								**M**	**L**		**H**
CO3	**M**		**M**	**H**												**H**
CO4	**L**	**M**	**H**		**L**										**M**	**H**
CO5	**M**			**H**									**M**	**L**		**H**

UNIT	CONTENTS	**Hours**
UNIT – 1	**PULSE DIGITAL MODULATION:** Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, Quantization error, Companding in PCM systems. Differential PCM systems(DPCM). Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems, noise in PCM and DM systems, Time division multiplexing, Frequency division multiplexing	12
UNIT – 2	**DIGITAL MODULATION TECHNIQUES:** Introduction, ASK, FSK, PSK, DPSK, DEPSK, QPSK, M-ary PSK ASK, FSK, similarity of BFSK and BPSK. **DATA TRANSMISSION :**Base band signal receiver, probability of error, the optimum filter, matched filter, probability of error using matched filter, coherent reception, non-coherent detection of FSK, calculation of error probability of ASK, BPSK, BFSK,QPSK	12
UNIT – 3	**INFORMATION THEORY:** Discrete messages, concept of amount of information and its properties. Average information, Entropy and its properties. Information rate, Mutual information and its properties	12
UNIT – 4	**SOURCE CODING:** Introductions, Advantages, Shannon's theorem, Shanon-Fano coding, Huffman coding, efficiency calculations, channel capacity of discrete and analog Channels, capacity of a Gaussian channel, bandwidth –S/N trade off.	12
UNIT – 5	**LINEAR BLOCK CODES:** Introduction, Matrix description of Linear Block codes, Error detection and error correction capabilities of Linear block codes, Hamming codes, Binary cyclic codes, Algebraic structure, encoding, syndrome calculation, BCH Codes. **CONVOLUTIONAL CODES:** Introduction, encoding of convolution codes, time domain approach, transform domain approach. Graphical approach: state, tree and trellis diagram decoding using Viterbi algorithm.	12
	Tota	60

TEXT BOOKS:

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

REFERENCES:

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

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III Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
ANTENNA and WAVE PROPAGATION (PE2)					

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

		Knowledge Level (K)
CO1	Identify basic antenna parameters	K2
CO2	Design and analyze wire antennas, loop antennas, reflector antennas, lens antennas, horn antennas and micro-strip antennas	K6
CO3	Design and analyze antenna arrays, analyze antennas with parasitic elements	K3
CO4	To analyze different types of non-resonant radiators and patch antennas	K3
CO5	To gain knowledge in VHF,UHF and microwave antennas, know the various antenna parameters measurements and understand the wave propagation	K1

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**M**				**L**								**L**		**H**	**M**
CO2			**H**												**H**	**L**
CO3	**M**												**M**			**H**
CO4			**H**												**L**	**M**
CO5					**M**											

UNIT	CONTENTS	**Hours**
UNIT – 1	**ANTENNA FUNDAMENTALS:** Introduction, Radiation Mechanism – Single Wire, 2-Wire, dipoles, Current Distribution on a thin wire antenna. Antenna Parameters - Radiation Patterns, Patterns in Principal Planes, Field Regions, Main Lobe and Side Lobes, Beam-width, Radiation Intensity, Directivity, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance, Beam Area and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height, illustrated Problems	12
UNIT – 2	**THIN LINEAR WIRE ANTENNAS:** Retarded Potentials, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Evaluation of Field Components, Power Radiated, Radiation Resistance, Beam-widths, Directivity, Effective Area and Effective Height. Natural current distributions, fields and patterns of Thin Linear Center-fed Antennas of different lengths, Radiation Resistance at a point which is not current maximum. Antenna Theorems – Applicability and Proofs for equivalence of directional characteristics, Loop Antennas: Small Loops - Field Components, Comparison of far fields of small loop and short dipole, Concept of short magnetic dipole, D and R_r relations for small loops.	12
UNIT – 3	**ANTENNA ARRAYS :** 2 element arrays – different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End-fire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison; Concept of Scanning Arrays. Directivity Relations (no derivations). Related Problems. Binomial Arrays, Effects of Uniform and Non-uniform Amplitude Distributions, Design Relations.Arrays with Parasitic Elements, Yagi-Uda Arrays, Folded Dipoles and their characteristics.	12
UNIT – 4	**NON-RESONANT RADIATORS :** Introduction, Traveling wave radiators – basic concepts, Long wire antennas – field strength calculations and patterns, Microstrip Antennas-Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Impact of different parameters on characteristics. Broadband Antennas: Log periodic antenna, Basic principle, Helical Antennas – Significance, Geometry, basic properties; Design considerations for monofilar helical antennas in Axial Mode and Normal Modes (Qualitative Treatment).	12
UNIT – 5	**VHF, UHF AND MICROWAVE ANTENNAS:** Reflector Antennas: Flat Sheet and Corner Reflectors. Paraboloidal Reflectors - Geometry, characteristics, types of feeds, F/D Ratio, Spill Over, Back Lobes, Aperture Blocking, Off-set Feeds, Case grain Feeds Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns; FRIIS Transmission Equation, Antenna Measurements , Patterns Required, Set Up, Distance Criterion, Directivity and Gain Measurements (Comparison, Absolute and 3-Antenna Methods). **WAVE PROPAGATION:** types of propagations.Sky Wave Propagation – Formation of Ionospheric Layers and their Characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF and Skip Distance Space Wave Propagation – Mechanism, LOS and Radio Horizon.	12
	Tota	60

TEXT BOOKS : 1. Antennas for All Applications – John D. Kraus and Ronald J. Marhefka, 3rd Edition, TMH, 2003.
2.Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.
REFERENCES : 1. Antenna Theory - C.A. Balanis, John Wiley and Sons, 2nd Edition, 2001.
2..Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol. 5, Standard Publishers Distributors, Delhi.3.Antennas – John D. Kraus, McGraw-Hill, 2nd Edition, 1988.

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		3	**0**	**0**	**3**

COMPUTER ARCHITECTURE and ORGANIZATION (PE2)

Pre-requisite: Digital Logic Design

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

		Knowledge Level (K)#
CO1	Explain the representation of data, the register transfer language and Micro operations	K1, K2
CO2	Describe Basic computer organization and design ; programming the basic computer and design the micro programmer control unit	K1, K2,K4
CO3	Devise the design central processing unit and explain various algorithms for computer arithmetic operations	K4, K2
CO4	Discuss various Peripheral devices and various data transfer skills	K1, K2
CO5	Discuss memory Hierarchy and different types of memories	K1, K2

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**L**	**H**											**L**		**M**	
CO2	**M**	**H**											**M**	**L**	**M**	
CO3		**M**	**M**										**M**	**M**	**M**	**L**
CO4	**L**	**M**	**H**	**M**									**H**		**H**	**M**
CO5	**M**	**L**	**L**	**H**									**M**		**H**	**H**

Unit	Contents	Hours
Unit I	**Chapter-1 :** **Introduction :** Digital Computers, Why study computer organization and Architecture?, A few basic issues, Von Neumann computers, Basic organization of a computer **Data Representation:** Data types, Complements, Fixed-point representation, Conversion of fractions, Floating-point representation **Register Transfer and Microoperations :** Register transfer language, Register transfer, Bus and Memory transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit	9 hours
Unit II	**Chapter-2** **Basic Computer Organization and Design:** Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference instructions, Input-Output and Interrupt, Complete Computer Description, Design of Basic computer **Programming the Basic Computer:** Introduction, Machine Language, Assembly language, The Assembler, Program Loops, Programming Arithmetic and Logic Operations **Microprogrammed Control:** Control Memory, Address Sequencing, Microprogram Example, Design of Control Unit	9 hours
Unit III	**Chapter-3** **Central Processing Unit:** Introduction, General Register Organization, Stack organization, Instruction Formats, Addressing Modes, Data transfer and Manipulation, Program Control, Reduced Instruction Set Computer **Computer Arithmetic**: Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms , Floating-Point Arithmetic Operations, Decimal Arithmetic Unit, Decimal Arithmetic Operations.	9 hours
Unit IV	**Chapter – 4** **Input-Output organization :** Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor (IOP), Serial Communication.	9 hours
Unit V	**Chapter – 5** **Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.	9 hours
	Total	45 hrs

Text Book

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

Reference Books

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

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III Year-II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
SOFT COMPUTING TECHNIQUES (PE2)					

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

		Knowledge Level (K)#
CO1	Students can understand the architecture of modern computer.	K3
CO2	They can analyze the Performance of a computer using performance equation	K6
CO3	Understanding of different instruction types	K4
CO4	Students can calculate the effective address of an operand by addressing modes	K5
CO5	They can understand how computer stores positive and negative numbers	K2

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		**M**											**H**		**H**	**H**
CO2														**L**	**M**	**L**
CO3	**L**												**H**			**M**
CO4			**H**		**H**									**M**	**H**	**L**
CO5				**M**										**M**		

UNIT	CONTENTS	**Hours**
UNIT – 1	**Introduction to soft computing:** Introduction, Artificial Intelligence, Artificial Neural Networks, Fuzzy systems, Genetic Algorithm and Evolutionary programming, Swarm Intelligent systems, Expert systems, Comparison among Intelligent systems.	12
UNIT – 2	**Artificial Neural Networks:** Introduction to Artificial Neural Networks, Classification of ANNS, First generation neural networks, Perceptron network, Adaline, Madaline, Second generation neural networks, Back propagation neural networks, Hopfield Neural Network, Kohonen neural network, Hamming neural network, Radial basis function neural networks, spike neuron models.	12
UNIT – 3	**Fuzzy Logic System:** Introduction to fuzzy logic, classical sets and fuzzy sets, fuzzy set operations, fuzzy relations, fuzzy composition, natural language and fuzzy interpretations, fuzzy inference system, fuzzy controllers	12
UNIT – 4	**Genetic Algorithm:** Introduction to Genetic algorithms, Genetic algorithms, procedures of Gas, working of Gas, Travelling sales man problem, Evolutionary programming, working principle of GA Machine learning classifier system	12
UNIT – 5	**Swarm Intelligent system** Introduction to swarm intelligence, back ground, Ant colony system, working of ant colony optimization, Particle swarm intelligent systems, Artificial bee colony system, cuckoo search algorithm..	12
	Tota	60

TEXT BOOKS:

1.Soft computing with MATLAB programming—N.P.Padhy, S.P.Simon, Oxford university press,2015
2. Neural Networks and Fuzzy Systems - Kosko, B., Prentice-Hall of India Pvt. Ltd., 1994.
3. Introduction to Artificial Neural Systems-Jacek.M.Zurada, Jaico Publishing House,1999

REFERENCE BOOKS:

1. Fuzzy Sets, Uncertainty and Information - Klir G.J. &Folger T.A., Prentice-Hall of India Pvt. Ltd., 1993.
2. Fuzzy Set Theory and Its Applications - Zimmerman H.J. Kluwer Academic Publishers,1994.
3. Introduction to Fuzzy Control - Driankov, Hellendroon, Narosa Publishers.
4. Artificial Neural Networks - Dr. B. Yagananarayana, 1999, PHI, New Delhi.
5. Elements of Artificial Neural Networks - KishanMehrotra, Chelkuri K. Mohan,Sanjay Ranka, Penram International.
6. Artificial Neural Network –Simon Haykin, 2nd Ed., Pearson Education.
7. Introduction Neural Networks Using MATLAB 6.0 - S.N. Shivanandam, S. Sumati, S. N.Deepa,1/e, TMH, New Delhi.

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III Year-II Semester		**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**
Biomedical Instrumentation (OE2)					

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

		Knowledge Level (K)#
CO1	Students will have a clear knowledge about human physiology system	K2
CO2	They will have knowledge of the principle of operation and the background knowledge of biomedical instruments and specific applications of biomedical engineering	K5
CO3	Provide students with an understanding of the basic physiology associated with the generation of various bioelectric signals like ECG,EEG etc.	K2
CO4	Provide students With the ideas of application of the principles of engineering , mathematics and physics to medicine and biology by which man kind is benefited	K4
CO5	Discuss the application of Electronics in Diagnosis Diagnostics and therapeutic area	K1

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**L**												**M**		**H**	**M**
CO2													**L**	**M**	**M**	**H**
CO3	**M**												**M**			**M**
CO4					**H**								**H**	**L**	**H**	**H**
CO5				**M**												

UNIT	CONTENTS	**Hours**
UNIT – 1	Sources of Bioelectric potentials and Electrodes: Resisting and Action Potentials, Propagation of Action Potentials, The Bioelectric Potentials. Electrodes: Electrode theory, Bio Potential Electrodes, Biochemical Transducers, introduction to bio-medical signals	12
UNIT – 2	The Cardiovascular System: The Heart and Cardiovascular System, The Heart, Blood Pressure, Characteristics of Blood Flow, Heart Sounds, Cardio Vascular Measurements, Electrocardiography, Measurement of Blood Pressure, Measurement of Blood Flow and Cardiac output, Plethysmography, Measurement of Heart Sounds, Event detection, PQRS & T-Waves in ECG, the first & second Heart beats, ECG rhythm analysis, the di-crotic notch in the carotid pulse detection of events and waves, analysis of exercise ECG, analysis of event related potentials, correlation analysis of EEG channels, correlation of muscular contraction	12
UNIT – 3	Patient Care & Monitory and Measurements in Respiratory System: The elements of Intensive Care Monitory, Diagnosis, Calibration and reparability of Patient Monitoring equipment, other instrumentation for monitoring patients, pace makers, defibrillators, the physiology of respiratory system, tests and instrumentation for mechanics of breathing ,respiratory theory equipment, analysis of respiration	12
UNIT – 4	Bio telemetry and Instrumentation for the clinical laboratory Introduction to bio telemetry, Physiological parameters adaptable to bio telemetry, the components of bio telemetry system, implantable units, applications of telemetry in patient care – The blood, tests on blood cells, chemical test, automation of chemical tests.	12
UNIT – 5	X-ray and radioisotope instrumentation and electrical safety of medical equipment: Generation of Ionizing radiation, instrumentation for diagnostic X-rays, special techniques, instrumentation for the medical use of radioisotopes, radiation therapy - Physiological effects of electrical current, shock Hazards from electrical Equipment, Methods of accident prevention, Modern Imaging Systems: Tomography, Magnetic resonance ,Imaging System, Ultrasonic Imaging System, Medical Thermograph	12
	Total	60

TEXT BOOK:

1. Biomedical Instrumentation and Measurements – C. Cromwell, F.J. Weibell, E.A.Pfeiffer – PHI.
2. Biomedical Instruments Theory and Design-Welkowitz, Elseiver

Reference:

1. Biomedical instrumentation systems- ShakthiChattarjee, Aubert Miller Cenage Learning
2. Hand Book of Bio-Medical Instrumentation – R.S. Khandpur, (TMH)

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

III Year - II Semester		**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**
ELECTRONIC MEASUREMENTS AND INSTRUMENTATION(OE2)					

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

		Knowledge Level (K)#
CO1	Select the instrument to be used based on the requirements.	K3
CO2	Understand and analyze different signal generators and analyzers.	K2
CO3	Understand the design of oscilloscopes for different applications	K2
CO4	Design different transducers for measurement of different parameters.	K6
CO5	Analyse the concept of AC Bridges design for different application	K4

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		**L**											**H**		**H**	**M**
CO2					**L**								**M**		**M**	
CO3	M												**M**			**M**
CO4			**M**		**M**								**M**	**L**		**H**
CO5				M												

UNIT	CONTENTS	**Hours**
UNIT – 1	Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity, Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error, DC Voltmeters- Multi-range, Range extension/Solid state and differential voltmeters, AC voltmeters- multi range, range extension, shunt. Thermocouple type RF ammeter, Ohmmeters series type, shunt type.	12
UNIT – 2	Signal Generator- fixed and variable, AF oscillators, Standard and AF sine and square wave signa generators, Function Generators, Square pulse, sweep, Arbitrary waveform. Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers, Digital Fourier Analyzers.	12
UNIT – 3	Oscilloscopes CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, Dual beam CRO, . Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital readout oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement, standard specifications of CRO, probes for CRO- Active & Passive, attenuator type.	12
UNIT – 4	AC Bridges Measurement of inductance- Maxwell's bridge, Anderson bridge, Measurement o capacitance -Schearing Bridge. Wheat stone bridge, Wien Bridge, Errors and precautions in using bridges, Q-meter.	12
UNIT – 5	Transducers- active & passive transducers : Resistance, Capacitance, inductance; Strain gauges, LVDT Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors. Measurement of physical parameters force, pressure, velocity and acceleration.	12
	Tota	60

TEXTBOOKS:

1. Electronic instrumentation, second edition - H.S.Kalsi, Tata McGraw Hill, 2004.
2. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D. Cooper, PHI, 5th Edition, 2002.

REFERENCES:

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 2nd Edition, 2003.

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III Year - II Semester		L	T	P	C
		2	0	2	3

DISPLAY DEVICES (OE-2)

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

		Knowledge Level (K)#
CO1	Able to understand the transmission of video signal and importance of television standards to effectively work with broadcasting application	K2
CO2	Able to acquire sound knowledge of latest topics in digital video transmission	K2
CO3	Able to analyze various colour television system with a greater emphasis on television standards	K1
CO4	Able to understand advanced topics in digital television and high definition television	K4
CO5	Analyze & Evaluate the NTSC &PAL colour systems	K4

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	L		H		L								H			
CO2		M												H		H
CO3			M	M											M	H
CO4			L													
CO5				M												

UNIT	CONTENTS	Hours
UNIT – 1	**INTRODUCTION:** TV transmitter and receivers, synchronization. Television Pictures: Geometric form and aspect ratio, image continuity, interlaced scanning, picture resolution, Composite video signal: Horizontal and vertical sync, scanning sequence, Colour signal generation and Encoding: Perception of brightness and colours, additive colour mixing, video signals for colours, luminance signal, colour difference signals, encoding of colour difference signals, formation of chrominance signals, PAL encoder.	12
UNIT – 2	**TV SIGNAL TRANSMISSION AND PROPAGATION:** Picture signal transmission, positive and negative modulation, VSB transmission, sound signal transmission, standard channel BW, TV transmitter, TV signal propagation, interference, TV broadcast channels. **MONOCHROME TV RECEIVER:** RF tuner, IF subsystem, video amplifier, sound section, sync separation and processing, deflection circuits, scanning circuits. PAL–D colour receiver: Electron tuners, IF subsystem, Y-signal channel, chroma decoder, separation of U & V Colour phasors, synchronous demodulators, subcarrier generation, raster circuits.	12
UNIT – 3	**VISION IF SUBSYSTEM:** AGC, noise cancellation, video and intercarrier sound signal detection, Colour receiver IF subsystem, Receiver sound system: FM detection, FM Sound detectors, typical applications.TV Receiver Tuners: Tuner operation, VHF and UHF tuners. **COLOUR SIGNAL DECODING:**PAL-D decoder, chroma signal amplifiers, separation of U and V signals, Color burst separation, Burst phase discriminator, Reference oscillator, Indent and color killer circuits, RO phase shift and 180 degrees PAL-SWITCH circuitry, U & V demodulators, Colour signal mixing	12
UNIT – 4	**HISTORY OF HDTV:** Analog and Digital TV Compared, Going HD, Broadcast Engineering and Information Technology, The Road to HDTV, The Grand Alliance, A DTV Standard at Last, Producing HDTV, HD Goes Coast-to-Coast, DTV Conversion. **COMPRESSION TECHNIQUES:** Compression, MPEG-2 Video Compression, MPEG-4, H.264, Motion – JPEG (M-JPEG) compression.	12
UNIT – 5	**DTV TRANSMITTER AND RECIEVER:** Engineering Basics, Presentation, Transmission, Reception and Demodulation, Transport Stream Demultiplexing, Decoding and Decompression, Program Assembly and Presentation, Receiver Issues, Presentation Concerns, standard bodies of HDTV and DTV. **EMERGING TECHNOLOGIES AND STANDARDS:** Technology and Standards Development, Presentation, Delivery and Distribution, MPEG and Metadata, Enhanced, Interactive and Personalized, Virtual Product Placement, Multiplatform Emergency Alert System.	12
	Total	60

TEXT BOOKS

1. Modern Television Practice – Principles, Technology and Service – R.R.Gulati, New Age International Publication, 2005

2. Television and Video Engineering – A.M.Dhake, 2nd Edition,

3. "HDTV and the Transition to Digital Broadcasting: Understanding New Television Technologies" by Philip J. Cianci, Focal Press, 2007.

REFERENCES: 1. Basic Television and Video Systems – B.Grob and C.E.Herndon, McGrawHill,1999**.**

2."Newnes Guide to Television and Video Technology" by Ibrahim.K.F, Newnes Publishers, 4th edition, 2007**.**

3."H.264 and MPEG-4 and Video compression video coding for Next-generation Multimedia" by Iain E.G.Richardson, John Wiley & Sons Ltd., 2003.

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IIIYear-II Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
VLSI Design LAB					

The students are required to design the schematic diagrams using CMOS logic and to draw the layout diagrams to perform the following experiments using CMOS 130nm Technology with necessary EDA tools (Mentor Graphics/Tanner)

List of Experiments:

1. Design and implementation of an inverter
2. Design and implementation of universal gates
3. Design and implementation of full adder
4. Design and implementation of full subtractor
5. Design and implementation of RS-latch
6. Design and implementation of D-latch
7. Design and implementation asynchronous counter
8. Design and Implementation of static RAM cell
9. Design and Implementation of differential amplifier
10. Design and Implementation of ring oscillator

Equipment Required:

1. Mentor Graphics/Tanner software-latest version
2. Personal computer with necessary peripherals.

Course Outcomes:

		Knowledge Level (K)#
CO1	Designing of Combinational circuits using backend tools	K6
CO2	Understand & Implementation Control Signal in Layouts	K2
CO3	Analyze static timing, IR drop and Cross talk in digital circuit Layouts	K4
CO4	Analyze the AC Characteristics of Amplifiers & oscillators using VLSI backend tools	K4
CO5	Apply the concept of Scaling while implementation of layouts	K3
CO6	Analyze the concept of Design Rules in DRC	K4
CO7	Evaluate the Efficiency of Routing	K5

Mapping of course outcomes with program outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	M	L		L									L			L
CO2	M		L		M									M		L
CO3		M	M		L											L
CO4		L		M									L			L
CO5	L		H		L									M	M	L
CO6	M		M	L									L			L
CO7		L	M		L										H	M

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IIIYear-II Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

DIGITALSIGNALPROCESSINGLAB

ListoftheExperiments/programs

StudenthastoperformatleastFOURExperimentsineachpart:

PART-1(SIGNALS)

1) Generationofdiscretetimesignalsfordiscretesignals
2) To verifytheLinear Convolution
a) UsingMATLAB
b) UsingCodeComposer Studio(CCS)
3) Toverifythe Circular Convolution fordiscrete signals
a) UsingMATLAB
b) UsingCodeComposer Studio(CCS)
4) ToFindtheadditionofSinusoidal Signals
5) ToverifyDiscreteFourierTransform(DFT)andInverseDiscreteFourierTransform(IDFT)
a) UsingMATLAB
b) UsingCodeComposer Studio(CCS)
6) TransferFunction StabilityAnalysis: usingpole-zeroplot, bode plot, Nyquist plot,z-planeplot.

PART-2(FILTERS)

7) FrequencyResponseof IIRlowpassButterworth Filter
8) FrequencyResponseof IIRhighpass ButterworthFilter
9) FrequencyResponseof IIR lowpassChebyshevFilter
10) FrequencyResponseof IIRhighpassChebyshevFilter
11) FrequencyResponseofFIR lowpassFilterusingRectangle Window
12) FrequencyResponseof FIRlowpassFilterusingTriangleWindow

PART–3(IMAGE PROCESSING)

13) Animageprocessingin a falsecontouringsystem
14) Togeneratethehistogramequalizationtotheimage
15) Toverifythe NormalizedCross Correlationto theaddition ofnoise andremoval ofnoise usingfilterstoanimage.
16) Computethe edgeof animageusingspatial filters.
17) Performtheimagemotionblurand calculatePSNRtothenoiseimage andalsonoisefreeimage.
ToverifythePSNRtotheSecondorderDecompositionofDiscreteWaveletransformsandtothereconstructedimageusinginverseDiscrete Wavelet transform

Course Outcomes:
On the completion of this laboratory course, the students will be able to:
1. Understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals.
2 Model the discrete time signals and systems and verify its properties and results.
3. Implement discrete computations using DSP processor and verify the results.
4. Realize the digital filters using a simulation tool and analyze the response of the filter for an audio signal.
5. Write programs using Matlab/Scilab/Octave to illustrate DSP concepts.

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	L											M				
CO2				M									M			
CO3														H	H	
CO4		M									L					L
CO5					H											

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IIIYear-II Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
DIGITALCOMMUNICATIONSLAB					

ListofExperiments:

1. Timedivisionmultiplexing.
2. FrequencyDivisionMultiplexing
3. Pulsecodemodulation.
4. Differentialpulsecodemodulation.
5. Deltamodulation.
6. Frequencyshiftkeying.
7. Phaseshiftkeying.
8. Differentialphaseshiftkeying.
9. Companding
10. SourceEncoderandDecoder
11. LinearBlockCode-EncoderandDecoder
12. BinaryCyclicCode–Encoder and Decoder
13. ConvolutionCode–Encoder andDecoder

EquipmentrequiredforLaboratories:

1. RPS– 0 –30 V
2. CRO – 0 –20 M Hz.
3. FunctionGenerators–0 –1MHz
4. RFGenerators – 0– 1000 M Hz./0 – 100 M Hz.
5. Multimeters
6. Lab ExperimentalkitsforDigitalCommunication
7. Components

Course Outcomes:

		Knowledge Level (K)#
CO1	Experiment with the principle of PCM, DPCM, DM, FDM and TDM	K4
CO2	Implement different digital carrier modulation and demodulation schemes	K3
CO3	Analyze Spectral characteristics of Pulse Modulations	K4
CO4	Evaluate the Source Coding techniques for different Examples	K5
CO5	Analyze the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency	K4
CO6	Understand the Concept of compression and decompression	K2
CO7	Apply the concept of channel coding techniques in real time applications	K3

Mapping of course outcomes with program outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	L	L		L									L			L
CO2			M		M									M		
CO3		M			L										M	L
CO4		L		M									L			
CO5	L		L											M	M	L
CO6			M	L									L			
CO7	M	L	M		L										M	M

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III Year - II Semester		L	T	P	C
		1	0	2	2

MACHINE LEARNING WITH SCIKIT(SKILL ADVANCED COURSES/SOFT SKILL COURSES)

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

		Knowledge Level (K)#
CO1	Understand the need for simulation/implementation for the verification of mathematical functions	K2
CO2	Understand the main features of the SCILAB program development environment to enable their usage in the higher learning.	K2
CO3	Implement simple mathematical functions/equations in numerical computing environment such as SCILAB	K3
CO4	Interpret and visualize simple mathematical functions and operations thereon using plots/display	K4
CO5	Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using SCILAB tools&Develop graphs by running Scilab programs	K4

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**			**L**								**M**	**M**		**H**	**M**
CO2					**M**						**L**		**M**	**M**	**H**	**H**
CO3						**H**				**L**			**M**			**M**
CO4							**H**		**M**				**M**	**H**	**H**	**H**
CO5								**M**								

UNIT	CONTENTS	Hours
UNIT – 1	The Fundamentals of Machine Learning,Learning from experience,Machine learning tasks,Training data and test data,Performance measures, bias, and variance,An introduction to scikit-learn ,Installing scikit-learn **,**Installing scikit-learn on Windows,Installing scikit-learn on Linux ,Installing scikit-learn on OS X,Verifying the installation**,**Installing pandas and matplotlib Linear Regression:Simple linear regression,Evaluating the fitness of a model with a cost function ,Solving ordinary least squares for simple linear regression**,**Evaluating the model,Multiple linear regression,Polynomial regression,Regularization,Applying linear regression,Exploring the data,Fitting and evaluating the model**,**Fitting models with gradient descent	12
UNIT – 2	Extracting features from categorical variables,Extracting features from text,The bag-of-words representation, Stop-word filtering, Stemming and lemmatization,Extending bag-of-words with TF-IDF weights,Space-efficient feature vectorizing with the hashing trick,Extracting features from images,Extracting features from pixel intensities,Extracting points of interest as features ,SIFT and SURF,Data standardization Binary classification with logistic regression,Spam filtering,Binary classification performance metrics,Accuracy,Precision and recall ,Calculating the F1 measure,ROC AUC,Tuning models with grid search,Multi-class classification,Multi-class classification performance metrics,Multi-label classification and problem transformation**,**Multi-label classification performance metrics	12
UNIT – 3	Decision trees ,Training decision trees,Selecting the questions,Information gain,Gini impurity,Decision trees with scikit-learn,Tree ensembles,The advantages and disadvantages of decision trees Clustering with the K-Means algorithm,Local optima,The elbow method,Evaluating clusters,Image quantization,Clustering to learn features	12
UNIT – 4	An overview of PCA ,Performing Principal Component Analysis,Variance, Covariance, and Covariance Matrices,Eigenvectors and eigenvalues,Dimensionality reduction with Principal Component Analysis ,Using PCA to visualize high-dimensional data,Face recognition with PCA	12
UNIT – 5	Kernels and the kernel trick,Maximum margin classification and support vectors,Classifying characters in scikit-learn,Classifying handwritten digits,Classifying characters in natural images Nonlinear decision boundaries,Feedforward and feedback artificial neural networks,Multilayer perceptron,Minimizing the cost function,Forward propagation,Backpropagation,Approximating XOR with Multilayer perceptron,Classifying handwritten digits	12
	Total	60

TEXT BOOKS

1Mastering Machine Learning with scikit-learn, Gavin Hackeling,Packt Publishing

REFERENCE BOOKS

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow, Aurélien Géron

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IV YEAR I SEM

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IV Year - I Semester		L	T	P	C
		3	0	0	3

ANALOG IC DESIGN (PE-3)

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

		Knowledge Level (K)#
CO1	Understand the concepts of MOS Devices and Modeling	K2
CO2	Design and analyze any Analog Circuits in real time applications.	K6
CO3	Extend the Analog Circuit Design to Different Applications in Real Time.	K2
CO4	Understand of Open-Loop Comparators and Different Types of Oscillators.	K2
CO5	Analyze the frequency response of amplifier and operational amplifier circuits	K4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**M**	**L**	**H**										**H**		**H**	**M**
CO2				**L**									**H**	**H**	**M**	**M**
CO3				**L**									**M**			**H**
CO4				**M**									**H**	**M**	**H**	**H**
CO5				M												

UNIT	CONTENTS	Contact Hours
UNIT – 1	**MOS Devices and Modeling:** The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Mode for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.	12
UNIT – 2	**Analog CMOS Sub-Circuits:** MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.	12
UNIT – 3	**CMOS Amplifiers:** Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.	12
UNIT – 4	**CMOS Operational Amplifiers:** Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.	12
UNIT – 5	**Comparators:** Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators. **Oscillators & Phase-Locked Loops:** General Considerations, Ring Oscillators, LC Oscillators, Voltage Controlled Oscillators. Simple PLL, Charge Pump PLLs, Non-Ideal Effects in PLLs, Delay Locked Loops, Applications.	12
	Tota	60

Text Books:

1. Design of Analog CMOS Integrated Circuits- BehzadRazavi, TMH Edition.
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

References:

1. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.
2. Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn, 2013.

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IV Year - I Semester		L	T	P	C
		3	0	0	3

MICROWAVE ENGINEERING (PE-3)

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

		Knowledge Level (K)#
CO1	Design and analysis of microwave transmission lines	K5
CO2	Working and analysis of microwave amplifiers and oscillators of low power and high power tubes	K3
CO3	Understand the designing & working of a microwave oscillator with solid state materials	K2
CO4	Understand the working of microwave components and s- parameters calculation for reciprocal for reciprocal components.	K2
CO5	Understand the S-parameter calculation for non-reciprocal components and measure of microwave parameters	K2

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**	**M**											**L**		**M**	**MM**
CO2				**L**												
CO3				**M**										**H**	**M**	
CO4														**H**		**M**
CO5				**M**									**L**			

UNIT	CONTENTS	Contact Hours
UNIT – 1	**MICROWAVE TRANSMISSION LINES:** Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations, Impossibility of TEM , Related Problems Excitation techniques-waveguides.**MICROSTRIP LINES**: Introduction, Zo Relations, Effective Dielectric Constant, Losses, Q factor.	12
UNIT – 2	**MICROWAVE TUBES:** Limitations and Losses of conventional tubes at microwave frequencies, Re-entran Cavities, Microwave tubes – O type and M type classifications, O-type tubes : Two Cavity Klystrons – Structure, Velocity Modulation Process and Applegate Diagram, Bunching Process and Applications, Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Oscillating Modes and o/p Characteristics Electronic and Mechanical Tuning, Applications, Related Problems.**HELIX TWTS:** Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Suppression of Oscillations. **M-type Tubes**Introduction, Cross-field effects, Magnetrons – Different Types, 8-Cavity Cylindrical Travelling Wave Magnetron – Hull Cut-off Condition, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode	12
UNIT – 3	**MICROWAVE SOLID STATE DEVICES:** Introduction, Classification, Applications. TEDs – Introduction Gunn Diode – Principle, RWH Theory, Characteristics, LSA Mode of Operation. Avalanche .Transit Time Devices – Introduction, IMPATT and TRAPATT Diodes – Principle of Operation and Characteristics	12
UNIT – 4	**WAVEGUIDE COMPONENTS AND APPLICATIONS - I :**Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide irises, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Resistive Card, Rotary Vane types; Waveguide Phase Shifters – Dielectric, Rotary Vane types Scattering Matrix– Significance, Formulation and Properties, S-Matrix Calculations for – 2 port Junction, E-plane and H-plane Tees, Magic Tee, Hybrid Ring; Directional Couplers – 2Hole, Bethe Hole types.	12
UNIT – 5	**Ferrite Components:**Faraday Rotation,relation between S-parameters in terms of Z and Y parameters, S-parameters of Gyrator, Isolator, Circulator.**MICROWAVE MEASUREMENTS:** Description of Microwave Bench – Different Blocks and their Features, Precautions; Microwave Power Measurement – Bolometer Method Measurement of Attenuation, Frequency, VSWR, Impedance Measurement	12
	Total	60

TEXT BOOKS:

1. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.
2. Microwave Devices and Circuits – Samuel Y. Liao, PHI, 3rd Edition,1994.

REFERENCES:

1. Microwave Principles – Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, CBS Publishers and Distributors, New Delhi, 2004
2. Microwave Engineering- Annapurna Das and SisirK.Das, McGraw Hill Education, 3rd Edition.
3. Microwave Engineering – G S N Raju , I K International

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

IV Year - I Semester		L	T	P	C
		3	0	0	3
INFORMATION THEORY & CODING(PE-3)					

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Design an Application with Error-Control coding	K1
CO2	Use Compression and Decompression Techniques	K2
CO3	Perform source coding and channel coding	K4
CO4	Design the channel performance using information theory	K6
CO5	Design BCH &RS Codes for channel performance improvement against burst errors	K

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**												**M**		**H**	**M**
CO2			**M**		**H**								**L**	**M**	**M**	**H**
CO3	**L**												**L**			**M**
CO4				**M**												
CO5				**M**												

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	**INFORMATION THEORY AND SOURCE CODING:**Uncertainty, information, entropy and its properties, entropy of binary memory less source and its extension to discrete memory less source, source coding theorem, data compression, prefix coding, Huffman coding, Lempel-Ziv coding, Source with memory and its entropy.	12
UNIT – 2	**DISCRETE CHANNELS:**Binary Symmetric Channel, mutual information & its properties, Channel capacity, channel coding theorem and its application to BSC, Shannon's theorem on channel capacity, capacity of a channel of infinite bandwidth, bandwidth - S/N trade off, practical communication systems in light of Shannon's theorem, Fading channel, channels with memory	12
UNIT – 3	**GROUPS, FIELDS AND LINEAR BLOCK CODES:**Galois field and its construction in GF(2^m) and its basic properties, vector spaces and matrices in GF(2), Linear block codes, systematic codes and its encoding circuit, syndrome and error detection, minimum distance, error detecting and correcting capabilities of block code, decoding circuit, probability of undetected error for linear block code in BSC, Hamming code and their applications.	12
UNIT – 4	**CYCLIC CODES AND BCH CODES:**Basic properties of Cyclic codes, Generator and parity check matrix of cyclic codes, encoding and decoding circuits, syndrome computation and error detection, cyclic Hamming codes, encoding and decoding of BCH codes, error location and correction.	12
UNIT – 5	**CONVOLUTIONALCODES** Introduction to convolution code, its construction and Viterbi algorithm for maximum likelihood decoding, Automatic repeat request strategies and their throughput efficiency considerations	12
	Tota	60

Text Books:

1. Sklar, Digital Communication, Pearson Education Asia, 2nd Edition,2001.
2. Shu Lin and Costello, Error Control Coding: Fundamentals and Applications, 2nd Edition, Pearson,2004.

Reference Books:

1. Simon Haykin, Digital Communication, Wiley Publications,2013.
2. Information theory and coding, Muralidhar Kulkarni, KS AShivaprakash,2015.

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IV Year - I Semester		L	T	P	C
		3	0	0	3

DATA COMMUNICATIONS & COMPUTER NETWORKS (PE4)

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

		Knowledge Level (K)#
CO1	Know the Categories and functions of various Data Communication Networks	K3
CO2	Design and analyze various error detection techniques.	K5
CO3	Demonstrate the mechanism of routing the data in network layer	K4
CO4	Know the Functioning of various Application layer Protocols.	K2
CO5	Identify the basic security threats of a network	K2

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO2		L											M	L		
CO3			M		H								M		L	
CO4																
CO5				M												L

UNIT	CONTENTS	Contact Hours
UNIT – 1	**Introduction to Data Communications:** Components, Data Representation, Data Flow, Networks- Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet – A Brief History, The Internet Today, Protocol and Standards – Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite, Addressing Introduction, Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs –The 802.11 Architecture,	12
UNIT – 2	**Data Link Layer:** Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols. 802.11 MAC Protocol, IEEE 802.11 Frame.	12
UNIT – 3	**The Network Layer:** Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane, The Internet Protocol(IP):Forwarding and Addressing in the Internet- Datagram format, Ipv4 Addressing, Internet Control Message Protocol(ICMP), Ipv6	12
UNIT – 4	**Transport Layer:** Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and De-multiplexing, Connectionless Transport: UDP –UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N(GBN), Selective Repeat(SR), Connection Oriented Transport: TCP – The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control – The Cause and the Costs of Congestion, Approaches to Congestion Control	12
UNIT – 5	**Application Layer:** Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the File Transfer: FTP,-FTP Commands and Replies, Electronic Mail in the Internet- STMP, Comparison with HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages.	12
	Tota	60

TEXT BOOKS:

1. Computer Networking A Top-Down Approach – Kurose James F, Keith W, 6thEdition , Pearson,2017.
2. Data Communications and Networking Behrouz A.Forouzan4th Edition McGraw Hill Education,2017.

REFERENCES:

1. Data communication and Networks – BhusanTrivedi, Oxford university press,2016
2. Computer Networks – Andrew S Tanenbaum, 4th Edition, PearsonEducation,2003.
3. Understanding Communications and Networks,3rdEdition,W.A.Shay,CengageLearning,2003.

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IV Year - I Semester		L	T	P	C
		3	0	0	3

LOW POWER VLSI DESIGN
(PE4)

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

		Knowledge Level (K)#
CO1	Understand the need of Low power circuit design.	K2
CO2	Attain the knowledge of architectural approaches.	K4
CO3	Analyze and design Low-Voltage Low-Power combinational circuits.	K4
CO4	Known the design of Low-Voltage Low-Power Memories	K6
CO5	Summarize the power optimization and trade- off technique in digital circuits	K2

#Based on suggested Revised BTL

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**				**M**								**M**		**H**	**M**
CO2			**M**										**L**	**H**	**M**	**H**
CO3													**M**			**L**
CO4			**M**										**H**	**L**	**M**	**H**
CO5				M												

Mapping of course outcomes with program outcomes
(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	**Fundamentals:** Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.	12
UNIT – 2	**Supply Voltage Scaling for Low Power:** Device Feature Size Scaling, Constant-Field Scaling, Constant-Voltage Scaling, Architectural-Level Approaches: Parallelism for Low Power, Pipelining for Low Power Combining Parallelism with Pipelining, Voltage Scaling Using High-Level Transformations: Multilevel Voltage Scaling Challenges in MVS Voltage Scaling Interfaces, Static Timing Analysis Dynamic Voltage and Frequency Scaling	12
UNIT – 3	**Low-Power Design Approaches:** Low-Power Design through Voltage Scaling – VTCMOS circuits MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. Power Gating, Clock Gating Versus Power Gating, Power- Gating Issues, Isolation Strategy, State Retention Strategy, Power-Gating Controller, Power Management, Combining DVFS and Power Management.	12
UNIT – 4	**Low-Voltage Low-Power Adders:** Introduction, Standard Adder Cells, CMOS Adder's Architectures - Ripple Carry Adders, Carry Look- Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low-Power Design Techniques –Trends of Technology and Power Supply Voltage.	12
UNIT – 5	**Low-Voltage Low-Power Memories:** Basics of ROM, Low-Power ROM Technology, Basics of SRAM Memory Cell, Pre-charge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM Self-Refresh Circuit.	12
	Tota	60

TEXT BOOKS:

1. CMOS Digital Integrated Circuits – Analysis and Design – Sung-Mo Kang, Yusuf Leblebici,TMH,2011.
2. Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo, Kaushik Roy, TMH ProfessionalEngineering,1st edition,2004

REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRCPress,2011
2. Low Power CMOS VLSI Circuit Design – Kaushik Roy, Sharat C. Prasad, John Wiley & Sons,2000.
3. Practical Low Power Digital VLSI Design – Gary K. Yeap, Kluwer Academic Press,2002.

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IV Year - I Semester		L	T	P	C
		3	0	0	3
DIGITAL IMAGE PROCESSING(PE4)					

Pre-requisite: Signals & Systems, Digital Signal Processing

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

		Knowledge Level (K)#
CO1	Describe the Image Processing system, Use of Digital Image Processing in different spectra and its general applications, scope of digital image processing and compare various image transforms.	K1 & K2
CO2	Apply basic operations like intensity transformations in spatial and frequency domain.	K3
CO3	Describe Image degradation model and Explain the restoration techniques on images	K2 & K4
CO4	Analyze the digital Images using wavelets and multi resolution processing and use various coding techniques for various image compression methods.	K4 & K3
CO5	State morphological operators; Explain various segmentation techniques on digital images; Explain various Colour models and Colour Image Processing	K1,K2

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**												**M**	**L**		
CO2		**M**													**M**	**H**
CO3															**M**	**H**
CO4					**M**										**H**	**M**
CO5		**H**													**H**	**M**

Unit	Contents	Contact Hours
Unit I	**Introduction:** Introduction to Image Processing, Examples of fields that use Digital Image Processing, Fundamental steps in digital image processing, components of an image processing system, Elements of Visual Perception, Light and the Electromagnetic Spectrum, Examples of the fields that use Digital Image Processing, Image sensing and acquisition, image sampling and quantization, Some basic relationships between pixels, An introduction to the mathematical tools used in digital image processing. (Text Book: R. C. Gonzalez and R. E. Woods, "Digital Image Processing, 3rd edition, Pearson, 2008.) **Image Transforms:** Need for image transforms, Image transforms, Fourier Transform, 2D Discrete Fourier Transform and its properties, Walsh Transform, Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, Singular Value Decomposition.(Text Book: Jayaraman, S. Esakkirajan, and T. Veerakumar," Digital Image Processing", Tata McGraw-Hill Education, 2009)	9 Hours
Unit II	**Intensity Transformations and Spatial Filtering:** Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, and sharpening spatial filters. **Filtering in the Frequency Domain:** The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering (Text Book: R. C. Gonzalez and R. E. Woods, "Digital Image Processing, 3rd edition, Pearson, 2008.)	9 Hours
Unit III	**Image Restoration and Reconstruction:** A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position – Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, image reconstruction from projections. (Text Book: R. C. Gonzalez and R. E. Woods, "Digital Image Processing, 3rd edition, Pearson, 2008.)	9 Hours
Unit IV	**Wavelets and Multi resolution Processing:** Image pyramids, sub band coding, Multi resolution expansions, wavelet transforms in one dimensions& two dimensions, Wavelet packets. **Image compression:** Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Block Transform coding, Predictive coding (Text Book: R. C. Gonzalez and R. E. Woods, "Digital Image Processing, 3rd edition, Pearson, 2008.)	9 Hours
Unit V	**Image segmentation:** Fundamentals, point, line, edge detection, thresholding, and Region –based segmentation **Morphological Image Processing:** Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms, gray-scale morphology **Color image processing:** Color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression. (Text Book: R. C. Gonzalez and R. E. Woods, "Digital Image Processing, 3rd edition, Pearson, 2008.)	9 hours
	Total	**45 hour**

Text Books

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing, 3rd edition, Pearson,2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar," Digital Image Processing", Tata McGraw-Hill Education, 2009.

Reference Books

1. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint,2002.
2. B.Chanda, D.DuttaMajumder, "Digital Image Processing and Analysis", PHI, 2009.

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IV Year - I Semester		L	T	P	C
		3	0	0	3

DSP PROCESSORS AND ARCHITECTURES (PE5)

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

		Knowledge Level (K)#
CO1	Understand the basic concepts of Digital Signal Processing.	K2
CO2	To differentiate the architectural features of General purpose processors and DSP processors.	K2
CO3	Understand the architectures of TMS320C54xx devices and ADSP 2100 DSP devices.	K3
CO4	Write the simple assembly language programs by using instruction set of TMS320C54xx.	K4
CO5	To interface the various devices to DSP Processors.	K3&K4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	L	M										M			H
CO2		H	M	M											L	H
CO3			H	M												H
CO4			H	M												H
CO5			H												M	H

UNIT	CONTENTS	Contact Hours
UNIT – 1	**Introduction to Digital Signal Processing:**Introduction, a Digital signal-processing system, the sampling process, discrete time sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation.**Computational Accuracy in DSP Implementations:**Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter	12
UNIT – 2	**Architectures for Programmable DSP Devices**Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation UNIT, Programmability and Program Execution, Speed Issues, Features for External interfacing	12
UNIT – 3	**Programmable Digital Signal Processors:**Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX Processors,Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX Instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54XX Processors.	12
UNIT – 4	**Analog Devices Family of DSP Devices :**Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor. Introduction to Black fin Processor – The Black fin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory.	12
UNIT – 5	**Interfacing Memory and I/O Peripherals to Programmable DSP Devices:**Memory -space organization, interface External bus interfacing signals, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access	12
	Total	60

TEXT BOOKS:

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. A Practical Approach To Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009
3. Embedded Signal Processing with the Micro Signal Architecture: Woon-SengGan, SenM.Kuo, Wiley-IEEE Press, 2007

REFERENCE BOOKS:

1. Digital Signal Processors, Architecture, Prog and Applications-B. Venkataramani and M. Bhaskar, 2002, TMH.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.
3. Digital Signal Processing App Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices, DSP Division, Edited by Amy Mar, PHI

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IV Year - I Semester		L	T	P	C
		3	0	0	3
RADAR ENGINEERING (PE5)					

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

		Knowledge Level (K)#
CO1	State the radar range equation and solve some analytical problems.	K1
CO2	Discuss the different types of radars and its applications.	K2
CO3	Describe the concept of tracking and different tracking techniques.	K1
CO4	Analyze the various components of radar receiver and its performance	K4
CO5	Able to carry out research and development of the radar system design	K3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	M			H	L								H		L	M
CO2					M								L	L	M	H
CO3			H										M			H
CO4					L								L	L	H	H
CO5			M													

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	**Basics of Radar**: Introduction, Maximum Unambiguous Range, simple Radar range Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Illustrative Problems **Radar Equation :** Modified Radar Range Equation, SNR, probability of detection, probability of False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets – sphere, cone-sphere), Creeping Wave, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.	12
UNIT – 2	**CW and Frequency Modulated Radar :** Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Illustrative Problems.**FM-CW Radar:** Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter, Multiple Frequency CW Radar	12
UNIT – 3	**MTI and Pulse Doppler Radar:** Introduction, Principle, MTI Radar with – Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, N^{th} Cancellation Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.	12
UNIT – 4	**Tracking Radar:** Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.	12
UNIT – 5	**Detection of Radar Signals in Noise:** Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection, Noise Figure and Noise Temperature.**Radar Transmitters & Receivers** – Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Series versus parallel feeds, Applications, Advantages and Limitations. Radomes. Modulators, solid-state transmitters	12
	Total	60

TEXT BOOKS:

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Ed., 2007.

REFERENCE BOOKS:

1. Radar: Principles, Technology, Applications – Byron Edde, Pearson Education, 2004.
2. Radar Principles – Peebles, Jr., P.Z., Wiley, New York, 1998.
3. Principles of Modern Radar: Basic Principles – Mark A. Richards, James A. Scheer, William A. Holm, Yesdee, 2013

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IV Year - I Semester		L	T	P	C
		3	0	0	3
EMBEDDED SYSTEMS (PE-5)					

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

		Knowledge Level (K)#
CO1	Know basics of embedded system, classification, memories, different communication interface and what embedded firmware is and its role in embedded system, different system components.	K2
CO2	Distinguish all communication devices in embedded system, other peripheral device	K2
CO3	Distinguish concepts of C versus embedded C and compiler versus cross-compiler	K2
CO4	Choose an operating system, and learn how to choose an RTOS	K4
CO5	Acquire knowledge about devices and buses used in embedded networking	K1

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1			L	L	L									M		
CO2	L	M	M												M	M
CO3	M	M	L										M	M		
CO4	H	H	M	M											H	H
CO5			M													

UNIT	CONTENTS	Contact Hours
UNIT – 1	**Introduction:** Embedded System-Definition, History, Classification, application areas and purpose of embedded systems, The typical embedded system-Core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, PCB and passive components. Characteristics Quality attributes of an Embedded systems, Application-specific and Domain-Specific examples of an embedded system, Main processing elements of embedded system, hardware and software partitions.	12
UNIT – 2	**Embedded Hardware Design:** Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.	12
UNIT – 3	**Embedded Firmware Design:** Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.	12
UNIT – 4	**Real Time Operating System:** Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Threads, Processes and Scheduling, Task Scheduling, Communication, Synchronization, Device Drivers, How to choose an RTOS. Electronics and Communication Engineering **Hardware Software Co-Design:** Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware, ICE.	12
UNIT – 5	**Embedded System Development:** The integrated development environment, Types of files generated on cross-compilation, Deassembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools. **Embedded System Implementation And Testing:** The main software utility tool, CAD and the hardware, Translation tools-Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools. Test and evolution of an embedded systems(Build in self testetc).**Case study-** typical embedded system design flow with an example.	12
	Total	60

Text Books:

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

References:

1. Embedding system building blocks By Labrosse, CMP publishers.
2. Embedding system, Second Edition , RajKamal

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IV Year - I Semester		L	T	P	C
		2	0	2	3
VLSI Technology (OE3)					

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

		Knowledge Level (K)#
CO1	Apply the Concept of design rules during the layout of a circuit.	K3
CO2	Synthesize digital VLSI systems from register-transfer or higher level descriptions	K4
CO3	Understand current trends in semiconductor technology, and how it impacts scaling and performance	K2
CO4	Model and simulate digital VLSI systems using hardware design language.	K1
CO5	Analyse target devices interfacing process	K4

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	M			H									H		H	M
CO2			H										M	M	M	H
CO3				L									H			M
CO4	M												H	M	H	H
CO5				M												

UNIT	CONTENTS	Contact Hours
UNIT – 1	**Introduction :** Introduction to IC Technology, MOS and related VLSI Technology, Basic MOS Transistors Enhancement and Depletion modes of transistor action, IC production process, MOS and CMOS Fabrication processes, BiCMOS Technology, Comparison between CMOS and Bipolar technologies. **Basic Electrical Properties Of MOS and Bi-CMOS Circuits:** I_{ds} versus V_{ds} Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. The Pass transistor NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter, Alternative forms of pull-up, The CMOS Inverter, MOS transistor circuit model, Bi-CMOS Inverter, Latch-up in CMOS circuits and BiCMOS Latch-up Susceptibility	12
UNIT – 2	**MOS and Bi-CMOS Circuit Design Processes:** MOS Layers, Stick Diagrams, Design Rules and Layout General observations on the Design rules, 2µm Double Metal, Double Poly, CMOS/BiCMOS rules, 1.2µm Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter Symbolic Diagrams-Translation to Mask Form.	12
UNIT – 3	**Basic Circuit Concepts:** Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters Area Capacitance of Layers, Standard unit of capacitance, The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Fan-in and fan-out characteristics, Transistor switches, Realization of gates using NMOS PMOS and CMOS technologies. **Scaling Of MOS Circuits:** Scaling models, Scaling factors for device parameters, Limits due to sub threshold currents, current density limits on logic levels and supply voltage due to noise]	12
UNIT – 4	**Subsystem Design:** Architectural issues, switch logic, Gate logic, examples of structured design, clocked sequential circuits	12
UNIT – 5	**VLSI Design Issues:** VLSI Design issues and design trends, design process, design for testability, technology options, power calculations, package selection, clock mechanisms,Introduction mixed signal design, ASIC design flow, FPGA design flow, introduction to SoC design. Basic CPLD architecture, typical CPLD design flow **FPGA Design:** Basic FPGA architecture, , FPGA configuration, configuration modes, FPGA design process FPGA design flow.	12
	Total	60

Text Books:

1. Essentials of VLSI Circuits and Systems By Kamran Eshraghian, Douglas and A. Pucknell and SholehEshraghian, Prentice-Hall of India Private Limited,2005 Edition.

References:

1. VLSI Design By A.Albert Raj &T.Latha,PHI Learning Private Limited,2010.
2. VLSI Design-A.Shanthi and A.Kavita, New Age International Private Limited, 2006 First Edition.

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IV Year - I Semester		L	T	P	C
		2	0	2	3
SOFTWARE DEFINED RADIO(OE3)					

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

		Knowledge Level (K)#
CO1	Describe the basics of the software defined radio	K2
CO2	Analyze complex problems critically in the domains of Radio frequency implementation issues, multirate signal processing in SDR, as well as a Smart antenna techniques for better spectrum exploitation for conducting research	K4
CO3	Apply appropriate techniques for the development of scientific and technological knowledge in designing software defined radios and their usage for cognitive radio.	K3
CO4	Demonstrate advanced knowledge in the evolving paradigm of Software defined radio and technologies for its implementation	K3
CO5	To learn the hardware software architectures of software defined radio	K2

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1			**M**	**L**									**H**		**H**	**H**
CO2	**M**		**H**										**M**	**H**	**M**	**M**
CO3			**H**										**M**			**H**
CO4																
CO5				**M**												

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	Introduction: The Need for Software Radios, what is Software Radio, Characteristics and benefits of software radio- Design Principles of Software Radio, RF Implementation issues the Purpose of RF Front – End, Dynamic Range- The Principal Challenge of Receiver Design	12
UNIT – 2	RF Receiver Front- End Topologies- Enhanced Flexibility of the RF Chain with Software Radios- Importance of the Components to Overall Performance- Transmitter Architectures and Their Issues- Noise and Distortion in the RF Chain, ADC and DAC Distortion	12
UNIT – 3	Profile and Radio Resource Management: Communication Profiles- Introduction, Communication Profiles, Terminal Profile, Service Profile, Network Profile, User Profile, Communication Profile Architecture, Profile Data Structure	12
UNIT – 4	XML Structure, Distribution of Profile Data, Access to Profile Data, Management of Communication Profiles, Communication Class marks, Dynamic Class marks for Reconfigurable Terminals, Compression and Coding, Meta Profile Data	12
UNIT – 5	Radio Resource Management in Heterogeneous Networks: Introduction, Definition of Radio Resource Management, Radio Resource Units over RRM Phases, RRM Challenges and Approaches, RRM Modeling and Investigation Approaches, Investigations of JRRM in Heterogeneous Networks	12
	Total	60

Text Books:

2. Software Defined Radio Architecture System and Functions- Markus Dillinger, Kambiz Madani, WILEY 2003
3. Software Defined Radio: Enabling Technologies- Walter Tuttle Bee, 2002, Wiley Publications..

References:

1. Software Radio: A Modern Approach to Radio Engineering - Jeffrey H. Reed, 2002, PEA Publication.
2. Software Defined Radio for 3G - Paul Burns, 2002, Artech House.

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IV Year - I Semester		L	T	P	C
		2	0	2	3
BIOMEDICAL SIGNAL PROCESSING(OE-3)					

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

		Knowledge Level (K)#
CO1	The student will be able to understand various methods of acquiring bio signals	K2
CO2	The student will be able to understand various sources of bio signal distortions and its remedial techniques	K2
CO3	The students will be able to analyze ECG and EEG signal with characteristic feature points.	K4
CO4	The student will have a basic understanding of diagnosing bio-signals and classifying them.	K2
CO5	Develop a thorough understanding on basics of ECG pattern recognition and classification algorithms	K2

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1													**H**		**M**	**H**
CO2	**L**												**M**	**H**	**H**	**H**
CO3													**L**			**M**
CO4				**H**									**M**	**M**	**M**	**M**
CO5			**M**													

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	Random Processes: Stationary random process, Ergodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth and noise figure of systems.	12
UNIT – 2	Data Compression Techniques: Lossy and Lossless data reduction Algorithms. ECG data compression using Turning point, AZTEC, CORTES, Huffman coding, vector quantization, DICOM Standards	12
UNIT – 3	Cardiological Signal Processing: Pre-processing, QRS Detection Methods, Rhythm analysis, Arrhythmia Detection Algorithms, Automated ECG Analysis, ECG Pattern Recognition. Adaptive Noise Cancelling Principles of Adaptive Noise Cancelling, Adaptive Noise Cancelling with the LMS Adaptation Algorithm Noise Cancelling Method to Enhance ECG Monitoring, Fetal ECG Monitoring	12
UNIT – 4	Signal Averaging, Polishing: Mean and trend removal, Prony's method, Prony's Method based on the Least Squares Estimate, Linear prediction, Yule – Walker (Y –W) equations, Analysis of Evoked Potentials	12
UNIT – 5	Neurological Signal Processing: Modelling of EEG Signals, Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves. Auto Regressive (A.R.) modelling of seizure EEG. Sleep Stage analysis. Inverse Filtering, Least squares and polynomial modelling.	12
	Tota	60

TEXT BOOKS

1. Probability, Random Variables & Random Signal Principles – Peyton Z. Peebles, 4th Ed., 2009, TMH.
2. Biomedical Signal Processing- Principles and Techniques - D. C. Reddy, 2005, TMH.

REFERENCE BOOKS

1. Digital Bio Dignal Processing - Weitkunat R, 1991, Elsevier.
2. Biomedical Signal Processing - AkayM , IEEE Press.
3. Biomedical Signal Processing -Vol. I Time & Frequency Analysis - Cohen.A, 1986, CRC Press

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IV Year - I Semester		L	T	P	C
		2	0	2	3

PRINCIPLES OF SENSORS
(OE4)

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

		Knowledge Level (K)#
CO1	Understand general concepts of Internet of Things	K2
CO2	Recognize various devices, sensors and applications	K3
CO3	Understand and use various communication protocols for IoT	K5
CO4	Evaluate design issues in IoT applications	K5
CO5	Create IoT solutions using sensors, actuators and Devices&Understand general concepts of Internet of Things	K6

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1			**M**										**M**		**H**	**M**
CO2		**L**											**L**	**M**	**M**	**H**
CO3	**M**												**M**			**M**
CO4		**L**			**M**								**H**	**L**	**H**	**H**
CO5	**M**															

UNIT	CONTENTS	Hours
UNIT – 1	**Unit 1: INTRODUCTION** Basics of Measurement – Classification of errors – Error analysis – Static and dynamiccharacteristics of transducers .	12
UNIT – 2	**Unit 2:** Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types	12
UNIT – 3	**Unit 3:MOTION, PROXIMITY ANDRANGINGSENSORS** Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive,Capacitive.	12
UNIT – 4	**Unit 4:** LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).	12
UNIT – 5	**Unit 5: FORCE, MAGNETIC AND HEADINGSENSORS** Strain Gage, Load Cell, Magnetic Sensors–types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope,Inclinometers	12
	Total	60

TEXT BOOKS

1. Ernest O Doebelin, “Measurement Systems – Applications and Design”, TataMcGraw-Hill,2009.
2. Sawney A K and Puneet Sawney, “A Course in Mechanical Measurements andInstrumentation and Control”, 12th edition, Dhanpat Rai & Co, New Delhi,2013.

REFERENCE BOOKS

1. Patranabis D, “Sensors and Transducers”, 2nd Edition, PHI, New Delhi,2010.
2. John Turner and Martyn Hill, “Instrumentation for Engineers and Scientists”, Oxford SciencePublications,1999.
3. Richard Zurawski, “Industrial Communication Technology Handbook” 2nd edition, CRC Press, 2015

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IV Year - I Semester		L	T	P	C
		3	0	0	3
CONSUMER ELECTRONICS (OE4)					

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

		Knowledge Level (K)#
CO1	List technical specification of electronics Audio system (microphone and speaker).	K4
CO2	Trouble shoots consumer electronics products like TV, washing machine and AC.	K2
CO3	Identify and explain working of various colour TV transmission blocks.	K3
CO4	Understand various functions of Cam coder and shoot a video and take snapshots and save them in appropriate format	K2&K3
CO5	Understand the basic functions of various consumer electronic goods.	K2

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**M**												**M**		**M**	**H**
CO2		**M**											**H**	**L**	**H**	**M**
CO3			**L**		**H**								**L**			**H**
CO4													**M**	**M**		
CO5				**L**												

UNIT	CONTENTS	Hours
UNIT – 1	Audio Fundamentals and Devices: Basic characteristics of sound signal: level and loudness, pitch, frequency response, fidelity and linearity, Reverberation. Audio level metering, decibel level in acoustic measurement. Microphone: working principle, sensitivity, nature of response, directional characteristics.	12
UNIT – 2	Audio systems: CD player, home theatre sound system, surround sound. Digital console: block diagram, working principle, applications. FM tuner: concepts of digital tuning, ICs used in FM tuner TDA 7021T . PA address system: planning, speaker impedance matching, Characteristics, power amplifier, Specification	12
UNIT – 3	Television Receivers and Video Systems: PAL-D colour TV receiver, block diagram, Precision IN Line colour picture tube. Digital TVs:- LCD, LED , PLASMA, HDTV, 3-D TV, projection TV, DTH receiver..	12
UNIT – 4	Home / Office Appliances: FAX and Photocopier. Microwave Oven: types, single chip controllers, wiring and safety instructions, technical specifications. Washing Machine: wiring diagram, electronic controller for washing machine, technical specifications, types of washing machine, fuzzy logic.	12
UNIT – 5	Air conditioner and Refrigerators: Components features, applications, and technical specification. Digital camera and cam coder: - pick up devices - picture processing – picture storage.	12
	Total	60

TEXT BOOKS

1. Consumer Electronics, Bali S.P., Pearson Education India,2010.
2. Audio video systems : principle practices & troubleshooting, Bali R and Bali S.P.,Khanna Book Publishing Co. (P) Ltd., 2010Delhi , India.

REFERENCE BOOKS

1. Intellectual Property in Consumer Electronics, Software and Technology Startups, Springer Nature; 2014th edition (24 September 2013),ISBN-10:9781461479116.
2. 2. Consumer Electronics, B.R. Gupta , V. Singhal, S.K. Kataria & Sons; 2013th edition

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IV Year - I Semester		L	T	P	C
		3	0	0	3
Basics of IC Technology (OE4)					

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

		Knowledge Level (K)#
CO1	Understand and analyze the IC 741 operational amplifier and its characteristics	K2
CO2	Design the solution for linear & non-linear applications using IC741	K6
CO3	Elucidate and design the active filters and oscillators.	K2
CO4	Identify the needs of voltage regulators and timers	K3
CO5	Comprehend & differentiate the working principle of various data converters	K6

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1		**H**		**M**									**L**		**M**	**L**
CO2	**L**												**M**	**H**	**L**	**H**
CO3													**L**			**L**
CO4					**M**								**M**	**M**	**M**	**H**
CO5			**H**													

UNIT	CONTENTS	Hours
UNIT – 1	Introduction to Linear Integrated Circuits Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of741 Op-Amp, Modes of Operation - Inverting, Non-Inverting. Non-Linear Applications of OP-AMP Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, SchmittTrigger, Introduction to Voltage Regulators, Features of 723 Regulator.	12
UNIT – 2	Introduction to Filters Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters wave form generators Waveform Generators – Triangular, Saw tooth, Square Wave, IC555 Timer –FunctionalDiagram, Monostable, and Astable Operations	12
UNIT – 3	Digital Integrated Circuits Classification of Integrated Circuits, Comparison of Various Logic Families CombinationalLogic ICs – Specifications.	12
UNIT – 4	Applications of Digital ICs Code Converters, Decoders, Demultiplexers, LED & LCD Decoders with Drivers, Encoders,Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers	12
UNIT – 5	Memories Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static &Dynamic RAMs.	12
	Total	60

TEXT BOOKS

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

REFERENCE BOOKS

1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2ndEd., 2003.
2. Op Amps and Linear Integrated Circuits-Concepts and Applications James M.Fiore,Cengage Learning/ Jaico, 2009.
3. Operational Amplifiers with Linear Integrated Circuits by K. Lal Kishore –Pearson,2009.
4. Linear Integrated Circuits and Applications – Salivahanan, MC GRAW HILL EDUCATION.
5. Modern Digital Electronics – RP Jain – 4/e – MC GRAW HILL EDUCATION, 2010.

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IV Year - I Semester		L	T	P	C
		1	0	2	2

INTRODUCTION TO DATA ANALYTICS(SKILL ADVANCED COURSES)

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

		Knowledge Level (K)#
CO1	Explore the fundamental concepts of data analytics	K6
CO2	Understand data analysis techniques for applications handling large data	K2
CO3	Understand various machine learning algorithms used in data analytics process	K2
CO4	Visualize and present the inference using various tools	K4
CO5	Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making	K5

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**		**M**										**M**		**H**	**M**
CO2				**H**									**H**	**M**	**M**	**M**
CO3			**M**										**H**			**H**
CO4		**H**											**M**	**L**	**H**	**M**
CO5				**H**												

UNIT	CONTENTS	Hours
UNIT – 1	INTRODUCTION Data Analytics - Types – Phases - Quality and Quantity of data – Measurement - Exploratory data analysis - Business Intelligence	12
UNIT – 2	BIG DATA Big Data and Cloud technologies - Introduction to HADOOP: Big Data, Apache Hadoop, MapReduce - Data Serialization - Data Extraction - Stacking Data - Dealing with data.	12
UNIT – 3	DATA VISUALIZATION Introduction to data visualization – Data visualization options – Filters – Dashboard development tools – Creating an interactive dashboard with dc.js - summary.	12
UNIT – 4	ANALYTICS AND MACHINE LEARNING Machine learning – Modeling Process – Training model – Validating model – Predicting new observations – Supervised learning algorithms – Unsupervised learning algorithms.	12
UNIT – 5	ETHICS AND RECENT TRENDS Data Science Ethics – Doing good data science – Owners of the data - Valuing different aspects of privacy - Getting informed consent - The Five Cs – Diversity – Inclusion – Future Trends.	12
	Total	60

TEXT BOOKS

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Introducing Data Science, Manning Publications Co., 1st edition, 2016.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning: with Applications in R, Springer, 1st edition, 2013.
3. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley.
4. D J Patil, Hilary Mason, Mike Loukides, Ethics and Data Science, O' Reilly, 1st edition, 2018

REFERENCE BOOKS

1. Dr Anil Maheshwari, Data Analytics Made Accessible, Publisher: Amazon.com Services LLC.
2. Joel Grus, Data Science from Scratch: First Principles with Python, O'Reilly, 1st edition, 2015.
3. Cathy O'Neil, Rachel Schutt, Doing Data Science, Straight Talk from the Frontline, O' Reilly, 1st edition, 2013.
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2nd edition, 2014.
5. Eric Siegel, Predictive Analytics The Power to Predict Who Will Click, Buy, Lie, or Die, 2 nd Ed., Wiley

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IV Year - I Semester		L	T	P	C
		1	0	2	2

INTERFACING WITH ARDUINO(SKILL ADVANCED COURSES)

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

		Knowledge Level (K)#
CO1	Understand general concepts of Internet of Things	K2
CO2	Recognize various devices, sensors and applications	K4
CO3	Understand and use various communication protocols for IoT	K2
CO4	Evaluate design issues in IoT applications	K5
CO5	Create IoT solutions using sensors, actuators and Devices&Understand general concepts of Internet of Things	K6

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1		**H**			**H**								**M**		**M**	**H**
CO2				**M**									**M**	**H**	**L**	**M**
CO3	**M**												**H**			**H**
CO4													**H**	**M**	**M**	**M**
CO5	**L**				**L**											

UNIT	CONTENTS	Hours
UNIT – 1	Introduction to IoT: The impact of IoT in industry and daily life, Understanding the IoT ecosystem: devices, platforms, and applications. Overview of IoT Components –Analog sensors, Digital sensors	12
UNIT – 2	Programming an Arduino IoT Device, Preparing the development environment (Arduino IDE), Exploring the Arduino language (C/C++) syntax, Coding, compiling, and uploading to the microcontroller	12
UNIT – 3	Working with Arduino Communication Modules, Bluetooth Modules, WiFi Modules, RFID Modules, I2C and SPI	12
UNIT – 4	Interfacing Arduino and Blynk via USB, LED Blinking, Controlling a Servomotor. ESP8266 WiFi Serial Module – Overview, Setting up the Hardware, Interfacing with Arduino	12
UNIT – 5	Creating an IoT Temperature and Humidity Sensor System – Overview of DHT-22 Sensor, Interfacing the Hardware: Arduino, ESP8266 WiFi Module, and DHT-22 Sensor, Checking Your Data via ThingSpeak, Connecting Your Arduino Set-up to Blynk via WiFi, Running your Arduino IoT Sensor System, Troubleshooting	12
	Total	60

TEXT BOOKS

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014

REFERENCE BOOKS

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
2. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1

MINOR COURSES

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Minor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
ELECTRONIC DEVICES AND CIRCUITS					

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

		Knowledge Level (K)#
CO1	Apply the basic concepts of semiconductor physics.	K3
CO2	Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation.	K2
CO3	Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons..	K1
CO4	Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.	K2
CO5	Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions. & Perform the analysis of small signal low frequency transistor amplifier circuits using BJT and FET in different configurations.	K1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**M**			**L**									**L**		**M**	**H**
CO2					**M**									**M**		
CO3																**M**
CO4													**H**	**L**		
CO5			**H**												**H**	**L**

UNIT	**CONTENTS**	**Contact Hours**
UNIT – 1	**Junction Diode Characteristics :** energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.	12
UNIT – 2	**Special Semiconductor Devices**: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode, Tunnel Diode, UJT, PNPN Diode, SCR. Construction, operation and V-I characteristics.	12
UNIT – 3	Rectifiers and Filters: Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter(Series inductor), Capacitor filter(Stunt inductor), π-Filter, comparison of various filter circuits in terms of ripple factors.	12
UNIT – 4	**Transistor Characteristics: BJT:** Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.Transistor Biasing and Thermal Stabilization : Need for biasing, operating point, load line analysis,	12
UNIT – 5	FET: FET types, construction, operation, characteristicsμ, gm, rdparameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET. Small Signal Low Frequency Transistor Amplifier Models: BJT**:** Two port network, Transistor hybrid model,.**FET:** Generalized analysis of small signal model,.	12
	Total	60

Text Books:

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

References:

1. Integrated Electronics-J. Millman, C. Halkias,TataMc-Graw Hill, Second Edition,2009
2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016.
3. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, 4th Edition,2008.
4. Electronic Devices and Integrated Circuits – B.P. Singh,Rekha , Pearson publications, 2006.

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Minor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
SIGNALS and SYSTEMS					

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

		Knowledge Level (K)#
CO1	Differentiate the various classifications of signals and systems	K4
CO2	Analyze the frequency domain representation of signals using Fourier concepts	K4
CO3	Classify the systems based on their properties and determine the response of LTI Sytems	K6
CO4	Know the sampling process and various types of sampling techniques.	K1
CO5	Apply Laplace and z-transforms to analyze signals and Systems (continuous & discrete).	K3

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1			**M**		**H**									**M**		**H**
CO2	**L**	**H**											**M**	**L**	**M**	**M**
CO3				**M**									**L**	**M**		
CO4	**L**			**H**									**M**	**H**	**L**	**H**
CO5		**M**											**H**			

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	**INTRODUCTION:** Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function..	12
UNIT – 2	**FOURIER SERIES AND FOURIERTRANSFORM:** Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Relation between Trigonometric and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function.	12
UNIT – 3	**ANALYSIS OF LINEAR SYSTEMS:** Introduction**,** Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system, Related problems. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization,	12
UNIT – 4	**CORRELATION:** Auto-correlation and cross-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem **SAMPLING THEOREM :** Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling, Related problems.	12
UNIT – 5	**LAPLACE TRANSFORMS:** Introduction**,** Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Inverse Laplace transform, Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis. **Z–TRANSFORMS:** Concept of Z- Transform of a discrete sequence. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms. Distinction between Laplace, Fourier and Z transforms.	12
	Total	60

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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Minor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
SWITCHING THEORY and LOGIC DESIGN					

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

		Knowledge Level (K)#
CO1	Classify different number systems and apply to generate various codes.	K4
CO2	Design different types of combinational logic circuits.	K6
CO3	Apply knowledge of flip-flops in designing of Registers and counters	K3
CO4	The operation and design methodology for synchronous sequential circuits and algorithmic state machines.	K5
CO5	Produce innovative designs by modifying the traditional design techniques&Use the concept of Boolean algebra in minimization of switching functions	K4

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		**H**											**M**		**H**	**M**
CO2	**M**			M										**H**	**M**	**H**
CO3	**M**		L										**M**	**M**	**H**	**M**
CO4		**L**	M												**M**	**H**
CO5	**M**												**L**	**H**	**H**	

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	**REVIEW OF NUMBER SYSTEMS &CODES:** Representation of numbers of different radix, conversation from one radix to another radix, r-1's compliments and r's compliments of signed members. Gray code ,4 bit codes; BCD, Excess-3, 2421, 84-2-1 code etc. Error detection & correction codes: parity checking, even parity, odd parity, Hamming code. Realization of three level logic circuits. Study the pin diagram and obtain truth table for the following relevant ICs 7400,7402,7404,7408,7432,7486	12
UNIT – 2	BOOLEAN THEOREMS AND LOGIC OPERATIONS: Boolean theorems, principle of complementation & duality, De-morgan theorems. Logic operations ; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EX-NOR operations. Standard SOP and POS Forms, NAND-NAND and NOR-NOR realization	12
UNIT – 3	MINIMIZATION TECHNIQUES: Minimization and realization of switching functions using Boolean theorems, K-Map (up to 3 variables) COMBINATIONAL LOGIC CIRCUITS DESIGN: Design of Half adder, full adder, half subtractor, full subtractor, Excess 3 adder circuit and carry look-a-head adder circuit, Design code converts using Karnaugh method and draw the complete circuit diagrams.	12
UNIT – 4	COMBINATIONAL LOGIC CIRCUITS DESIGN USING MSI &LSI :Design of encoder ,decoder, multiplexer and de-multiplexers, Implementation of higher order circuits using lower order circuits .Realization of Boolean functions using decoders and multiplexers. Design of Priority encoder, 4-bit digital comparator and seven segment decoder.	12
UNIT – 5	SEQUENTIAL CIRCUITS I:Classification of sequential circuits (synchronous and asynchronous) , operation of NAND & NOR Latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip-flop. shift register, counters(Elementary treatment)	12
	Total	60

TEXT BOOKS:

1. Switching and finite automata theory Zvi.KOHAVI, Niraj.K.Jha 3rd Edition, Cambridge University Press,2009
2. Digital Design by M.MorrisMano,Michael D Ciletti,4th edition PHI publication,2008
3. Switching theory and logic design by Hill and Peterson**,**Mc-Graw Hill TMH edition, 2012.

REFERENCES:

1. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers,2006
2. Digital electronics by R S Sedha.S.Chand& company limited,2010
3. Switching Theory and Logic Design by A. AnandKumar,PHI Learning pvt ltd,2016.
4. Digital logic applications and design by John M Yarbough, Cengage learning, 2006.

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Minor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
ANALOG COMMUNICATIONS					

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

		Knowledge Level (K)#
CO1	Differentiate various Analog modulation and demodulation schemes and their spectral characteristics	K3
CO2	Analyze noise characteristics of various analog modulation methods	K4
CO3	Analyze various functional blocks of radio transmitters and receivers	K4
CO4	Design simple analog systems for various modulation techniques.	K6
CO5	Understand the importance of noise considerations in communication system	K2

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**L**				H								**M**			
CO2			**H**										**H**	**M**		
CO3				L									**M**	**H**		
CO4			**M**		L									**M**		
CO5		**M**														

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	Introduction to communications systems: communication, communication systems, infonnation,transmitter,channel-noise,receiver,modulation,description,need for modulation, bandwidth requirements, sine wave and fourier series review, frequency spectra of nonsinusoidal waves (chapter 1, george kennedy)	12
UNIT – 2	Noise, external noise, internal noise, noise calculations, noise calculations, noise figure, noise temparature(chapter 2, george kennedy)	12
UNIT – 3	Amplitude modulation ,amplitude modulation theory, generation of am (chapter 3, george kennedy)	12
UNIT – 4	Single-sideband techniques , suppression of unwanted sideband, extensions of ssb (chapter 4, george kennedy)	12
UNIT – 5	Frequency modulation , theory of frequency and phase modulation,noise and frequency modulation, generation of frequency modulation (chapter 5 george kennedy)	12
	Total	60

TEXT BOOKS:

1. Principles of Communication Systems – H Taub& D. Schilling, GautamSahe, TMH, 3rdEdition, 2007.
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004

REFERENCES:

1. Principles of Communication Systems - Simon Haykin, John Wiley, 2ndEdition, 2007
2. Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH,2007.
3. Electronic Communication systems – Tomasi,Pearson, fourth Edition, 2007.

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Minor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

Linear Integrated Circuits

Pre-requisite: Network Theory, Electronic Devices and Circuits, Electronic Circuit Analysis
Course Outcomes: At the end of the course, student will be able to

		Knowledge Level (K)#
CO1	Analyse the Differential Amplifier with Discrete components	K4
CO2	Describe the Op-Amp and internal Circuitry: 555 Timer, PLL	K1
CO3	Discuss the Applications of Operational amplifier: 555 Timer, PLL	K2
CO4	Design the Active filters using Operational Amplifier	K5
CO5	Use the Op-Amp in A to D & D to A Converters	K3

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1					**L**										**L**	**L**
CO2			**M**												**H**	**H**
CO3				**M**											**M**	**H**
CO4				**H**											**L**	**M**
CO5					**H**										**H**	**L**

Unit	Contents	Hours
Unit – 1	**Integrated Circuits:** **Differential Amplifier**- DC and AC analysis of (i) Dual input Balanced output Configuration, (ii) Dual Input Unbalanced Output, (iii)Single Ended Input – Balanced Output (iv) Single Ended Input – un Balanced Output, Cascade Differential Amplifier Stages, Level translator. (Text Book: Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1993) **Operational Amplifier:** Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Op-Amp internal Circuit, Examples of IC Op-Amps, FET Operational Amplifier (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003) Block Diagram Representation of Typical Op-Amp, Analysis of Typical Op-Amp Equivalent Circuit(only MC1435) (Text Book: Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1993) OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.	9 hrs
Unit – 2	**OP-AMPS Applications:** Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator. (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003) **Comparators and Waveform Generators:** Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators. (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003)	9 hrs
Unit – 3	**Active Filters:** Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and all pass filters. (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003)	9 hrs
Unit – 4	**Timer**s: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger. **Phase Locked Loops:** Introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation, AM, FM & FSK demodulators. Applications of VCO (566) (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003)	9 hrs
Unit – 5	**Digital To Analog And Analog To Digital Converters:** Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC.DAC and ADC Specifications. (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003)	9 hrs
	Total	45 hrs

Text Books:

1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition 2003.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1993.

References:

1. Operational Amplifiers & Linear Integrated Circuits –Sanjay Sharma ;SK Kataria&Sons;2nd Edition,2010
2. Design with Operational Amplifiers & Analog Integrated Circuits – Sergio Franco, McGraw Hill, 1988.
3. OP AMPS and Linear Integrated Circuits concepts and Applications, James M Fiore, Cenage Learning India Ltd.

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Minor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
ELECTRONIC CIRCUITS					

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

		Knowledge Level (K)#
CO1	Design and analysis of small signal high frequency transistor amplifier using BJT and FET.	K6
CO2	Design and analysis of multi stage amplifiers using BJT and FET and Differential amplifier using BJT.	K4
CO3	Derive the expressions for frequency of oscillation and condition for oscillation of RC and LC oscillators and their amplitude and frequency stability concept.	K3
CO4	Develop, Design and create simple analogue and digital electronic circuits	K6
CO5	Measure the characteristics electronic circuits and present experimental results	K2

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**L**		**H**											**H**		
CO2					**M**										**H**	
CO3		**M**											**H**	**M**		**H**
CO4				**L**												
CO5			**M**													

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	**Small Signal High Frequency Transistor Amplifier models:BJT:** Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid π conductance, Hybrid π capacitances, validity of hybrid π model, determination of high-frequency parameters in terms of low-frequency parameters , CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product. **FET:** Analysis of common Source and common drain Amplifier circuits at high frequencies.	12
UNIT – 2	**Multistage Amplifiers:** Classification of amplifiers, methods of coupling**, c**ascaded transistor amplifier and its analysis, analysis of two stage RC coupled amplifier, high input resistance transistor amplifier circuits and their analysis-Darlington pair amplifier, Cascode amplifier, Boot-strap emitter follower, Differential amplifier using BJT.	12
UNIT – 3	**Feedback Amplifiers :** Feedback principle and concept, types of feedback, classification of amplifiers, feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Performance comparison of feedback amplifiers, Method of analysis of feedback amplifiers.	12
UNIT – 4	**Oscillators:** Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and Wien bridge oscillators with BJT and FET and their analysis, Generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators using BJT, Frequency and amplitude stability of oscillators.	12
UNIT – 5	**Power Amplifiers:** Classification of amplifiers(A to H), Class A power Amplifiers, Class B Push-pull amplifiers, Complementary symmetry push pull amplifier, Class AB power amplifier, Class-C power amplifier, Thermal stability and Heat sinks.**Tuned Amplifiers**: Introduction, Q-Factor, small signal tuned amplifier, capacitance single tuned amplifier, double tuned amplifiers, , staggered tuned amplifiers	12
	Total	60

Text Books:

1. Integrated Electronics- J. Millman and C.C. Halkias, Tata McGraw-Hill, 1972.
2. Electronic Devices and Circuits Theory – Robert L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, Tenth Edition, 2009.
3. Electronic Devices and Integrated Circuits – B.P. Singh,Rekha , Pearson publications, 2006

References:

1. Electronic Circuit Analysis and Design – Donald A. Neaman, McGrawHill, 2010.
2. Microelectronic Circuits-Sedra A.S. and K.C. Smith, Oxford University Press, Sixth Edition, 2011.
3. Electronic Circuit Analysis-B.V.Rao, K.R.Rajeswari, P.C.R.Pantulu, K.B.R.Murthy, Pearson Edn.

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Minor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
DIGITAL SIGNAL PROCESSING					

Pre-requisite: Signals & Systems
Course Outcomes: At the end of the course, student will be able to

		Knowledge Level (K)#
CO1	Discuss Signals and Systems in Discrete Domain; z-Transforms and its applications to the analysis of LTI systems	K2
CO2	Explain the analysis of signals in frequency domain and calculation of DFT using FFT Algorithms	K2
CO3	Identify the FIR and IIR structures for the required digital filter and study of various filter structures	K1, K2
CO4	Analyze and Design a Digital filter (FIR&IIR) from the given specifications.	K4,K5
CO5	Describe the Architecture of DSP Processor	K1

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**H**												**H**			**M**
CO2	**H**												**M**			**H**
CO3	**M**		**M**	**H**												**H**
CO4	**M**	**M**	**H**												**M**	**H**
CO5	**M**			**H**									**M**			**H**

UNIT	CONTENTS	**Hours**
Unit -1	**Introduction:** Signals, Systems, and Signal Processing, Classification of Signals, The Concept of Frequency in Continuous Time and Discrete Time Signals **Discrete Time Signals and Systems**: Discrete Time Signals, Discrete Time Systems, Analysis of Discrete Time Linear Time Invariant Systems, Discrete Time Systems Described by Difference Equations, Implementation of Discrete Time Systems, Correlation of Discrete Time Signals **The z-Transform and Its Applications to the Analysis of LTI Systems**: The z-Transform, Properties, Rational z Transforms, Inversion of the z-Transform, Analysis of Linear Time Invariant Systems in the z-Domain, The One sided z-Transform.	9
Unit-2	**Frequency Analysis of Signals**: Frequency Analysis of Continuous Time Signals, Frequency Analysis of Discrete Time Signals, Frequency Domain and Time Domain Signal Properties, Properties of the Fourier Transform for Discrete Time Signals. **The Discrete Fourier Transform: Its Properties and Applications**: Frequency Domain Sampling: The Discrete Fourier Transform, Properties of the DFT, Linear Filtering Methods Based on the DFT, Frequency Analysis of Signals Using DFT, The Discrete Cosine Transform. **Efficient Computation of the DFT: Fast Fourier Transform Algorithms**: Direct Computation of the DFT, Radix-2 FFT Algorithms.	9
Unit-3	**Implementation of Discrete Time Systems**: Structures for the Realization of Discrete Time Systems, **Structures for FIR Systems**: Direct Form Structure, Cascade Form Structures, Frequency Sampling Structures **Structures for IIR Systems**: Discrete Form Structures Signal Flow Graphs and Transposed Structures, Cascade Form Structures, Parallel Form Structures.	9
Unit-4	**Design of Digital Filters**: General Considerations: Causality and Its Implications, Characteristics of Practical Frequency Selective Filters. **Design of FIR Filters**: Symmetric and Antisymmetric FIR Filters, Design of Linear Phase FIR Filters Using Windows, Design of Linear Phase FIR Filters by the Frequency Sampling Method. **Design of IIR Filters From Analog Filters**: IIR Filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation, Characteristics of Commonly Used Analog Filters. **Frequency Transformations**: Frequency Transformations in the Analog Domain, Frequency Transformations in the Digital Domain.	9
Unit-5	**Introduction to programmable DSPs**: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs ,Multiple Access Memory, Multiported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals. **Architecture of TMS320C5X:** Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Auxiliary Register Compare Register, Block Move Address Register, Block Repeat Registers, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals. TMS320C5X Assembly Language Instructions.	9
	Total	45

TEXT BOOKS:

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

Reference Books:

1. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, 3rd Edition, Pearson, 2014.
2. Digital Signal Processing-A. Nagoor Kani, 2nd Edition, McGrawHill Education

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Minor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
DIGITAL COMMUNICATIONS					

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

		Knowledge Level (K)#
CO1	Determine the performance of different waveform coding techniques for the generation and digital representation of the signals	K3
CO2	Determine the probability of error for various digital modulation schemes	K3
CO3	Analyse different source coding techniques	K4
CO4	Compute and analyse different error control coding schemes for the reliable transmission of digital information over the channel	K4
CO5	Understand the generation and detection of advanced modulation techniques	K2

Mapping of course outcomes with program outcomes

	PO1	**PO3**	**PO4**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**H**										H	M		
CO2		**L**						**L**						M
CO3			**M**				**M**		**M**				H	
CO4				**L**		**H**					M	M		
CO5														

UNIT	CONTENTS	**Hours**
UNIT – 1	**PULSE DIGITAL MODULATION:** Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, Quantization error, Differential PCM systems(DPCM). Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems, Time division multiplexing, Frequency division multiplexing	12
UNIT – 2	**DIGITAL MODULATION TECHNIQUES:** Introduction, ASK, FSK, PSK, DPSK, DEPSK, QPSK, M-ary PSK, ASK, FSK, similarity of BFSK and BPSK.	12
UNIT – 3	**INFORMATION THEORY:** Discrete messages, concept of amount of information and its properties. Average information, Entropy and its properties. Information rate, Mutual information and its properties	12
UNIT – 4	**SOURCE CODING:** Introductions, Advantages, Shannon's theorem, LINEAR BLOCK CODES: Introduction, Matrix description of Linear Block codes, Error detection and error correction capabilities of Linear block codes, Hamming codes, Binary cyclic codes, Algebraic structure, encoding, syndrome calculation, BCH Codes.	12
UNIT – 5	**CONVOLUTIONAL CODES:** Introduction, encoding of convolution codes, time domain approach, transform domain approach. Graphical approach: state, tree and trellis diagram decoding using Viterbi algorithm.	12
	Total	60

TEXT BOOKS:

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

REFERENCES:

1. Digital and Analog Communication Systems - Sam Shanmugam, John Wiley, 2005.
2. Digital Communications – John Proakis, TMH, 1983. Communication Systems Analog & Digital – Singh &Sapre, TMH, 2004.

3.Modern Analog and Digital Communication – B.P.Lathi, Oxford reprint, 3rd edition, 2004.

HONOR COURSES

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Honor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
ARTIFICIAL NEURAL NETWORKS					

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

		Knowledge Level (K)#
CO1	Develop the basic concepts of Nanotechnology and Nano machines	K3
CO2	Apply fundamentals of logic devices and the need of Quantum computing.	K4
CO3	Illustrate the operation of Silicon MOSFETS	K3
CO4	Describe the mathematical treatment for the modeling and design of the carbon nanotubes	K2
CO5	Understand the applications such as MEMS, RAM, Mass Storage devices and gain knowledge on Electrodes and Contacts	K2

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		**L**											**L**		**H**	
CO2														**M**		**H**
CO3			**M**													
CO4													**M**	**H**		**M**
CO5					**M**											

UNIT	CONTENTS	**Hours**
UNIT – 1	Introduction: What is neural Network, Human Brain, Models of a Neuron, Neural network viewed as a directed graph, feedback, Network Architectures, Knowledge representation, Artifical Intelligence and Neural Networks, Historical Notes	12
UNIT – 2	Learning Processes: Introduction, Error Correction Learning, Memory based learning, Hebbian learning, Competitive Learning, Boltzmann Learning, Credit assignment problem, learning with a teacher, learning without a teacher, learning tasks, memory, adaptation, statistical nature of learning process, statistical learning rheory, Probability approximately correct model of learning	12
UNIT – 3	Single Layer Perceptrons:Introduction, Adaptive filtering problem, unconstrained optimization techniques, linear least square filters, least mean square algorithm, learning curves,learning rate annealing techniques, perceptron,relation between the perceptron and bayes classifier for a Gaussian environment	12
UNIT – 4	Multilayer Perceptrons:Introduction,some prelimenaries, back-propagation algorithm, summary of back propagation algorithm,XOR problrm, Heuristics for making the backpropagation algorithm perform better, output representation and decision rule, convolutional networks	12
UNIT – 5	Radial Basis function networks:Introduction, covers theorem, interpolation problem, supervised learning as an III-posed hypersurface reconstruction, regularization theory, regularization networks, generalized radial basis function networks, XOR problem, estimation of the regularization parameter, approximation properties of RBF netwroks, comparison of RBF networks and multilayer perceptrons	12
	Tota	60

Text Books:

1. Neural Networks & Learning Machines, Simon Haykin, Pearson Education
2. Neural Networks - A Classroom Approach, Satish Kumar, MC Grawhill.

References Books:

1. J.A.freeman, D.M.Skapura,Neural Networks: Algorithms, Applications, and Programming Techniques, Pearson
2. M.H.GHassoun, Fundamentals of Artificial Neural Networks, PHI,

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Honor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
NANO ELECTRONICS					

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

		Knowledge Level (K)#
CO1	**Develop** the basic concepts of Nanotechnology and Nano machines	K3
CO2	**Apply** fundamentals of logic devices and the need of Quantum computing.	K3
CO3	**Illustrate** the operation of Silicon MOSFETS	K2
CO4	**Describe** the mathematical treatment for the modeling and design of the carbon nanotubes	K2
CO5	**Understand** the applications such as MEMS, RAM, Mass Storage devices and gain knowledge on Electrodes and Contacts	K4

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**L**												M		M	H
CO2																
CO3		**M**											H	M		M
CO4															H	
CO5				**M**										H		

UNIT	CONTENTS	**Hours**
UNIT – 1	Background to nanotechnology: Types of nanotechnology and nanomachines – periodictable – atomic structure – molecules and phases – energy – molecular and atomic size –surfaceand dimensional space – top down and bottom up; Molecular Nanotechnology: Electronmicroscope, scanning electron microscope – atomic force microscope –scanning tunnelling microscope –nanomanipulator – nanotweezers – atom manipulation– nanodots – self assembly – dip pennanolithography. Nanomaterials: preparation –plasma arcing – chemical vapor deposition –sol-gels – electrodeposition – ball milling –applications of nanomaterials;	12
UNIT – 2	Fundamentals of logic devices:- Requirements – dynamic properties – threshold gates;physical limits to computations; concepts of logic devices:- classifications – two terminaldevices – field effect devices – coulomb blockade devices – spintronics – quantum cellularautomata – quantum computing –DNA computer; performance of information processing systems;- basic binary operations,measure of performance processing capability of biological neurons – performance estimationfor the human brain. Ultimate computation:- power dissipation limit – dissipation in reversiblecomputation – the ultimate computer.	12
UNIT – 3	Silicon MOSFETS - Novel materials and alternate concepts:- fundamentals of MOSFETDevices- scaling rules – silicon-dioxide based gate dielectrics – metal gates – junctions &contacts – advanced MOSFET concepts. Quantum transport devices based on resonanttunneling:- Electron tunneling – resonant tunneling diodes – resonant tunneling devices; Singleelectron devices for logic applications:- Single electron devices – applications of singleelectron devices to logic circuits.	12
UNIT – 4	Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes –assemblies – purification of carbon nanotubes – electronic propertics – synthesis ofcarbon nanotubes – carbon nanotube interconnects – carbon nanotube FETs –Nanotube for memory applications – prospects of an all carbon nanotubenanoelectronics	12
UNIT – 5	Electrodes & contacts – functions – molecular electronic devices – first test systems –simulation and circuit design – fabrication; Future applications: MEMS – robots – randomaccess memory – mass storage devicesfor washing machine, technical specifications, types ofwashing machine, fuzzy logic.	12
	Total	60

Text Books:

1. 'Introduction to Nanoelectronics' by V. V. Mitin, V. Kochelap, Michel A Stroscio.Cambridge, 2007.
2. 'Fundamental of Nanoelectronics' by George W Hanson, Prentice Hall, 2008.

References Books:

1. Michael Wilson, KamaliKannangara, Geoff Smith, Michelle Simmons and Burkhard
2. Raguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman & Hall /CRC, 2002

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Honor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
COMPUTER NETWORKS					

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

		Knowledge Level (K)#
CO1	Understand and explore the basics of Computer Networks and VariousProtocols.	K2
CO2	Understand the World Wide Web concepts	K2
CO3	Administrate a network and flow of information	K4
CO4	Understand easily the concepts of network security, mobile and ad hocnetworks	K2
CO5	Have the Knowledge on Internet transport protocols&Understand the different layers of TCP/IP Protocol Suite	K1

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1				**H**									H	M		H
CO2		**M**													H	
CO3				H										H		
CO4	**M**												MM		M	M
CO5				**H**												

UNIT	CONTENTS	**Hours**
UNIT – 1	OVERVIEW OF THE INTERNET Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet historystandards and administration; Comparison of the OSI and TCP/IP reference model.Physical Layer: Guided transmission media, wireless transmission media. DataLink Layer – design issues, CRC Codes, Elementary Data link Layer protocols, sliding window protocol	12
UNIT – 2	MULTIPLE ACCESS PROTOCOLS ALOHA, CSMA, Collision free protocols, Ethernet- Physical Layer, Ethernet MacSub layer, data link layer switching & use of bridges, learning bridges, spanningtree bridges, repeaters , hubs, bridges , switches, routers and gateways.	12
UNIT – 3	NETWORK LAYER Network Layer Design issues, store and forward packet switching connection lessand connection oriented networks-routing algorithms-optimality principle, shortestpath, flooding, Distance Vector Routing, Count to Infinity Problem, HierarchicalRouting, Congestion control algorithms, admission control.	12
UNIT – 4	INTERNETWORKING Tunneling, Internetwork Routing, Packet fragmentation, IPv4, Ipv6 Protocol, IPaddresses, CIDR, IMCP, ARP, RARP, DHCP. Transport Layer: Services provided tothe upper layers elements of transport protocol-addressing connectionestablishment, connection release,Connection Release, Crash Recovery	12
UNIT – 5	THE INTERNET TRANSPORT PROTOCOLS UDP-RPC, Real Time Transport Protocols, The Internet Transport ProtocolsIntroduction to TCP, The TCP Service Model, The TCP Segment Header, TheConnection Establishment, The TCP Connection Release, The TCP ConnectionManagement Modeling, The TCPSliding Window, The TCP Congestion Control, Thefuture of TCP. Application Layer-Introduction ,providing services, Applicationslayer paradigms, Client server model. Standard client-server application-HTTP,FTP, electronic mail, TELNET, DNS, SSH	12
	Total	60

TEXT BOOKS

1. Data Communications and Networking – Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education.

REFERENCE BOOKS

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.
2. Understanding communications and Networks, 3rd Edition, W.A.Shay, Cengage Learning.
3. Introduction to Computer Networks and Cyber Security, Chwan-Hwa (John) Wu, J. David Irwin, CRC Press.
4. Computer Networks, L.L.Peterson and B.S.Davie,4th edition, ELSEVIER.
5. Computer Networking: A Top-Down Approach Featuring the Internet, James F.Kurose,K.W.Ross,3rd Edition, Pearson Education.

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Honor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
ARTIFICIAL INTELLIGENCE					

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

		Knowledge Level (K)#
CO1	Understanding the basic concept of AI	K1
CO2	Understanding reasoning and fuzzy logic for artificial intelligence	K2
CO3	Understanding game playing and natural language processing.	K2
CO4	Apply AI techniques to real world problems to develop intelligent systems	K4
CO5	Understand the concept of Artificial Intelligence, search techniques and knowledge representation issues	K3

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		**M**											**M**			
CO2	**L**														**M**	
CO3					**H**								**H**			**M**
CO4		**M**														
CO5			**M**													

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word Problems, State Space Search & Heuristic Search Techniques: Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System, Characteristics And Issues In The Design Of Search Programs, Additional Problems. Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.	12
UNIT – 2	Knowledge Representation Issues: Representations And Mappings, Approaches To Knowledge Representation. Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.	12
UNIT – 3	Symbolic Reasoning Under Uncertainty: Introduction To No monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bays' Theorem, Factors And Rule-Base Systems, Bayesian Networks, Dempster Shafer Theory	12
UNIT – 4	Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC	12
UNIT – 5	Game Playing: Overview, And Example Domain: Overview, Mini Max, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI	12
	Total	60

References:

1. Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

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Honor Course		**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
MACHINE LEARNING					

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

		Knowledge Level (K)#
CO1	Understand the concepts of computational intelligence like machine learning	K2
CO2	Ability to get the skill to apply machine learning techniques to address the real time Problems in different areas	K3
CO3	Understand the Neural Networks and its usage in machine learning application.	K2
CO4	Apply principles and algorithms evaluate models generated from data	K4
CO5	Apply the algorithms to a real world problems	K3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1			M											M		
CO2													H			H
CO3		L												H	H	
CO4			M													
CO5			L													

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	Introduction Well-posed learning problems, designing a learning system Perspectives and issues in machine Learning Concept learning and the general to specific ordering Introduction, A concept learning task, concept learning as search, Find-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination algorithm, Remarks on Version Spaces and Candidate Elimination, Inductive Bias. Decision Tree Learning Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.	12
UNIT – 2	Artificial Neural Networks Introduction, Neural Network Representation, Appropriate Problems for Neural Network Learning, Perceptions, Multilayer Networks and the Back propagation Algorithm, Discussion on the Back Propagation Algorithm, An illustrative Example: Face Recognition Evaluation Hypotheses Motivation, Estimation Hypothesis Accuracy, Basics of Sampling Theory, A General Approach for Deriving Confidence Intervals, Difference in Error of Two Hypotheses, Comparing Learning Algorithms.	12
UNIT – 3	Bayesian learning Introduction, Bayes Theorem, Bayes Theorem and Concept Learning Maximum Likelihood and Least Squared Error Hypotheses, Maximum Likelihood Hypotheses for Predicting Probabilities, Minimum Description Length Principle , Bayes Optimal Classifier, Gibs Algorithm, Naïve Bayes Classifier, An Example: Learning to Classify Text, Bayesian Belief Networks, EM Algorithm. Computational Learning Theory Introduction, Probably Learning an Approximately Correct Hypothesis, Sample Complexity for Finite Hypothesis Space, Sample Complexity for Infinite Hypothesis Spaces, The Mistake Bound Model of Learning. Instance-Based Learning Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.	12
UNIT – 4	Pattern Comparison Techniques Temporal patterns, Dynamic Time Warping Methods, Clustering, Codebook Generation, Vector Quantization Pattern Classification Introduction to HMMS, Training and Testing of Discrete Hidden Markov Models and Continuous Hidden Markov Models, Viterbi Algorithm, Different Case Studies in Speech recognition and Image Processing	12
UNIT – 5	Analytical Learning Introduction, Learning with Perfect Domain Theories : PROLOG-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operations. Combining Inductive and Analytical Learning Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis.	12
	Total	60

Text Books

1. Machine Learning – Tom M.Mitchell,-MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – Hwang Juang.

References

1. Machine Learning : An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

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Honor Course		L	T	P	C
		4	0	0	4

DIGITAL CONTROL SYSTEMS

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

		Knowledge Level (K)#
CO1	Understand the concepts of Digital control systems	K2
CO2	Analyze and design discrete systems in state variable analysis	K4
CO3	Relate the concepts of stability analysis and design discrete time systems.	K4
CO4	Steady state error analysis of digital control systems	K5
CO5	Digital control design with digital controller &Design of full and reduced order observer	K2

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**H**			**H**									**H**			
CO2													**M**	**M**	**H**	
CO3			**M**													**H**
CO4		**M**											**H**	**M**		
CO5																**M**

UNIT	CONTENTS	Hours
UNIT – 1	INTRODUCTION Block Diagram of typical control system- advantages of sampling in control systems– examples of discrete data and digital systems – data conversion and quantization– sample and hold devices – D/A and A/D conversion – sampling theorem –reconstruction of sampled signals –ZOH. Z-transform: Definition and evaluation ofZ-transforms – mapping between s-plane and z-plane – inverse z-plane transform –theorems of the Z-transforms – limitations of z-transforms –pulse transfer function –pulse transfer function of ZOH –relation between G(s) and G(z) – signal flow graphmethod applied to digital systems	12
UNIT – 2	STATE SPACE ANALYSIS State space modelling of digital systems with sample and hold – state transitionequation of digital time in variant systems – solution of time in variant discretestate equations by the Z-Transformation – transfer function from the state model –Eigen values – Eigen vector and diagonalisation of the A-matrix – Jordan canonicalform. Computation of state transition matrix-Transformation to phase to variablecanonical form-The state diagram – decomposition of digital system – Response ofsample data system between sampling instants using state approach. Stability:Definition of stability – stability tests – The second method of Liapunov.	12
UNIT – 3	TIME DOMAIN ANALYSIS Comparison of time response of continuous data and digital control systemscorrelation between time response and root locus j the s-plane and z-plane – effectof polezero configuration in the z-plane upon the maximum overshoot and peaktime of transient response – Root loci for digital control systems – steady state erroranalysis of digital control systems – Nyquist plot – Bode plot-G.M and P.M	12
UNIT – 4	DESIGN The digital control design with digital controller with bilinear transformation –Digital PID controller-Design with deadbeat response-Pole placement through statefeedback-Design of full order state observer-Discrete Euler Lagrance Equation –Discrete maximum principle	12
UNIT – 5	DIGITAL STATE OBSERVER Design of – Full order and reduced order observers. Design by max. Principle:Discrete Euler language equation-discrete maximum principle.	12
	Tota	60

TEXT BOOKS

1. Discrete-Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition.
2. Digital Control and State Variable Methods by M. Gopal, TMH.

REFERENCE BOOKS

1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
2. Digital Control Engineering, M. Gopal
3. Digital Control Engineering Analysis and Design, M. Sami Fadali, AntonioVisioli,Second Edition, Academic Press

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Honor Course		L	T	P	C
		4	0	0	4

PATTERN RECOGNITION

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

		Knowledge Level (K)#
CO1	Explain & compare a variety of pattern classifications ,structural pattern recognition	K2
CO2	Analyze the pattern classifier combination technique	K4
CO3	Illustrate the artificial neural network based pattern recognition	K2
CO4	Discuss the application pattern recognition	K2
CO5	Summarize the various techniques in pattern recognition	K2

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**												**M**		**M**	
CO2		**L**	**M**										**H**			**H**
CO3				**M**										**M**	**H**	**M**
CO4																
CO5					**H**								**H**		**H**	

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	Introduction: Fundamental problems in pattern Recognition system design, Design concepts and methodologies, Simple pattern recognition model. Decisions and Distance Functions: Linear and generalized decision functions, Pattern space and weight space, Geometrical properties, implementations of decision functions, Minimum-distance pattern classifications. Probability - Probability of events: Random variables, Joint distributions and densities, Movements of random variables, Estimation of parameter from samples.	12
UNIT – 2	Decision making - Baye's theorem, Multiple features, Conditionally independent features, Decision boundaries, Unequal cost of error, estimation of error rates, the leaving-oneout-techniques, characteristic curves, estimating the composition of populations. Baye's classifier for normal patterns. Non Parametric Decision Making: histogram, kernel and window estimation, nearest neighbour classification techniques. Adaptive decision boundaries, adaptive discriminant functions, Minimum squared error discriminant functions, choosing a decision making techniques.	12
UNIT – 3	Clustering and Partitioning: Hierarchical Clustering: Introduction, agglomerative clustering algorithm, the single-linkage, complete-linkage and average-linkage algorithm. Ward's method Partition clustering-Forg's algorithm, K-means's Algorithm, Isodata algorithm.	12
UNIT – 4	Pattern Preprocessing and Feature selection: distance measures, clustering transformation and feature ordering, clustering in feature selection through entropy minimization, features selection through orthogonal expansion, binary feature selection.	12
UNIT – 5	Syntactic Pattern Recognition and Application of Pattern Recognition: Concepts from formal language theory, formulation of syntactic pattern recognition problem, syntactic pattern description, recognition grammars, automata as pattern recognizers, Application of pattern recognition techniques in bio-metric, facial recognition, IRIS scon, Finger prints, etc.	12
	Total	60

Reference books:

1. Pattern recognition and Image Analysis, Gose. JohnsonbaughJost, PHI.
2. Pattern Recognition Principle, Tou. Rafael. Gonzalez, Pea.
3. Pattern Classification, Richard duda, Hart., David Strok, Wiley

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Honor Course		L	T	P	C
		4	0	0	4
IMAGE AND VIDEO PROCESSING					

Pre-requisite: Signals & Systems, Digital Signal Processing.

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

		Knowledge Level (K)#
CO1	Define the digital image, representation of digital image, importance of image resolution, applications in image processing.	K1
CO2	Express the advantages of representation of digital images in transform domain, application of various image transforms.	K2
CO3	Describe how an image can be enhanced by using histogram techniques, filtering techniques etc	K3
CO4	Discuss image degradation, image restoration techniques using spatial filters and frequency domain	K2
CO5	Discuss the detection of point, line and edges in images, edge linking through local processing, global processing	K2

 # Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H	M											H	M		
CO2	M				M								M	H		
CO3					H								L	H		
CO4					L								L	M		
CO5				H	L								M	M		

(Please fill the above with Levels of Correlation, viz., L, M, H)

Unit	Contents	Contact Hours
Unit – 1	**Fundamentals of Image Processing and Image Transforms:** Introduction, Image sampling, Quantization, Resolution, Image file formats, Elements of image processing system, Applications of Digital image processing Introduction, Need for transform, image transforms, Fourier transform, 2 D Discrete Fourier transform and its transforms, Importance of phase, Walsh transform, Hadamard transform, Haar transform, slant transform Discrete cosine transform, KL transform, singular value decomposition, Radon transform, comparison of different image transforms.	9 hrs
Unit – 2	**Image Enhancement:** Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering. **Image Restoration:** Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, Blind deconvolution	9 hrs
Unit – 3	**Image Segmentation:** Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation., Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform, Active contour **Image Compression:** Introduction, Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard, Wavelet-based image compression, JPEG Standards.	9 hrs

Unit – 4	**Basic Steps of Video Processing:** Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.	9 hrs
Unit – 5	**2-D Motion Estimation:** Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.	9 hrs
	Total	45 hrs

TEXT BOOKS:

1. Digital Image Processing – Gonzaleze and Woods, 3rd Ed., Pearson.
2. Video Processing and Communication – Yao Wang, JoemOstermann and Ya–quin Zhang. 1st Ed., PH Int.
3. S.Jayaraman, S.Esakkirajan and T.VeeraKumar, "Digital Image processing, Tata McGraw Hill publishers, 2009

REFRENCE BOOKS:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – ScotteUmbaugh, 2nd Ed, CRC Press, 2011.
2. Digital Video Processing – M. Tekalp, Prentice Hall International.
3. Digital Image Processing – S.Jayaraman, S.Esakkirajan, T.Veera Kumar – TMH, 2009.
4. Multidimentional Signal, Image and Video Processing and Coding – John Woods, 2nd Ed, Elsevier.
5. Digital Image Processing with MATLAB and Labview – Vipula Singh, Elsevier.
6. Video Demystified – A Hand Book for the Digital Engineer – Keith Jack, 5th Ed., Elsevier.

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