UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ACADEMIC REGULATIONS (R19)

B.Tech FOUR YEAR DEGREE Programme

(*Applicable for the batches admitted from the **A.Y. 2019-20***)

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/

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ACADEMIC REGULATIONS (R19) FOR B. TECH. (REGULAR)

*Applicable for the students of B. Tech. (Regular) from the Academic Year **2019-20** onwards*

1. **Award of B. Tech. Degree**

A student will be declared eligible for the award of B. Tech. Degree if he fulfils the followingacademic 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 academic years
2. The candidate shall register for 160 credits and secure all the 160 credits.
3. A student will be eligible to get Under Graduate degree with ***Honors or additional Minor Engineering***[1], if he/she completes an additional 20 credits. These could be acquired through recommended NPTEL/SWAYAM MOOC courses recommended by the respective Board of Studies. To award Honors degree, student should not have any backlog history with other requirements.

2. **Courses of study**

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 of Marks

(i) The performance of a student in each semester shall be evaluated subject – wise with a maximum of **100 marks for theory subject** and **50 marks for practical subject**. The project work shall be evaluated for 200 marks.

(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. The weightage of Internal marks for 30 consists of Descriptive – 15, Assignment - 05 (Theory, Design, Analysis, Simulation, Algorithms, Drawing, etc. as the case may be and for *Engineering / Applied Physics Virtual Lab to be considered as Assignment – internal evaluation only*) Objective -10.

the objective examination is for 20 minutes duration. The subjective examination is for 90 minutes 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 marks for 30. **Internal Marks** can be calculated with 80% weightage for best of the two Mids and 20% weightage for other Mid Exam. ***As the syllabus is framed for 5 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 a semester***. For *Audit Courses viz., Engineering / Applied Physics Virtual Lab, Physical fitness activities* satisfactory report is mandatory. If any student fails to achieve report/certificate, he/she need to submit it at later stage.

(iv) The end semester examination is conducted covering the topics of all Units 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 subjects there shall be continuous evaluation during the semester for 20 internal marks and 30 end examination marks**. The internal 20 marks shall be awarded as follows: day to day work and record-10 marks and the remaining 10 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examiner as follows:

	Procedure	*Experimentation*	*Result*	*Viva-voce*	*Total*
Marks	5	15	5	5	30

(vi) For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) 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.*

*(vii)*For the seminar, each student has to be evaluated based on the presentation of 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, 40% marks are mandatory to declare as pass. There shall be no external examination for seminar.*

(vii) *Socially Relevant Projects* (0.5 credits each) is evaluated internally for 50 marks in each semester. *However, student has to get 40% marks in a semester to declare as pass.*

(viii) Industrial Training / Skill Development Programmes / Research Project in higher learning institutes for 1.0 credit in seventh semester. Work starts in the end of sixth semester and complete by beginning of seventh semester. *This shall be internally evaluated in seventh semester for 50 marks. Student has to secure minimum 40% marks to declare as pass*

(ix) Project work starts in seventh semester with 02 credits (50 marks to be given – internal marks). The marks are awarded based on: *Selection of Area, Defining the problem, Submission of the Abstract and Presentation of seminar*

(x) 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. Attendance Requirements

1. A student is eligible to write the External examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.
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 course work.***
3. Shortage of Attendance below 65% in aggregate shall 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 eligible to write their end semester examination of that class.
6. A stipulated fee shall be payable towards condonation of shortage of attendance.
7. A student will be promoted to the next semester if he satisfies the (i) attendance requirement of the present semester and (ii) minimum required credits.
8. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

5. Minimum Academic Requirements

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 secures not less than 35% of marks in the end semester exam, and minimum 40% of marks in the sum total of the internal marks and end semester examination marks.**

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

5.3 A student will be **promoted from II year to III year** if he fulfills the academic requirement **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 160 credits.

6. Course Pattern

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 conducted next.
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 to him.
4. To encourage students towards Entrepreneurship: Gap year concept for student entrepreneur in residence for outstanding students who wish to pursue entrepreneurship is allowed to take a break of one year at any time after IV Sem to pursue full time entrepreneurship. This period may be extended to two years at most and these two years would not be counted while calculating duration of study. For thisCAC approval is mandatory.

7. Cumulative Grade Point Average (CGPA)

Marks Range Theory (Max – 100)	Marks Range Lab (Max – 50)	Letter Grade	Level (G)	Grade Point
≥ 90	≥ 45	>90	Outstanding (O)	10
≥80 to <90	≥40 to <45	90-80	Excellent (S)	9
≥70 to <80	≥35 to <40	80-70	Very Good (A)	8
≥60 to <70	≥30 to <35	70-60	Good (B)	7
≥50 to <60	≥25 to <30	60-50	Fair (C)	6
≥40 to <50	≥20 to <25	50-40	Satisfactory (D)	5
<40	<20	<40	Fail (F)	0
			Absent	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

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

Where Ci is the number of credits of the ith course and Gi is the grade point scored by the 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.

$$\textbf{CGPA} = \sum \textbf{(Ci X Si)} / \sum \textbf{Ci}$$

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.

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8. Award of Class

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

Class Awarded	CGPA to be secured	From the CGPA secured from 160 Credits.
First Class with Distinction	≥ 7.75 without backlog history	
First Class	≥ 6.75 < 7.75 without backlog history ≥ 6.75 with backlog history	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 4.75 to < 5.75	

9. ***Honors Degree***[2]: A student
   i. Should complete an **additional 20 credits** by doing Board of Studiesrecommended NPTEL/SWAYAM MOOC courses
   ii. Students should complete all the courses in the **first attempt** and in four years (*excluding any authorized break*) with CGPA of at least 8.00
10. ***Minor Engineering***: A student
   i. Should complete an **additional 20 credits** by doing respective Board ofStudies recommended NPTEL/SWAYAM MOOC courses
11. If any of the course is reappeared under MOOCS (NPTEL/SWAYAM), those will notbe considered for awarding honors degree
12. Minimum Instruction Days: The minimum instruction days for each semester shall be 90 working days.
13. There shall be no branch transfers after the completion of the admission process.
14. There shall be no transfer from one college/stream to another within the Constituent Collegesand Units of Jawaharlal Nehru Technological University Kakinada.

15. Withholding of Results

If the student has not paid the dues, if any, to the university or if any case of indiscipline is pending against him, the result of the student will be withheld. His degree will be withheld insuch cases.

16. Transitory Regulations

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.

17. 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, the decisionof the Vice-Chancellor is final.
4. The University may change or amend the academic regulations or syllabi at any timeand the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.

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ACADEMIC REGULATIONS (R19) 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 of study in not less than three academic years and not more than six academic years.

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

2. The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech.

3. Promotion Rule

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

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 of Class

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 four classes:

Class Awarded	**CGPA to be secured**	**From the CGPA secured from 121 Credits from II Year to IV Year**
First Class with Distinction	≥ 7.75 with no failures	
First Class	≥ 6.75 to <7.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 4.75 to < 5.75	

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

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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 ofmodesty or Injury to a student

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

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA-533003, Andhra Pradesh (India)
For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

ABSOLUTELY NO TO RAGGING

1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal fromthe 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 Cardsand show them when demanded
7. The Principal and the Wardens may visit Hostels and inspect the rooms any time.

Jawaharlal Nehru Technological University Kakinada
For Constituent Colleges and Affiliated Colleges of JNTUK

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UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION
MISSION
PROGRAM EDUCATIONAL OBJECTIVES

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
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.

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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.

PROGRAM SPECIFIC OUTCOMES

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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 andinter disciplinary applications

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COURSE STRUCTURE

I YEAR I SEMESTER							
S.No	Course Code	**Courses**	PO's	L	T	P	C
1	BS1101	Mathematics – I		3	0	0	3
2	HS1101	Communicative English		3	0	0	3
3	BS1102	Applied Chemistry		3	0	0	3
4	ES1101	Basic Electrical Engineering		3	0	0	3
5	ES1103	Network Analysis		3	0	0	3
6	HS1102	English communication skills Lab - I		0	0	2	1
7	BS1103	Applied Chemistry Lab		0	0	3	1.5
8	ES1104	Electronic Workshop		0	0	2	1
9	ES1105	Essentials of Electrical Engineering Lab		0	0	2	1
10	MC1101	Environmental Science		3	0	0	0
11	AC	Physical Fitness Activities		2	0	0	0
		Total		20	0	9	19.5

I YEAR II SEMESTER							
S.No	Course Code	**Courses**	PO's	L	T	P	C
1	BS1201	Mathematics – II		3	0	0	3
2	BS1202	Mathematics – III		3	0	0	3
3	BS1203	Applied Physics		3	0	0	3
4	ES1201	Problem Solving and Programming using C		3	0	0	3
5	ES1202	Engineering Drawing		1	0	3	2.5
6	BS1204	Applied Physic Lab		0	0	3	1.5
7	HS1201	English Communication Skills Lab- II		0	0	3	1.5
8	AC	Applied Physics Virtual Lab		0	0	2	0
9	ES1203	Problem Solving and Programming using C Lab		0	0	3	1.5
10	PR1201	Engineering Exploration Project - Design Thinking (15 Hrs per Sem.)		0	0	0	0.5
11	MC1201	Constitution of India		3	0	0	0
		Total		16	0	14	19.5

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II Year – I Semester

S. No.	Course	Category	L	T	P	Credits
1	Electronics Devices and Circuits	PC	3	0	0	3
2	Switching Theory and Logic Design	PC	3	0	0	3
3	Signals and Systems	PC	3	0	0	3
4	Object Oriented Design& Programming using Java	ES	3	0	0	3
5	Random Variables and Stochastic Process	PC	3	1	0	3
6	Computer Architecture and Organization	ES	3	0	0	3
7	Electronics Devices and Circuits - Lab	LC	0	0	3	1.5
8	Switching Theory and Logic Design - Lab	LC	0	0	3	1.5
9	Object Oriented Design& Programming using Java lab	LC	0	0	3	1.5
			Sub-Total			**22.5**

II Year–II Semester

S. No.	Course	Category	L	T	P	Credits
1	Mathematics -4	BS	3	0	0	3
2	Managerial Economics & Financial Analysis	HS	3	0	0	3
3	Electronics Circuit Analysis	PC	2	1	0	2
4	Control Systems	PC	2	1	0	2
5	Electromagnetic Waves and Transmission Lines	PC	3	0	0	3
6	Analog Communications	PC	3	0	0	3
7	Electronics Circuit Analysis – Lab	LC	0	0	3	1.5
8	Analog Communications – Lab	LC	0	0	3	1.5
9	Socially Relevant Projects		0	0	1	0.5
10	Indian Traditional Knowledge/ Employability Skills - 1 and 2/PE&HV		3	0	0	0
			Sub-Total			**19.5**

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III Year – I Semester

S. No.	Course	Category	L	T	P	Credits
1	Integrated Circuits and applications	PC	3	0	0	3
2	Microprocessor and Microcontrollers	PC	3	0	0	3
3	Digital Communications	PC	3	0	0	3
4	Antennas and Wave Propagation	PC	3	0	0	3
5	Professional Elective (PE1)	PE	3	0	0	3
6	Integrated Circuits and applications – Lab	LC	0	0	3	1.5
7	Digital Communications Lab	LC	0	0	3	1.5
8	Microprocessor and Microcontrollers – Lab	LC	0	0	3	1.5
9	Socially Relevant Projects		0	0	1	0.5
			Sub-Total			**20**

III Year – II Semester

S. No.	Course	Category	L	T	P	Credits
1	Internet of Things	PC	3	0	0	3
2	VLSI Design	PC	3	0	0	3
3	Digital Signal Processing	PC	3	0	0	3
4	Open Elective (OE1)	OE	3	0	0	3
5	Professional Elective (PE2)	PE	3	0	0	3
6	Professional Elective (PE3)	PE	3	0	0	3
7	VLSI Lab	LC	0	0	3	1.5
8	Digital Signal Processing Lab	LC	0	0	3	1.5
9	Mandatory Course - Indian Traditional Knowledge/ Life Sciences/PE&HV	MC	3	0	0	0
			Sub-Total			**21**

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IV Year– I Semester

S. No.	Course	Category	L	T	P	Credits
1	Optical communication	PC	3	0	0	3
2	Microwave engineering	PC	3	0	0	3
3	Professional Elective (PE4)	PE	3	0	0	3
4	Professional Elective (PE5)	PE	3	0	0	3
5	Open Elective(OE2)	OE	3	0	0	3
6	Microwave & optical communication lab	LC	0	0	3	1.5
7	Internet of Things(IOT) Lab	LC	0	0	3	1.5
8	Projet Work-Phase 1	PR	-	-	-	2
9	Industrial Training / Skill Development Programmes / Research Project	Project	-	-	-	1
			Sub-Total			**21**

IV Year– II Semester

S. No.	Course	Category	L	T	P	Credits
1	Professional Elective (PE6)	PE	3	0	0	3
2	Professional Elective (PE7)	PE	3	0	0	3
3	Open Elective (OE3)	OE	3	0	0	3
4	Project Work	Project	-	-	-	8
			Sub-Total			**17**
			Total			**160**

Program Elective – I:

1.	Data structures and Algorithms
2.	Electronic Measurements and Instrumentation
3.	Telecommunicationsand SwitchingNetwork

Program Elective – II:

1.	Digital IC Design
2.	Electromagnetic Interference & Compatibility (EMI/EMC)
3.	Soft computingtechniques and Python programming

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Program Elective – III:

1.	Analog IC Design
2.	Simulation& Mathematical Modeling
3.	Information Theory & Coding

Program Elective – IV:

1.	Data Communications & Computer networks
2.	Low power VLSI Design
3.	Digital Imaging Processing

Program Elective – V:

1.	DSP processors and Architectures
2.	Radar Engineering
3.	Embedded Systems

Program Elective – VI:

1.	Satellite Communication
2.	FPGA Design
3.	Speech Processing

Program Elective – VII:

1.	Cellular & Mobile Communications
2.	Tele Vision Engineering
3.	Biomedical signal processing

Open Elective-I:

1.	Data Communications
2.	EMI/EMC

Open Elective-II:

1.	Biomedical Instrumentation
2.	Electronic Measurements and Instrumentation

Open Elective-III:

1.	VLSI
2.	Mobile Communications

Department of Electronics and Communication Engineering

Suggested 12 Weeks SWAYAM / NPTEL Courses for B.Tech. Honors Degree

S.No	Name of the course	Institute	Duration
1	Analog Electronic Circuits	IIT Delhi	12 Weeks
2	Principle of Signals & Systems	IITK	12 Weeks
3	Analog Circuits and Systems through SPICE Simulation	IIT KGP	12 Weeks
4	Fundamentals of semiconductor devices	IISc	12 Weeks
5	Digital electronic circuits	IIT KGP	12 Weeks
6	Microprocessors & Interfacing	IITG	12 Weeks
7	Modern Digital Communication Techniques	IITKGP	12 Weeks
8	Analog IC Design	IITM	12 Weeks
9	Digital system design, with PLDs and FPGAs	IITKGP	12 Weeks
10	Optical Engineering	IITM	12 Weeks
11	VLSI Design Verification and test	IITG	12 Weeks
12	Digital Speech Processing	IITKGP	12 Weeks
13	Satellite Communication	IITKGP	12 Weeks

14	Discrete Time Signal Processing	IITKGP	12 Weeks
15	Advanced Antenna Theory	IITR	12 Weeks
16	Information theory & Coding	IISc	12 Weeks

Department of Electronics and Communication Engineering

Suggested 12 Weeks SWAYAM / NPTEL Courses for Minor Engineering

S.No	Name of Course	Institute	Duration
1	Analog Electronic Circuits	IIT Delhi	12 Weeks
2	Network Analysis	IIT KGP	12 Weeks
3	Signals & Systems	IISER Bhopal	12 Weeks
4	Digital electronic circuits	IIT KGP	12 Weeks
5	Microprocessors & Microcontrollers	IITKGP	12 Weeks
6	Digital IC Design	IITM	12 Weeks
7	Principles of Communication Systems-I	IITK	12 Weeks
8	Principles of Digital Communication	IITD	12 Weeks
9	Analog IC Design	IITM	12 Weeks
10	VLSI Design Verification and test	IITG	12 Weeks
11	Digital Signal Processing	IITK	12 Weeks
12	Advanced Antenna Theory	IITR	12 Weeks
13	Information theory & Coding	IISc	12 Weeks

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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

NETWORK ANALYSIS

COURSE OBJECTIVES:

- To understand the basic concepts on RLC circuits.
- To know the behavior of the steady states and transients states in RLC circuits.
- To know the basic Laplace transforms techniques in periods' waveforms.
- To understand the two port network parameters.
- To understand the properties of LC networks and filters.

UNIT – I

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

UNIT – II

Transients : First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, Evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots. Solutions using Laplace transform method. (Text Books: 1,2,3, Reference Books: 1,3)

UNIT – III

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

UNIT – IV

Resonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance,

Condition for maximum impedance, current in anti resonance, Bandwidth of parallel resonance, general case-resistance present in both branches, anti resonance at all frequencies. (Text Books:2,3, Reference Books: 3)

Network Theorems: Thevinin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition,Max Power Transfer, Tellegens- problem solving using dependent sources also. (Text Books: 1,2,3, Reference Books: 2)

UNIT – V

Two-port Networks: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h-parameters, Inverse h-parameters, Inverse Transmission line parameters, Relationship between parameter sets, Parallel connection of two port networks, Cascading of two port networks, series connection of two port networks, problem solving including dependent sources also. (Text Books: 1,2, Reference Books: 1,3)

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.

COUSE OUTCOME:

COs		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 POs&PSOs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**1**															
CO2				**2**									**2**			
CO3	2		2											**3**	**3**	
CO4		**2**														**1**
CO5	3				**3**									2		

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

I Year - I Semester		L	T	P	C
		0	0	2	1
ELECTRONIC WORKSHOP					

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

Mapping of course outcomes with POs&PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**1**	1														1
CO2			1	**2**									**2**			
CO3	2													**3**	**3**	
CO4		**2**		1	3								**1**			**1**
CO5			2											1		

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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

ELECTRONIC DEVICES AND CIRCUITS

Course Objectives:
The main objectives of this course are

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

UNIT-I:Review of Semi-Conductor Physics: Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors

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

UNIT-II:

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

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

UNIT- III: Transistor Characteristics:

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

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

UNIT- IV: Transistor Biasing and Thermal Stabilization : Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in V_{BE}, Ic, and β, Stability factors, (S,S',S''), Bias compensation, Thermal runaway, Thermal stability.
FET Biasing- methods and stabilization.

UNIT- V: Small Signal Low Frequency Transistor Amplifier Models:

BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.FET: Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

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Text Books:

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

References:

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

Course Outcomes:

After learning the course, the student will be able:

		Knowledge Level
CO1	Apply the basic concepts of semiconductor physics and 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
CO2	Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.	K1
CO3	Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.	K2
CO4	Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions.	K1
CO5	Perform the analysis of small signal low frequency transistor amplifier circuits using BJT and FET in different configurations.	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	3	1	-	2	-	-	-	-	-	-	-	-	2	-	1	1
CO2	2	2	1	-	-	-	-	-	-	-	-	-	2	-	2	2
CO3	2	2	2	1	-	-	-	-	-	-	-	-	3	-	2	2
CO4	1	2	1	2	-	-	-	-	-	-	-	-	2	-	2	1
CO5	2	3	1	2	-	-	-	-	-	-	-	-	2	-	3	2

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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

SWITCHING THEORY and LOGIC DESIGN

Course Objectives:

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

UNIT – I

REVIEW OF NUMBER SYSTEMS & CODES:

Representation of numbers of different radix, conversation from one radix to another radix, r-1's compliments and r's compliments of signed members. Gray code ,4 bit codes; BCD, Excess-3, 2421, 84-2-1 code etc. Error detection & correction codes: parity checking, even parity, odd parity, Hamming code.

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.

UNIT – II

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.

UNIT – III

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.

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INTRODUCTION OF PLD's :

PLDs: PROM, PAL, PLA -Basics structures, realization of Boolean functions, Programming table.

UNIT – IV

SEQUENTIAL CIRCUITS I:

Classification of sequential circuits (synchronous and asynchronous) , operation of NAND & NOR Latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip-flop. Design of 5ripple counters, 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.

UNIT – V

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).

TEXT BOOKS:

1. Switching and finite automata theory Zvi.KOHAVI, Niraj.K.Jha 3rd Edition, Cambridge University Press,2009
2. Digital Design by M.Morris Mano, Michael D Ciletti,4th edition 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.
5. TTL 74-Series data book.

Course Outcomes:

- Classify different number systems and apply to generate various codes.
- Use the concept of Boolean algebra in minimization of switching functions
- Design different types of combinational logic circuits.
- Apply knowledge of flip-flops in designing of Registers and counters
- The operation and design methodology for synchronous sequential circuits and algorithmic state machines.
- Produce innovative designs by modifying the traditional design techniques

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	3	-	-	-	-	-	-	-	-	2	-	-	-
CO3	-	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	1	-	-	-	3	-	-	-	-	-	-	-	-	-	-	1

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

SIGNALS and SYSTEMS

Course Objectives:
The main objectives of this course are given below:

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

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

UNIT –II: FOURIER SERIES AND FOURIER TRANSFORM:
Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, 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.

UNIT-III: ANALYSIS OF LINEAR SYSTEMS: Introduction**,** Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system, Related problems. Filter characteristics of linear systems. 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 rise time.

UNIT –IV:
CORRELATION: Auto-correlation and cross-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between Convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.
SAMPLING THEOREM : Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling, Related problems.

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UNIT –V:

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.

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, 2nd Edn,1997
3. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition,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

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

- Differentiate the various classifications of signals and systems
- Analyze the frequency domain representation of signals using Fourier concepts
- Classify the systems based on their properties and determine the response of LTI Systems.
- Know the sampling process and various types of sampling techniques.
- Apply Laplace and z-transforms to analyze signals and Systems (continuous & discrete).

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**2**	**3**
CO2	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**2**	**3**
CO3	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**
CO4	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**
CO5	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**2**	**3**

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

II Year - I 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

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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

Mapping of course outcomes with program outcomes:

EC	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
EC219.1	2	2	2	2	2	-	2	-	2	2	2	3	3	-	3	-
EC219.2	2	2	3	3	2	2	2	-	2	2	2	2	3	3	2	2
EC219.3	2	2	3	-	2	2	-	-	2	2	-	2	2	-	3	-
EC219.4	2	2	3	2	2	-	2	-	2	2	-	-	2	3	-	2
EC219.5	2	3	3	2	3	-	-	-	2	2	3	2	-	-	-	3

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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 Objectives:

- To give students an introduction to elementary probability theory, in preparation to learn the concepts of statistical analysis, random variables and stochastic processes.
- To mathematically model the random phenomena with the help of probability theory concepts.
- To introduce the important concepts of random variables and stochastic processes.
- To analyze the LTI systems with stationary random process as input.

UNIT I

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

UNIT II

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

UNIT III

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

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

UNIT IV

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

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UNIT V

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

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

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI, 4th Edition, 2002.
3. Probability Theory and Stochastic Processes – B. PrabhakaraRao, BS Publications.
4. Probability and Random Processes with Applications to Signal Processing, Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
5. Schaum's Outline of Probability, Random Variables, and Random Processes.
6. An Introduction to Random Signals and Communication Theory, B.P. Lathi, International Textbook, 1968.
7. Probability Theory and Random Processes, P. Ramesh Babu, McGrawHill, 2015.

Course Outcomes:

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

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

Mapping of course outcomes with program outcomes:

Mapping of COs with POs and PSOs																
	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO	a	b	c	d	e	f	g	h	i	j	k	l	3	-	1	3
CO1	3	-	-	-	-	-	1	-	-	-	-	-	3	2	3	-
CO2	2	3	2	-	2	-	-	1	-	-	-	-	-	1	-	3
CO3	-	-	-	1	-	2	-	-	3	-	-	-	3	-	1	3
CO4	-	2	-	2	1	-	-	-	-	-	-	-	3	1	2	-
CO5	-	-	-	-	-	-	-	-	3		3	2	2	1	1	2

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

COMPUTER ARCHITECTURE and ORGANIZATION

Course Objectives:
The student will

- Understand the fundamentals of different instruction set architectures and their relationship to the CPU design.
- Understand the principles and the implementation of computer arithmetic and ALU.
- Understand the memory system, I/O organization.
- Understand the operation of modern CPUs including interfacing, pipelining, memory systems and busses.
- Understand the principles of operation of multiprocessor systems.

Unit-I
Introduction
Organization and Architecture, Structure and function, computer components, computer function interconnection structures, Bus interconnection

Unit-II
Memory & I/O
Cache Memory: Computer memory system overview, cache memory principles, elements of cache design ARM Cache organization
Internal Memory Technology: semiconductor main memory, error correction Advanced DRAM Organization.
External Memory: Magnetic Disk, RAID, Optical Memory, Magnetic Tape

Unit-III
Input / Output: External Devices, I/O modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access I/O Channels and Processors.
Unit-IV
Computer Arithmetic: The Arithmetic and Logic Unit (ALU), Integer Representation, Integer Arithmetic Floating-Point Representation, Floating-Point Arithmetic
Instruction Sets: Machine Instruction Characteristics, Types of operands, Types of operations Addressing, Instruction Formats
Processor Structure and Function: Processor Organization, Register Organization, The Instruction cycle, Instruction Pipelining. Reduced Instruction Set Computers
Unit-V
Micro programmed Control: Basic Concepts, Microinstruction Sequencing, Microinstruction Execution.

Parallel Processing: The use of Multiple Processors, Symmetric Multiprocessors,

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Text Books

1. William Stallings, "Computer Organization and Architecture", Pearson Publishers, Eighth Edition.
2. M.Morris Mano," **Computer System Architecture**," Pearson Publishers, 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.

Course Outcomes:

- Students can understand the architecture of modern computer.
- They can analyze the Performance of a computer using performance equation
- Understanding of different instruction types.
- Students can calculate the effective address of an operand by addressing modes
- They can understand how computer stores positive and negative numbers.
- Understand the concepts of I/O Organization and Memory systems.

Mapping of course outcomes with program outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	3	2	3	2	2	-	-	-	-	-	-	1	3	-	2	3
CO2	1	3	-	2	1	-	-	-	-	-	-	1	3	-	2	3
CO3	2	1	-	-	-	-	-	-	-	-	-	-	3	-	-	3
CO4	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-	3
CO5	2	3	2	1	-	-	-	-	-	-	-	-	3	-	2	3
CO6	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-

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		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.

Electronic Workshop Practice:

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.

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

1. P-N Junction Diode Characteristics
   Part A: Germanium Diode (Forward bias& Reverse bias)
   Part B: Silicon Diode (Forward Bias only)
2. Zener Diode Characteristics
   Part A: V-I Characteristics
   Part B: Zener Diode as Voltage Regulator
3. Rectifiers (without and with c-filter)
   Part A: Half-wave Rectifier
   Part B: Full-wave Rectifier
4. BJT Characteristics(CE Configuration)
   Part A: Input Characteristics
   Part B: Output Characteristics
5. FET Characteristics(CS Configuration) Part A: Drain Characteristics
   Part B: Transfer Characteristics
6. SCR Characteristics
7. UJT Characteristics
8. Transistor Biasing
9. CRO Operation and its Measurements
10. BJT-CE Amplifier
11. Emitter Follower-CC Amplifier
12. FET-CS Amplifier

Equipment required:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multi-meters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes

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7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components

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.

Mapping of course outcomes with program outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	1	2	1	3	3	1	-	-	-	-	1	2	2	3	3	3
CO2	1	3	2	3	3	2	-	-	-	-	1	2	2	2	2	3
CO3	1	3	3	3	2	1	-	-	-	-	1	1	3	2	3	3
CO4	1	2	2	3	2	2	-	-	-	-	1	1	2	2	3	2
CO5	1	2	2	3	2	2	-	-	-	-	1	2	3	2	3	3
CO6	1	3	2	3	3	1	-	-	-	-	1	1	2	3	2	3

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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

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Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	-	2	1	-	-	-	-	-	-	-	1	-	-	1
CO2	2	-	2	-	2	-	-	-	-	-	-	-	-	2	-	1
CO3	-	2	2	-	1	-	-	-	-	-	-	-	-	-	-	1
CO4	-	1	-	2	1	-	-	-	-	-	-	-	1	-	-	1
CO5	-	-	3	-	1	-	-	-	-	-	-	-	-	2	2	1
CO6	2	-	2	-	1	-	-	-	-	-	-	-	1	-	-	1
CO7	-	-	2	-	1	-	-	-	-	-	-	-	-	-	3	2

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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).

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Course Outcomes:

- Able to write programs for solving real world problems using java collection frame work.
- Able to write programs using abstract classes.
- Able to write programs using inheritance, exception handling, polymorphism.
- Able to write multithreaded programs.

Mapping of course outcomes with program outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
EC219.1	3	3	3	2	3	-	2	-	2	2	-	3	3	3	-	3
EC219.2	2	2	3	3	2	-	-	-	2	2	2	2	3	2	2	-
EC219.3	2	2	3	3	3	2	-	-	2	2	-	2	2	-	3	-
EC219.4	2	2	3	3	3	2	-	-	2	2	-	2	3	-	3	2
EC219.5	2	3	3	3	3	-	-	-	2	2	3	2	2	-	2	3

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

ELECTRONIC CIRCUIT ANALYSIS

Course Objectives:

The main objectives of this course are:

- To learn hybrid-pi parameters at high frequency and compare with low frequency parameters.
- Learn and understand the purpose of cascading of single stage amplifiers and derive the overall voltage gain.
- Analyze the effect of negative feedback on amplifier characteristics and derive the characteristics.
- Learn and understand the basic principle of oscillator circuits and perform the analysis of different oscillator circuits.
- Compare and analyze different Power amplifiers like Class A, Class B, Class C, Class AB and other types of amplifiers.
- Analyze different types of tuned amplifier circuits.

UNIT-I 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.

UNIT-II

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

UNIT -III

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

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

Unit-IV

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.

UNIT-V

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

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

Text Books:

1. Integrated Electronics- J. Millman and C.C. Halkias, Tata McGraw-Hill, 1972.
2. Electronic Devices and 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.

Course Outcomes:

At the end of this course the student can able to

- Design and analysis of small signal high frequency transistor amplifier using BJT and FET.
- Design and analysis of multi stage amplifiers using BJT and FET and Differential amplifier using BJT.
- Derive the expressions for frequency of oscillation and condition for oscillation of RC and LC oscillators and their amplitude and frequency stability concept.
- Know the classification of the power and tuned amplifiers and their analysis with performance comparison.

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Course Outcomes:

After learning the course, the student will be able:

		Knowledge Level
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.	K1
CO6	Perform the analysis of small signal low frequency transistor amplifier circuits using BJT and FET in different configurations.	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	3	1	-	2	-	-	-	-	-	-	-	-	2	-	1	1
CO2	2	2	1	-	-	-	-	-	-	-	-	-	2	-	2	2
CO3	2	2	2	1	-	-	-	-	-	-	-	-	3	-	2	2
CO4	1	2	1	2	-	-	-	-	-	-	-	-	2	-	2	1
CO5	2	3	1	2	-	-	-	-	-	-	-	-	2	-	3	2

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		3	0	0	3

CONTROL SYSTEMS

Course Objectives:

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

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

UNIT II
TRANSFER FUNCTION REPRESENTATION
Transfer Function of DC Servo motor - AC Servo motor- Synchrotransmitter and Receiver, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra– Representation by Signal flow graph - Reduction using mason's gain formula.
TIME RESPONSE ANALYSIS
Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants.

UNIT III
STABILITY ANALYSIS IN S-DOMAIN
The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability 100

Root Locus Technique:
The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

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

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UNIT V
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.

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, 2 Edition, 2014.

Course Outcomes:

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

Mapping of course outcomes with program outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
EC222.1	3	2	2	2	2	2	1	1	2	-	2	2	2	2	3	3
EC222.2	3	3	3	2	-	-	1	1	3	2	1	2	1	2	3	3
EC222.3	3	3	3	2	1	1	-	1		3	1	2	2	1	3	3
EC222.4	3	3	2	3	-	-	1	-	3	3	2	2	3	1	2	3

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

ELECTROMAGNETIC WAVES and TRANSMISSION LINES

Course Objectives:

The main objectives of this course are to understand

- Fundamentals of steady electric and magnetic fields using various laws
- Apply the concept of static and time varying Maxwell equations and power flow using pointing theorem
- Wave characteristics in different media for normal and oblique incidence
- Implement various concepts of transmission lines and impedance measurements

SYLLABUS:

Prerequisites: Understanding of Cartesian co-ordinates, spherical & cylindrical systems

UNIT I:

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

UNIT II:

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.

UNIT III:

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.

UNIT IV:

Magneto Statics : 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.

UNIT V:

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.

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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 SasiBhushana Rao,Wiley India 2013.
4. Networks, Lines and Fields John D. Ryder, Second Edition, Pearson Education, 2015.

Course Outcomes:

At the end of this course the student can able to

- Determine E and H using various laws and applications of electric & magnetic fields
- Apply the Maxwell equations to analyze the time varying behavior of EM waves
- Gain the knowledge in uniform plane wave concept and characteristics of uniform plane wave in various media
- Calculate Brewster angle, critical angle and total internal reflection
- Derive and Calculate the expressions for input impedance of transmission lines, reflection coefficient, VSWR etc. using smith chart

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1
CO2	1	2	-	1	-	-	-	-	-	-	-	-	2	-	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
CO4	2	-	-	1	-	-	-	-	-	-	-	-	2	-	-	1
CO5	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	2

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

ANALOG COMMUNICATIONS

Course Objectives:

Students undergoing this course are expected to

- Familiarize with the fundamentals of analog communication systems.
- Familiarize with various techniques for analog modulation and demodulation of signals.
- Distinguish the figure of merits of various analog modulation methods.
- Develop the ability to classify and understand various functional blocks of radio transmitters and receivers.
- Familiarize with basic techniques for generating and demodulating various pulse modulated signals.

UNIT I

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.

UNIT II

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 AM Systems, FDM.

UNIT III

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.

UNIT IV

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 additional circuits.

UNIT V

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

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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

TEXT BOOKS:

1. Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe, TMH, 3rd Edition, 2007.
2. Principles of Communication Systems - Simon Haykin, John Wiley, 2nd Edition, 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.

Course Outcomes:

After undergoing the course, students will be able to

- Differentiate various Analog modulation and demodulation schemes and their spectral characteristics
- Analyze noise characteristics of various analog modulation methods
- Analyze various functional blocks of radio transmitters and receivers
- Design simple analog systems for various modulation techniques.

Mapping of course outcomes with program outcomes:

Mapping of COs with POs and PSOs																
	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO9**	**PO 10**	**PO 11**	**PO1 2**	**PS O1**	**PS O2**	**PS O3**	**PS O4**
CO	***a***	***b***	***c***	***d***	***e***	***f***	***g***	***h***	***i***	***j***	***k***	***l***	-	**(2)**		**(3)**
CO1	**3**	-	**1**	-	**2**	-	**1**	-	**2**	-	-	**2**	**3**	-	**3**	-
CO2	-	**3**	-	**1**	-	**2**	-	**1**	-	-	-	-	-	**1**	-	**2**
CO3	**1**	-	**2**	-	-	-	**1**	-	**3**	-	-	-	**2**	-	**1**	-
CO4	**2**	**2**	-	**2**	**1**	**1**	-	-		-	-	**1**	**3**	**1**	-	-

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

Equipment required:

Software:

i. Multisim/ Equivalent Industrial Standard Licensed simulation software tool.
ii. Computer Systems with required specifications

Hardware Required:

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

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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	3	2	1	2	-		-	-	-	-	-	-	2	-	3	2
CO2	2	3	3	2	-	-	-	-	-	-	-	-	2	-	3	3
CO3	2	3	3	2	-	-	-	-	-	-	-	-	2	-	3	3
CO4	2	3	3	2	-	-	-	-	-	-	-	-	2	-	3	3
CO5	2	3	2	2	-	-	-	-	-	-	-	-	2	-	2	3
CO6	2	3	1	3	-	-	-	-	-	-	-	-	2	-	2	3
CO7	2	3	3	2	-	-	-	-	-	-	-	-	2	-	3	2

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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

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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	**1**	-	-	-	-	-	-	-	-	-	-	**2**	-	-	-	-
CO2	-	-	-	**-2**	-	-	-	-	-	-	-	-	**-2**	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	**-3**	**-3**	-
CO4	-	**2**	-	-	-	-	-	-	-	-	**-1**	-	-	-	-	**-1**
CO5	-	-	-	-	**3**	-	-	-	-	-	-	-	-	-	-	-

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

INTEGRATED CIRCUITS AND APPLICATIONS

Course Objectives:

- To understand the basic operation &performance parameters of differential amplifiers.
- To understand & learn the measuring techniques of performance parameters of OP-AMP
- To learn the linear and non-linear applications of operational amplifiers.
- To understand the analysis & design of different types of active filters using opamps
- To learn the internal structure, operation and applications of different analog ICs
- To Acquire skills required for designing and testing integrated circuits

UNIT I

Characteristics of OP-Amps, Integrated circuits-Types, Classification, Package Types and Temperature ranges, Power supplies, Op-amp Block Diagram, ideal and practical Op-amp Specifications, DC and AC characteristics, 741 op-amp & its features, Op-Amp parameters & Measurement, Input & Out put Off set voltages & currents, slew rate, CMRR, PSRR, drift, Frequency Compensation techni
ques. Inverting and Non-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier, AC amplifier, V to I, I to V converters, Buffers. Non- Linear function generator, Comparators, Multivibrators, Triangular and Square wave generators, Log and Anti log Amplifiers, Precision rectifiers.

UNIT II

ACTIVE FILTERS, ANALOG MULTIPLIERS AND MODULATORS: Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and all pass filters. Four Quadrant Multiplier, IC 1496, Sample & Hold circuits.

UNIT III

TIMERS & PHASE LOCKED LOOPS: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger; PLL - 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).

UNIT IV

DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC.DAC and ADC Specifications, Specifications AD 574 (12 bit ADC).

Unit-V

Digital IC's and Logic Families:

Study about 74X138,74X139,74X49,74X148,74X541,74X85,74X175,74X163.Introduction to logic families, CMOS logic, CMOS steady state and dynamic electrical behavior, CMOS logic families. Bipolar logic, transistor-transistor logic, TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, Emitter coupled logic. Introduction to FPGA, CPLD Architecture.

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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,1987.
3. Operational Amplifiers–C.G. Clayton, Butterworth & Company Publ. Ltd./Elsevier, 1971
4. Digital Design Principles & Practices – John F.Wakerly, PHI/ Pearson Education Asia, 3rd Edition, 2005

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.
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

Course Outcomes:

- Design circuits using operational amplifiers for various applications.
- Analyze and design amplifiers and active filters using Op-amp.
- Diagnose and trouble-shoot linear electronic circuits.
- Understand the gain-bandwidth concept and frequency response of the amplifier configurations.
- Understand thoroughly the operational amplifiers with linear integrated circuits.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	-	3	-	-	-	-	-	-	-	-	2	2	-	2
CO2	3	1	-	-	2	-	-	-	-	-	-	-	2	2	-	2
CO3	2	-	2	-	-	-	-	-	-	-	-	-	-	3	-	2
CO4	2	3	3	2	2	-	-	-	-	-	-	-	2	3	-	2

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

MICRO PROCESSORS AND MICRO CONTROLLERS

Course Objectives:

- learn concepts of microprocessor, different addressing modes and programming of 8086.
- understand interfacing of 8086, with memory and other peripherals.
- learn concept of DMA, USART RS-232 and PIC controller.
- study the features of advanced processors and Pentium processors.
- study the features of 8051 Microcontroller, its instruction set and also other controllers.

UNIT-I: 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, the processor 8088, machine language instruction formats, addressing mode of 8086, instruction set of 8086,assembler directives and operators.

UNIT-II: 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, interrupt programming.

UNIT-III: BASIC AND SPECIAL PURPOSE PROGRAMMABLE PERIPHERALS AND THEIR INTERFACING WITH 8086/88

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, control of high power devices using 8255. Block diagram and functional aspects of 8254 PIT, 8259A, PIC, 8279 keyboard/display controller, 8251 USART, 8257 DMA Controller

UNIT-IV: 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.

UNIT-V: 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 bit processors, ARM architecture and organization, ARM family, Thumb instructions, programming models of ARM 7, Register set, CPR, SPSR

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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 Gillispie Mazidi, Rolin D.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.

Course Outcomes:

After going through this course the student will be able to

No.	Course Outcomes	Knowledge Level (K)
CO1	Understand the fundamentals, different addressing modes and Develop programming skills	K2
CO2	Perform 8086 interfacing with different peripherals and implement programs	K5
CO3	Describe the key features of serial and parallel communication and able to understand advanced microprocessors	K2
CO4	Design a microcontroller for simple applications, programming and interfacing of 8051	K5

Mapping of course outcomes with program outcome:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	-	3	3	2	-	-	-	-	-	-	-	-	3	2	3
CO3	3	-	3	-	-	-	-	-	-	-	-	-	-	3	-	3
CO4	2	3	3	2	2	-	-	-	-	-	-	-	-	3	2	3

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

Course Objectives:

- Understand different pulse digital modulation techniques and their comparison.
- Familiarize various digital modulation techniques and calculation of their error probabilities.
- Understand the concept of entropy and different source coding techniques
- Familiarize with block codes, cyclic codes and convolutional codes

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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.

UNIT V

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.

LINEAR BLOCK CODES: Introduction, Matrix description of Linear Block codes, Error detection and error correction capabilities of Linear block codes, Hamming codes

CONVOLUTIONAL CODES: Introduction, encoding of convolution codes, tree and trellis diagram decoding using Viterbi algorithm.

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TEXT BOOKS:

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

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.

Course Outcomes:

After undergoing the course students will be able to:

- Determine the performance of different waveform coding techniques for the generation and digital representation of the signals.
- Determine the probability of error for various digital modulation schemes
- Analyse different source coding techniques
- Compute and analyse different error control coding schemes for the reliable transmission of digital information over the channel.

Mapping of course outcomes with program outcomes:

Correlation Levels as :																
1=LOW		**2=MODERATE**			**3=HIGH**											
CO	***PO 1***	***PO 2***	***PO 3***	***PO 4***	***PO 5***	***PO 6***	***PO 7***	***PO 8***	***PO 9***	***PO10***	***P011***	***PO12***	***PSO 1***	***PSO 2***	***PSO 3***	***PSO4***
EC314.1	3	3	2	-	-	-	-	1	2	3	-	3	2	-	2	2
EC314.2	3	3	2	-	-	-	-	1	3	2	-	3	2	-	2	2
EC314.3	3	3	3	-	-	-	-	3	3	2	-	3	2	-	2	2
EC314.4	3	2	2	-	-	-	-	3	3	3	-	3	2	-	2	2

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

III Year - I Semester		L	T	P	C
		3	0	0	3
ANTENNA and WAVE PROPAGATION					

Course Objectives:
The student will be able to

- understand the applications of the electromagnetic waves in free space.
- introduce the working principles of various types of antennas
- discuss the major applications of antennas with an emphasis on how antennas are employed to meet electronic system requirements.
- understand the concepts of radio wave propagation in the atmosphere.

UNIT I

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

UNIT II

THIN LINEAR WIRE ANTENNAS: Retarded Potentials, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Evaluation of Field Components, Power Radiated, Radiation Resistance, 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.

UNIT III

ANTENNA ARRAYS : 2 element arrays – different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End-fire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison; Concept of Scanning Arrays. Directivity Relations (no derivations). Related Problems. Binomial Arrays, Effects of Uniform and Non-uniform Amplitude Distributions, Design Relations. Arrays with Parasitic Elements, Yagi-Uda Arrays, Folded Dipoles and their characteristics.

UNIT IV

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.

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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).

UNIT V

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, Cassegrain Feeds. Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns; Lens Antennas – Geometry, Features, Dielectric Lenses and Zoning Applications, FRIIS Transmission Equation, Antenna Measurements – Impedance, Patterns Required, Set Up, Distance Criterion, Directivity and Gain Measurements (Comparison, Absolute and 3-Antenna Methods).

WAVE PROPAGATION : Concepts of Propagation – frequency ranges and types of propagations. Ground Wave Propagation–Characteristics, Parameters, Wave Tilt, Flat and Spherical Earth Considerations. Sky Wave Propagation – Formation of Ionospheric Layers and their Characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF and Skip Distance – Calculations for flat and spherical earth cases, Optimum Frequency, LUHF, Virtual Height, Fundamental Equation for Free-Space Propagation, Basic Transmission Loss Calculations. Space Wave Propagation – Mechanism, LOS and Radio Horizon. Tropospheric Wave Propagation – Radius of Curvature of path, Effective Earth‟s Radius, Effect of Earth‟s Curvature, Field Strength Calculations, Duct Propagation, Tropospheric Scattering.

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. Antennas and Wave Propagation –G.S.N.Raju, Pearson Publications, New Delhi, 2004.
3. Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol. 5, Standard Publishers Distributors, Delhi.
4. Electronic and Radio Engineering – F.E. Terman, McGraw-Hill, 4th Edition, 1955.
5. Antennas – John D. Kraus, McGraw-Hill, 2nd Edition, 1988.

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Course Outcomes:

CO. No	Description	Knowledge Level
EC312.1	Identify basic antenna parameters	K2
EC312.2	Design and analyze wire antennas, loop antennas, reflector antennas, lens antennas, horn antennas and microstrip antennas	K2
EC312.3	Quantify the fields radiated by various types of antennas	K4
EC312.4	Analyze antenna measurements to assess antenna's performance	K3
EC312.5	Identify the characteristics of radio wave propagation	K3
EC312.6	Design and analyze antenna arrays	K4

Mapping of course outcomes with program outcomes:

Correlation Levels as :										
1=LOW	**2=MODERATE**			**3=HIGH**						
CO	***PO1***	***PO2***	***PO3***	***PO4***	***PO5***	***PO6***	***PO7***	***PO8***	***PO9***	***PO10***
EC313.1	3	3	3	-		2	2	-	-	-
EC313.2	3	3	2	2	2	2	1	-	-	-
EC313.3	3	3	3	3	2	-	-	-	-	-
EC313.4	3	2	2	2	-	-	-	-	-	-
EC313.5	3	2	3	3	2	1	-	-	-	-
EC313.6	3	3	1	1	3	-	-	-	-	-

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III Year - I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
DATA STRUCTURES and ALGORITHMS(PE1)					

Course objectives:

- Explain the systematic methods of efficiently organizing and accessing data in data structures and algorithms.
- Identify the properties and structural patterns in data structures.
- Apply abstract data types to the design of data structures.
- Analyze algorithms using a mathematical notation and experimental studies.
- Perform comparative analysis of the typical data structures and algorithms.
- Design and analyze recursive algorithms in data structures

UNIT – I:
Data Structures Basics: Structure and Problem Solving, Data structures, Data structure Operations, Algorithm: complexity, Time- space trade-off.
Linked List: Introduction, Linked lists, Representation of linked lists in Memory, traversing a linked list, Searching a linked list, Memory allocation and Garbage collection, insertion into linked list, Deletion from a linked list, Types of linked list.

UNIT – II:
Stack and Queue: Introduction, Array Representation of Stack, Linked List Representation of stack, Application of stack, Queue, Array Representation of Queue, Linked List Representation of Queue.
Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Sequential and Other Representations of Trees, Tree Traversal.

UNIT – III:
Graphs: Matrix Representation of Graphs, List Structures, Other Representations of Graphs, Breadth First Search, Depth First Search, Spanning Trees. Directed Graphs Types of Directed **Graphs;** Binary Relation as a Digraph; Euler‟s Digraphs; Matrix Representation of Digraphs.
Applications of Graphs: Topological Sorting, Shortest-Path Algorithms – Weighted Shortest Paths – Dijkstra‟s Algorithm, Minimum spanning tree- Prim‟s Algorithm, Introduction to NP-Completeness.

UNIT – IV:
Searching and Sorting Techniques: Sorting Techniques – Bubblesort, Merge sort, Selection sort, Heap sort, Insertion Sort, Searching Techniques – SequentialSearching, Binary Searching, Search Trees.
Elementary Algorithms: Notation for Expressing Algorithms; Role and Notation for Comments; Example of an Algorithm; Problems and Instances; Characteristics of an Algorithm;Building Blocks of Algorithms; Procedure and Recursion – Procedure, Recursion; Outline of Algorithms; Specification Methods for Algorithms.

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UNIT – V:

Mathematical Functions and Notations: Functions and Notations; Modular Arithmetic / Mod Function; Mathematical Expectation in Average Case Analysis; Efficiency of an Algorithm; Well Known Asymptotic Functions and Notations; Analysis of Algorithms – Simple Examples; Well Known Sorting Algorithms – Insertion sort, Bubble sort, Selection sort, Shell sort, Heap sort.

Divide and Conquer: Divide and Conquer Strategy; Binary Search; Max. And Min.; Merge sort; Quick sort. Greedy Method: Greedy Method Strategy; Optimistic Storage on Tapes; Knapsack Problem; Job Sequencing with Deadlines; Optimal Merge Pattern; Single Source Shortlist Paths.

Dynamic Programming: Dynamic Programming Strategy; Multistage Graphs; All Pair Shortest Paths; Travelling Salesman Problems. Backtracking Strategy, 8-Queens Problem, Sum of Subsets, Knapsack Problem.

TEXTBOOKS:

1. Data structures and Algorithm Analysis in C++, M. A. Weiss, 3rd Edition, Addison-Wesley, 2005.
2. Data structures in C++, Malik D.S, 2nd Edition, Cengage Learning, 2009.
3. Data structures, Richard F.Gilberg andBehrouz A. Forouzan, 2nd Edition, Cengage Learning, 2007.

REFERENCE BOOKS:

1. Data Structures and Algorithms: Concepts – Techniques and Applications, G. A. V. Pai, 1st Edition, McGraw Hill Education,2017.
2. Classic Data Structures, Debasis Samanta, 2nd Edition, PHI, 2009.
3. Data structures, Seymour Lipschutz, 1st Edition, McGraw Hill Education, 2014.

Course Outcomes:

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

- Demonstrate analytical comprehension of concepts such as abstract data types
- Analyze various generic programming techniques,
- Compare various sorting algorithms and perform their efficiency analysis.
- Demonstrate the ability to analyze, design, apply and use data structures and algorithms to solve engineering problems and evaluate their solutions.
- Demonstrate the ability of using generic principles for data representation & manipulation with a view for efficiency, maintainability, and code-reuse

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

Course Objectives:

- Static and Dynamic characteristics of instruments
- Designing Principles of various instruments
- Various types of analyzers and signal generators
- Concepts of oscilloscopes and its applications.
- Principles of different transducers for measurement of different parameters

UNIT I

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, Multi-meter for Voltage, Current and resistance measurements.

UNIT II

Signal Generator- fixed and variable, AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Square pulse, Random noise, sweep, Arbitrary waveform. Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers, Digital Fourier Analyzers.

UNIT III

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.

UNIT IV

AC Bridges Measurement of inductance- Maxwell‟s bridge, Anderson bridge. Measurement of capacitance - Schearing Bridge. Wheat stone bridge. Wien Bridge, Errors and precautions in using bridges. Q-meter.

UNIT V

Transducers- active & passive transducers : Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors.
Measurement of physical parameters force, pressure, velocity, humidity, moisture, speed, proximity and displacement. Introduction to Data acquisition systems.

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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.
3. Electronic Measurements and instrumentation- B.M.Oliver & John M.Cage.

REFERENCES :

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 2nd Edition, 2003.
2. Electronic Test Instruments, Analog and Digital Measurements - Robert A.Witte, Pearson Education, 2nd Ed., 2004.
3. Electronic Measurements & Instrumentations by K. Lal Kishore, Pearson Education - 2005.
4. Electronic Measurements & Instrumentations- Terman & Petit.

Course Outcomes:

The student will be able to

- Select the instrument to be used based on the requirements.
- Understand and analyze different signal generators and analyzers.
- Understand the design of oscilloscopes for different applications.
- Design different transducers for measurement of different parameters.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**2**	1	1	-	2	-	-	-	-	-	-		-	1	2	-
CO2	-	-	-	**2**	-	-	-	-	-	-	-	-	**2**	-	-	1
CO3	2	-	1	-	-	-	-	-	-	-	-	-	-	**3**	**3**	-
CO4	-	**2**	-	1	-	-	-	-	-	-		-	2	-	-	**1**
CO5	2	-	-	2	**3**	-	-	-	-	-	-	-	2	-	2	-

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III Year - I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
TELE COMMUNICATIONS and SWITCHING NETWORKS(PE1)					

Course Objectives:

- Focuses on Understanding the means of measuring traffic.
- Discusses the implication of the traffic level on system designs.
- Provides the various categories of switching techniques
- Gives an understanding of the telephone networks

UNIT I
TELECOMMUNICATION SWITCHING SYSTEMS : Introduction, Elements of switching systems, switchingnetwork configuration, principles of cross bar switching.

UNIT II
Electronic space division switching, Time division switching, Combination switching.

UNIT III
TELEPHONE NETWORKS : Subscriber loop systems, switching hierarchy and routing, transmission plan,numbering plan, charging plans.

UNIT IV
SIGNALING TECHNIQUES : In channel signaling, common channel signaling. Network traffic load and parameters, grade of service and blocking probability.

UNIT V
DATA COMMUNICATION NETWORKS : Introduction, network architecture, layered network architecture, protocols, data communications hardware, data c

ommunication circuits.Public switched data networks, connection oriented & connection less service, Circuit Switching, packet switching and virtual circuit switching concepts, OSI reference model, LAN, WAN, MAN & Internet. Repeaters,
Bridges, Routers and gate ways.

TEXT BOOKS :
1. Tele communication switching system and networks - Thyagarajan Viswanath, PHI, 2000.
2. Advanced electronic communications systems - Wayne Tomasi, PHI, 2004.

REFERENCES :
1. Digital telephony - J. Bellamy, John Wiley, 2nd edition, 2001.
2. Data Communications & Networks - Achyut. S.Godbole, TMH, 2004.
3. Principles of Communication Systems – H. Taub & D. Schilling , TMH, 2nd Edition, 2003.
4. Data Communication & Networking - B.A. Forouzan, TMH, 3rd Edition, 2004.

5. Telecommunication switching, Traffic and Networks - J E Flood, Pearson Education, 2002.

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Course Outcomes:

The student will be able to

- Evaluate the time and space parameters of a switched signal
- Establish the digital signal path in time and space, between two terminals
- Evaluate the inherent facilities within the system to test some of the SLIC, CODEC and digital switch functions.
- Investigate the traffic capacity of the system.
- Evaluate methods of collecting traffic data.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO2	-	-	-	2	-	-	-	-	-	-	-	-	2	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	-
CO4	-	2	-	-	-	-	-	-	-	-	1	-	-	-	-	1
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-

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III Year - I Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
INTEGRATED CIRCUITS and APPLICATIONS LAB					

Minimum Twelve Experiments to be conducted :

1. Study of ICs – IC 741, IC 555, IC 565, IC 566, IC 1496 – functioning, parameters and Specifications.
2. OP AMP Applications – Adder, Subtractor, Comparator Circuits.
3. Integrator and Differentiator Circuits using IC 741.
4. Active Filter Applications – LPF, HPF (first order)
5. Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.
6. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.
7. Function Generator using OP AMPs.
8. IC 555 Timer – Monostable Operation Circuit.
9. IC 555 Timer – Astable Operation Circuit.
10. Schmitt Trigger Circuits – using IC 741 and IC 555.
11. IC 565 – PLL Applications.
12. IC 566 – VCO Applications.
13. 4 bit DAC using OP AMP.
14. Verilog Modules on Logic Gates
15. Verilog Modules on Half adder and Full adder
16. Verilog Modules on Flip-Flops.

Equipment required for Laboratories:

1. RPS
2. CRO
3. Function Generator
4. Multi Meters
5. IC Trainer Kits (Optional)
6. Bread Boards
7. Components:- IC741, IC555, IC565, IC1496, IC723, 7805, 7809, 7912 and other essential components.
8. Analog IC Tester
9. Xilinix software-latest version
10. Personal computer with necessary pheripherals

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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

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	3	3	-	2	-	1	-	-	-	-	-	-	-	-
CO2	3	-	3	3	-	-	-	-	2	1	-	-	-	-	-	-
CO3	2	2	2	3	2	-	-	3	2	2	-	-	-	-	-	-
CO4	2	-	2	3	-	-	-	-	2	-	-	-	-	-	-	-
CO5	2	-	2	3	-	-	-	-	3	-	-	-	-	-	-	-
CO6	3	2	2	3	2	-	-	-	3	2	-	-	-	-	-	-

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

.List of Experiments:

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

Equipment required for Laboratories:

1. RPS – 0 – 30 V
2. CRO – 0 – 20 M Hz.
3. Function Generators – 0 – 1 M Hz
4. RF Generators – 0 – 1000 M Hz./0 – 100 M Hz.
5. Multimeters
6. Lab Experimental kits for Digital Communication
7. Components

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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	1	1	-	1	-	-	-	-	-	-	-	-	1	-	-	1
CO2	-	-	2	-	2	-	-	-	-	-	-	-	-	2	-	-
CO3	-	2	-	-	1	-	-	-	-	-	-	-	-	-	2	1
CO4	-	1	-	2	-	-	-	-	-	-	-	-	1	-	-	-
CO5	1	-	1	-	-	-	-	-	-	-	-	-	-	2	2	1
CO6	-	-	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO7	2	1	2	-	1	-	-	-	-	-	-	-	-	-	2	2

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III Year - I Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
MICROPROCESSORS and MICROCONTROLLERS LAB					

The students are required to develop the necessary Algorithm, Flowchart and Assembly Language Program Source Code for executing the following functions using MASM/TASM software and to verify the results with necessary Hardware Kits.

PART-I: MICROPROCESSOR 8086

1. Introduction to MASM/TASM.
2. Arithmetic operation- Multi byte Addition and Subtraction, Multiplication and Division- Signed and unsigned Arithmetic operation, ASCII- Arithmetic operation.
3. Logic operations-Shift and rotate- Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
4. By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.
5. DOS/BIOS programming: Reading keyboard (Buffered with and without echo)- Display characters, Strings.

PART-II: INTERFACING WITH MICROPROCESSOR

1. 8259 – Interrupt Controller-Generate an interrupt using 8259 timer.
2. 8279 – Keyboard Display- Write a program to display a string of characters.
3. 8255 – PPI-Write ALP to generate sinusoidal wave using PPI.
4. 8251 – USART-Write a program in ALP to establish Communication between two processors.

PART-III: MICROCONTROLLER 8051

1. Reading and Writing on a parallel port.
2. Timer in different modes.
3. Serial communication implementation.

PART-IV: INTERFACING WITH MICROCONTROLLER

Write C programs to interface 8051 chip to Interfacing modules to Develop single chip solutions.

1. Simple Calculator using 6 digit seven segment display and Hex Keyboard interface to 8051.
2. Alphanumeric LCD panel and Hex keypad input interface to 8051.
3. External ADC and Temperature control interface to 8051.
4. Generate different waveforms Sine, Square, Triangular, and Rampetc. using DAC interface to 8051; change the frequency and Amplitude.

EQUIPMENT REQUIRED FOR LABORATORY

1. MASM/TASM software
2. 8086 Microprocessor Kits
3. 8051 Micro Controller kits
4. Interfaces/peripheral subsystems
   - i) 8259 PIC
   - ii) 8279-KB/Display
   - iii) 8255 PPI
   - iv) 8251 USART
5. A/D and D/AC Interface

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Course Outcomes:

After learning the course, the student will be able:

CO. No	Description	Knowledge Level
EC326.1	Understand the fundamentals of assembly level programming of microprocessors & microcontrollers	Knowledge
EC326.2	Apply the programing knowledge for arithmetic and logical operations in 8086 & 8051	Application
EC326.3	Apply the programing knowledge for arithmetic and logical operations in 8051	Application
EC326.4	Develop the programs for sorting	Application
EC326.5	Develop the programs for string manipulation programs	Application
EC326.6	Contrast how different I/O devices can be interfaced to processor and will explore several techniques of interfacing.	Analysis
EC326.7	Apply the programing knowledge for understanding of communication standards in 8086	Knowledge
EC326.8	Apply the programing knowledge for understanding of communication standards in 8051	Knowledge

CO-PO Mapping Attainment

Correlation Levels as :												
1=LOW 2=MODERATE 3=HIGH												
CO	***PO1***	***PO2***	***PO3***	***PO4***	***PO5***	***PO6***	***PO7***	***PO8***	***PO9***	***PO10***	***PO11***	***PO12***
EC326.1	2	3	3	2	2	-	-	-	-	--	-	-
EC326.2	3	3	3	2	3	-	-	-	-	-	-	-
EC326.3	2	2	3	3	2	-	-	-	-	-	-	-
EC326.4	3	-	2	2	3	-	-	--	-	--	-	-
EC326.5	2	-	3	3	3	-	-	-	-	-	-	-
EC326.6	2	3	-	2	2	-	-	-	-	-	-	-
EC326.7	3	3	3	2	3	-	-	-	-	-	-	-
EC326.8	2	-	-	2	2	-	-	-	-	-	-	-

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

INTERNET OF THINGS

Course Objectives:

- To learn and understand elements of IoT system.
- Acquire knowledge about various protocols of IoT.
- To learn and understand design principles and capabilities of IoT.

UNIT I: 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.

UNIT II: 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.

UNIT III: 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.

UNIT IV: 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.

UNIT V: IoT Case Studies

IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.

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 Joseph Yiu,2011
3. Vijay Madisetti, Arshdeep Bahga, Internet of Things, "A Hands on Approach", University Press, 2015.

References:

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

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Course Outcomes:

The student will be able to:

CO. No	Description	Knowledge Level
EC321.1	Understand internet of Things and its hardware and software components.	**K2**
EC417.2	Interface I/O devices, sensors &communication modules.	**K3**
EC417.3	Remotely monitor data and control devices.	**K3**
EC417.4	Design real time IoT based applications	**K1**

Correlation Levels as POs													**PSOs**			
1=LOW 2=MODERATE 3=HIGH																
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	***PS O1***	***PS O2***	***PS O3***	***PS O4***
EC417.1	3	2	3	2	3	-	-	-	-	-	-	-	3	2	2	2
EC417.2	3	2	2	2	3	2	-	-	-	-	-	-	3	2	2	2
EC417.3	2	2	2	2	2	1	-	-	-	-	-	-	3	2	2	2
EC417.4	3	3	3	2	3	1	-	-	-	-	-	-	3	3	3	3

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

Course Objectives:

- Introduces Mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnects.
- Discusses the various fabrication steps of IC and come across basic electrical properties of MOSFET.
- Provides CMOS technology-specific layout rules in the placement and routing of transistors and interconnect and to verify the functionality, timing, power and parasitic effects.
- Discusses concepts and techniques of modern integrated circuit design and testing (CMOS VLSI).
- Introduces static CMOS combinational and sequential logic at the transistor level, including mask layout.

Unit-I:

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.

Unit-II:

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.

Unit-III:

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, Choice of layers, 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.

Unit-IV:

Subsystem Design: Architectural issues, switch logic, Gate logic, examples of structured design, clocked sequential circuits, system considerations, general considerations of subsystem design processes, an illustration of design processes.

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Unit-V:

VlSI Design Issues: VLSI Design issues and design trends, design process, design for testability, technology options, power calculations, package selection, clock mechanisms, 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, FPGA design examples-stack, queue and shift register implementation using VHDL, step-by-step approach of FPGA design process on Xilinx environment.

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.

Course Outcomes:

After going through this course the 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	2	-	-	2	-	-	-	-	-	-	-	2	3	-	2	2
CO2	-	-	-	-	-	-	-	-	-	2	-	-	-	1	3	3
CO3	-	1	-	-	-	1	-	-	-	-	-	-	2	-	-	2
CO4	-	-	-	-	-	-	-	-	3	-	-	-	-	-	1	3
CO5	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-

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

Course Objectives:

- Analyze the Discrete Time Signals and Systems
- Know the importance of FFT algorithm for computation of Discrete Fourier Transform
- Understand the various implementations of digital filter structures
- Learn the FIR and IIR Filter design procedures
- Know the need of Multirate Processing
- Learn the concepts of DSP Processors

UNIT I

INTRODUCTION: Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems , stability of LTI systems, Invertability, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms, solution of difference equations using Z-transforms, System function.

UNIT II

DISCRETE FOURIER SERIES & FOURIER TRANSFORMS: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

UNIT III.

DESIGN OF IIR DIGITAL FILTERS& REALIZATIONS: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms.

UNIT IV

DESIGN OF FIR DIGITAL FILTERS & REALIZATIONS:

Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique, Comparison of IIR & FIR filters.Basic structures of FIR systems, *Lattice structures, Lattice-ladder structures*

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UNIT V

INTRODUCTION TO DSP PROCESSORS: 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, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals

TEXT BOOKS:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis,Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI
3. Digital Signal Processors – Architecture, Programming and Applications,, B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 2002
4. Digital Signal Processing – K Raja Rajeswari, I.K. International Publishing House

Reference Books:

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing: MH Hayes, Schaum‟s Outlines, TATA Mc-Graw Hill, 2007.
3. DSP Primer - C. Britton Rorabaugh, Tata McGraw Hill, 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris,Thomson, 2007.
5. Digital Signal Processing – Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006

Course Outcomes:

After going through this course the student will be able to

		Knowledge Level (K)#
CO1	Apply the difference equations concept in the anayziation of Discrete time systems.	K3
CO2	Use the FFT algorithm for solving the DFT of a given signal.	K3
CO3	Design a Digital filter (FIR&IIR) from the given specifications.	K4
CO4	Realize the FIR and IIR structures from the designed digital filter.	K4
CO5	Apply the signal processing concepts on DSP Processor.	K3

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO	PSO
CO1	3	2	-	2	-	-	-	-	-	-	-	-	2	-	-	3
CO2	2	3	-	3	-	-	-	-	-	-	-	-	2	-	-	3
CO3	3	2	3	2	-	-	-	-	-	-	-	-		-	3	-
CO4	2	3	-	3	-	-	-	-	-	-	-	-	3	-	-	3
CO5	2	2	-	3	-	-	-	-	-	-	-	-	2	-	-	3

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III Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
DIGITAL IC DESIGN(PE-2)					

Course Objectives:

- The student will be able to understand the MOS Design.
- In this course, students can study Combinational MOS Logic Circuits and Sequential MOS Logic Circuits.
- Another main object of this course is to motivate the graduate students to design and to develop the Digital Integreated Circuits for different Applications.
- The concepts of Semiconductor Memories, Flash Memory, RAM array organization.

UNIT-I:

MOS Design: Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

UNIT-II:

Combinational MOS Logic Circuits: MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates , AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates.

UNIT-III:

Sequential MOS Logic Circuits: Behaviour of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

UNIT-IV:

Dynamic Logic Circuits: Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits.

UNIT-V:

Interconnect: Capacitive Parasitics, Resistive Parasitics, Inductive Parasitics, Advanced Interconncet Techniques.

Semiconductor Memories: Memory Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory-NOR flash and NAND flash.

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Text Books:

1. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, 2nd Ed., PHI.

2. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.

References:

1. CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Ed., 2011.
2. CMOS VLSI Design – Neil H.E Weste, David harris, Ayan Banerjee 3rd Edition, Pearson

Course Outcomes:

After going through this course the student will be able to

- Understand the concepts of MOS Design.
- Design and analysis of Combinational and Sequential MOS Circuits.
- Extend the Digital IC Design to Different Applications.
- Understand the Concepts of Semiconductor Memories, Flash Memory, RAM array organization.

CO.No	DESCRIPTION	Knowledge Leve (K)#
EC424.1	Understand the concepts of MOS Design.	K2
EC424.2	Design and analysis of Combinational and Sequential MOS Circuits.	K2
EC424.3	Extend the Digital IC Design to Different Applications.	K4
EC424.4	Understand the Concepts of Semiconductor Memories, Flash Memory, RAM array organization	K3

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO1**	**PSO1**	**PSO**	**PSO**	**PSO**
EC424.1	1	1	3	3	2	-	-	-	1	-	-	-	2	1	3	3
EC424.2	1	2	3	3	3	-	-	-	1	-	-	-	2	1	3	3
EC424.3	3	1	3	2	3	-	-	-	1	-	-	-	2	1	2	3
EC424.4	1	2	2	1	1	-	-	-	1	-	-	-	2	1	1	3

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III Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
ELECTROMAGNETIC INTERFERENCE & COMPATIBILITY(PE2)					

Course Objectives:

- Student shall be able to understand the root causes for Electromagnetic Noise (EMI), its sources.
- Shall be able to understand the effects of EMI and the required precautions to be taken/to be discussed with his peer group.
- Shall be able to understand the different measurement techniques of EMI (for conducted and normal) and their influences in detail.
- Shall be able to understand different compatibility techniques (EMC) to reduce/suppress EMI.
- Shall be able to understand different standards being followed across the world in the fields of EMI/EMC.

UNIT-I:
Natural and Nuclear sources of EMI / EMC: Introduction, Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations. An overview of EMI / EMC, Natural and Nuclear sources of EMI.

UNIT-II:
EMI from apparatus, circuits and open area test sites: Electromagnetic emissions, noise from relays and switches, non-linearities in circuits, passive intermodulation, cross talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.

UNIT-III:
Radiated and conducted interference measurements: Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents / voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI detectors and measurements.

UNIT-IV:
ESD, Grounding, shielding, bonding and EMI filters: Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design. ESD, Electrical fast transients / bursts, electrical surges.

UNIT-V:
Cables, connectors, components: Introduction, EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, Transient and Surge Suppression Devices.
EMC standards- National / International: Introduction, Standards for EMI and EMC, MIL-Standards, IEEE/ANSI standards, CISPR/IEC standards, FCC regulations, Euro norms, British Standards, EMI/EMC standards in JAPAN, Conclusions.

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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,**

Course Outcomes

At the end of this Course,

- Students shall be able to distinguish effects of EMI and counter measures by EMC-techniques.
- Students shall apply the knowledge gained in selecting proper gadget/device/appliance/system, as per EMC-norms specified by regulating authorities.
- Students shall choose career in the fields of EMI/EMC as an Engineer/Researcher/Entrepreneur in India/abroad.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	2	-	-	-	-	1	-	-	-	1	-	-	-
CO2	-	1	-	-	-	-	-	-	1	-	-	-	2	-	-	2
CO3	-	-	2	1	-	-	-	-	1	-	-	-	2	-	-	-

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III Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
SOFT COMPUTING TECHNIQUES AND PYTHON PROGRAMMING (PE-2)					

Course Objectives:

- Teach an example of scripting and interpretative language and compare it with classical compiled programming languages
- Introduce the student to Python programming fundamentals
- Expose students to application development and prototyping using Python
- Learn to apply fundamental problem solving technique
- Introduce the student to soft computing and genetic algorithms with relevant applications

UNIT-I:

Introduction: History of Python, Need of Python Programming, how a program works, Variables, Operators in python, type conversions, expressions, if, if-elif-else, for, while, break, continue, pass.

UNIT – II:

Types, Data structures and functions: Types - Integers, Strings, Booleans; Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions. Defining Functions, Calling Functions, Passing Arguments, types of arguments, Anonymous Functions, Scope of the Variables in a Function - Global and Local Variables, introduction to modules, creating modules, name spacing.

UNIT –III: Design with classes and GUI - Classes, 'self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, polymorphism, working with instances. GUI Programming, using the tkinter module, display text with label widgets, widgets with frames, button widgets and info dialog boxes, getting input with entry widget, check buttons, radio buttons, Turtle Graphics.

UNIT – IV: Introduction to soft computing and fuzzy systems: Evolutionary computing, soft computing vs hard computing, soft computing methods, recent trends in soft computing, characteristics of soft computing, applications of soft computing, fuzzy sets, fuzzy relations, fuzzy logic, fuzzy rule-based systems

UNIT – V: Genetic Algorithms: Basic concepts, basic operators for genetic algorithms, crossover and mutation properties, genetic algorithm cycle, fitness function. Rough sets, rule induction and discernibility matrix, integration of soft computing techniques.

TEXT BOOKS :

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage learning.
2. Think Python First Edition, by Allen B. Downey, O‟rielly publishing, 2001.
3. Python Programming, vamsi kurama, Pearson, 2017.
4. Soft Computing – Advances and applications – Jan 2015 by B.K. Tripathy and J.Anuradha Cengage Learning

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REFERENCE BOOKS:

1. Introduction to Computation and programming using python. John v. guttag, the MIT press, 2nd Edition, 2016.
2. James Payne, beginning python using python 2.6 and python 3, Wrox publishing, 2010.

Course Outcomes:

- Understand and comprehend the basics of python programming.
- Demonstrate the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.
- Explain the use of the built-in data structures list, sets, tuples and dictionary.
- Make use of functions and its applications.
- Identify real-world applications using oops, files and exception handling provided by python.
- Formulate and implement a program to solve a real-world problem using GUI and Turtle graphics.
- Understand soft computing applications

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1	PSO1	PSO2	PSO3	PSO4
CO1	1			1									1		2	2
CO2													2			
CO3	2		3													2
CO4		2											2			
CO5	1			2												
CO6																2

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III Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
ANALOG IC DESIGN(PE-3)					

Course Objectives:

The student will be introduced to

- The student will be able to understand the behavior of MOS Devices and Small-Signal & Large-Signal Modeling of MOS Transistor and Analog Sub-Circuits.
- In this course, students can study CMOS Amplifiers like Differential Amplifiers, Cascode Amplifiers, Output Amplifiers, and Operational Amplifiers.
- Another main object of this course is to motivate the graduate students to design and to develop the Analog CMOS Circuits for different Analog operations.
- The concepts of Open-Loop Comparators and Different Types of Oscillators like Ring Oscillator, LC Oscillator etc.

UNIT -I:

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 Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT -II:

Analog CMOS Sub-Circuits: MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT -III:

CMOS Amplifiers: Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

UNIT -IV:

CMOS Operational Amplifiers: Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT -V:

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.

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Text Books:

1. Design of Analog CMOS Integrated Circuits- Behzad Razavi, 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.

Course Outcomes:

After going through this course the student will be able to

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

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	3	-	-	-	-	-	-	-	-	-	3	-	3	2
CO2	-	-	-	1	-	-	-	2	-	-	-	-	3	3	2	2
CO3	-	-	-	1	-	-	-	2	-	-	-	-	2	-	-	3
CO4	-	-	-	2	-	-	-	-	-	-	-	-	3	-	3	3

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

SIMULATION & MATHEMATICAL MODELING(PE-3)

Course Objective:
To introduce various system modelling and simulation techniques and highlight their applications in different areas. It includes modelling, design, simulation, planning, verification and validation.

UNIT – I:
Introduction to Simulation
When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study. The basics of Spreadsheet simulation, Simulation example: Simulation of queuing systems in a spreadsheet. General Principles, Simulation software: Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event Scheduling; List processing.

UNIT – II:
Mathematical Models
Statistical Models in simulation – Concepts, Discrete Distribution, Continuous Distribution, Poisson Process, Empirical Distributions, Queuing Models – Characteristics, Notation, Queuing Systems, Markovian Models, Generation of Pseudo Random numbers, Properties of random numbers, Techniques for generating random numbers, Testing random number generators, Generating Random-Variates, Inverse Transform technique, Acceptance- Rejection technique, Composition & Convolution Method

UNIT – III:
Analysis of Simulation Data
Input modelling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.
Estimation of Absolute Performance: Types of simulations with respect to output analysis; Stochastic nature of output data; Absolute measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations.

UNIT – IV:
Verification, Calibration, and Validation
Optimization: Model building, verification and validation; Verification of simulation models; Calibration and validation of models, Optimization via Simulation
Simulation of computer systems and case studies
Simulation tools, Model input, high level computer system simulation, comparison of systems via simulation, simulation programming techniques, development of simulation models.

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UNIT – V:

Case Studies

City traffic simulation, Indoor air quality simulation of a building, machine health simulation (DC motor health)

TEXTBOOKS:

1. Discrete Event System Simulation, Jerry Banks and John S. Carson II, 5th Edition, Pearson, 2010.
2. Simulation Modelling and Analysis, Averill M. Law, 4thEdition, McGraw Hill, 2007.
3. Introduction to probability models, Sheldon M. Ross, 7th Edition, Academic Press, 2000.

REFERENCE BOOKS:

1. Simulation, Sheldon M. Ross, 5th Edition, Elsevier, 2012.
2. System Modelling and Simulation – An Introduction, Frank L. Severance, Wiley, 2001.
3. System Simulation, Geoffrey and Gordon, 2nd Edition, PHI, 2002.
4. Handbook of simulation: Principles, Methodology, Advances, Applications and Practice, Jerry Banks, 1st Edition, Wiley, 1998.

Course Outcomes:

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

- Solve real world problems which cannot be solved strictly by mathematical approaches.
- Understand the principles within mathematic modelling of materials science.
- Demonstrate the ability describe the mathematical components in mechanical and thermal analyses.
- be able to describe the conditions in numerical code for solving stress loading problems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1			2									2			2
CO2		1		2									1		2	
CO3	2	2	1										2		2	2
CO4				1									1		1	

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III Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
INFORMATION THEORY & CODING(PE-3)					

Course objectives:
The main objectives of this course are given below

- Understand the concept of Entropy and source coding
- Understand the concept of channel and its capacity
- Encoding and Decoding of Digital Data Streams
- Be Aware of Compression and Decompression Techniques
- Learn the Concepts of Multimedia Communication

UNIT I
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.

UNIT II
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.

UNIT III
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.

UNIT IV
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.

UNIT V
CONVOLUTIONAL CODES

Introduction to convolution code, its construction and Viterbi algorithm for maximum likelihood decoding. Automatic repeat request strategies and their throughput efficiency considerations.

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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 AShiva prakash, 2015.
3. JS Chithode, Information theory and coding, Technical publishers, 1st Edition, 2014.

Course Outcomes:

At the end of this course the student will be able to

- Design an Application with Error-Control coding
- Use Compression and Decompression Techniques
- Perform source coding and channel coding

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1		2									2		2	2
CO2		2	2	1									2		1	2
CO3	1		1										2			1

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III Year - II Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
VLSI 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	2	1	-	1	-	-	-	-	-	-	-	-	1	-	-	1
CO2	2	-	1	-	2	-	-	-	-	-	-	-	8	2	-	1
CO3	-	2	2	-	1	-	-	-	-	-	-	-	-	-	-	1
CO4	-	1	-	2	-	-	-	-	-	-	-	-	1	-	-	1
CO5	1	-	3	-	1	-	-	-	-	-	-	-	-	2	2	1
CO6	2	-	2	1	-	-	-	-	-	-	-	-	1	-	-	1
CO7	-	1	2	-	1	-	-	-	-	-	-	-	-	-	3	2

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III Year - II Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
DIGITAL SIGNAL PROCESSING LAB					

List of the Experiments / programs

Student has to perform at least FOUR Experiments in each part:

PART-1(SIGNALS)

1) Generation of discrete time signals for discrete signals
2) To verify the Linear Convolution
a) Using MATLAB
b) Using Code Composer Studio(CCS)
3) To verify the Circular Convolution for discrete signals
a) Using MATLAB
b) Using Code Composer Studio(CCS)
4) To Find the addition of Sinusoidal Signals
5) To verify Discrete Fourier Transform(DFT) and Inverse Discrete Fourier Transform(IDFT)
a) Using MATLAB
b) Using Code Composer Studio(CCS)
6) Transfer Function Stability Analysis: using pole-zero plot, bode plot, Nyquist plot, z-plane plot.

PART-2 (FILTERS)

7) Frequency Response of IIR low pass Butterworth Filter
8) Frequency Response of IIR high pass Butterworth Filter
9) Frequency Response of IIR low pass Chebyshev Filter
10) Frequency Response of IIR high pass Chebyshev Filter
11) Frequency Response of FIR low pass Filter using Rectangle Window
12) Frequency Response of FIR low pass Filter using Triangle Window

PART – 3(IMAGE PROCESSING)

13) An image processing in a false contouring system
14) To generate the histogram equalization to the image
15) To verify the Normalized Cross Correlation to the addition of noise and removal of noise using filters to an image.
16) Compute the edge of an image using spatial filters.
17) Perform the image motion blur and calculate PSNR to the noise image and also noise free image.
To verify the PSNR to the Second order Decomposition of Discrete Wavelet transforms and to the reconstructed image using inverse Discrete Wavelet transform

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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	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO2	-	-	-	2	-	-	-	-	-	-	-	-	2	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	-
CO4	-	2	-	-	-	-	-	-	-	-	1	-	-	-	-	1
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-

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

Course Objectives:

- The functionality of each of the components that comprise a fiber-optic communication system and the losses.
- The principles of all types of optical fibers and their characteristics
- Analyze optical transmitters and detectors.
- Analyze and design optical communication and fiber optic sensor systems and the models of analog and digital receivers.

UNIT I

Overview of optical fiber communication - Historical development, The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays, Cylindrical fibers- Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index, Related problems.

UNIT II

Fiber materials:- Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers-Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Information capacity determination, Group delay, Types of Dispersion:- Material dispersion, Wave-guide dispersion, Polarization-Mode dispersion, Intermodal dispersion, Pulse broadening in Graded index fiber, Related problems.

UNIT III

Optical fiber Connectors-Connector types, Single mode fiber connectors, Connector return loss, Fiber Splicing-Splicing techniques, Splicing single mode fibers, Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints.

UNIT IV

Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies, Reliability of LED&ILD, Optical detectors- Physical principles of PIN and APD, Detector response time, Comparison of Photo detectors, Related problems.

UNIT V

Source to fiber power launching - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantum limit, Analog receivers.Optical system design - Point-to- point links- Component choice and considerations, Link power budget, Rise time budget with examples, Line coding in Optical links, WDM, Necessity, Principles, Measurement of Attenuation and Dispersion, Eye pattern.

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TEXT BOOKS:

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004.

RERFERENCES :

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education,2005.
2. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.

Course Outcomes:

After going through this course the student will be able to

CO. No	Description	Knowledge Level
EC414.1	Choose necessary components required in modern optical communications systems	K2
EC414.2	Design and build optical fiber experiments in the laboratory, and learn how to calculate electromagnetic modes in waveguides, the amount of light lost going through an optical system, dispersion of optical fibers	K2
EC414.3	Use different types of photo detectors and optical test equipment to analyze optical fiber and light wave systems.	K4
EC414.4	Choose the optical cables for better communication with minimum losses	K3
EC414.5	Design, build, and demonstrate optical fiber experiments in the laboratory	K3

Correlation Levels as :

1=LOW 2=MODERATE 3=HIGH

CO	***PO1***	***PO2***	***PO3***	***PO4***	***PO5***	***PO6***	***PO7***	***PO8***	***PO9***	***PO10***	***P011***	***PSO1***	***PSO2***	***PSO3***	***PSO4***
EC414.1	-	-	-	-	3	-	-	-	-	2	-	2	-	-	2
EC414.2	-	3	3	-	-	-	2	-	-	-	1	2	-	-	2
EC414.3	-	-	-	2	-	-	2	-	-	-	-	2	-	-	2
EC414.4	-	-	-	2	3	-	-	-	-	2	-	2	-	-	2
EC414.5	-	2	3	-	2	-	-	-	-	-	2	2	-	-	2

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

Course Objectives:

The student will

- Understand fundamental characteristics of waveguides and Microstrip lines through electromagnetic field analysis.
- Understand the basic properties of waveguide components and Ferrite materials composition
- Understand the function, design, and integration of the major microwave components oscillators, power amplifier.
- Understand a Microwave test bench setup for measurements.

UNIT I

MICROWAVE TRANSMISSION LINES: Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations, Impossibility of TEM mode. Related Problems. Excitation techniques-waveguides

MICROSTRIP LINES– Introduction, Zo Relations, Effective Dielectric Constant, Losses, Q factor.

UNIT II

MICROWAVE TUBES: Limitations and Losses of conventional tubes at microwave frequencies. Re-entrant C avities, 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.

UNIT III

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.

UNIT IV

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, MagicTee, Hybrid Ring; Directional Couplers – 2Hole, Bethe Hole types, Ferrite Components– Faraday Rotation.

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UNIT V

SCATTERING MATRIX PARAMETERS: definition of scattering matrix, Properties, scattering matrix of two-port networks, salient features of S-Matrix, relation between S-parameters in terms of Z and Y parameters, S-parameters of two port, three port and four port networks.

MICROWAVE MEASUREMENTS: Description of Microwave Bench – Different Blocks and their Features, Precautions; Microwave Power Measurement – Bolometer Method. Measurement of Attenuation, Frequency, VSWR, Impedance Measurement.

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 Sisir K.Das, Mc Graw Hill Education, 3rd Edition.
3. Microwave Engineering – G S N Raju , I K International
4. Microwave and Radar Engineering – G Sasibhushana Rao, Pearson

Course Outcomes:

After going through this course the student will be able to

CO. No	Description	Knowledge Level
EC322.1	Design different modes in waveguide structures	K2
EC322.2	Calculate S-matrix for various waveguide components and splitting the microwave energy in a desired direction	K2
EC322.3	Distinguish between Microwave tubes and Solid State Devices, calculation of efficiency of devices.	K4
EC322.4	Measure various microwave parameters using a Microwave test bench	K3

CO	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PSO1*	*PSO2*	*PSO3*	*PSO4*
EC322.1	2	1	3	2	-	-	1	-	-	-	1	2	2	1	2
EC322.2	2	3	2	2	1	1	-	-	-	1	1	2	1	2	3
EC322.3	2	2	2	3	1	1	1	1	1	1	-	2	-	1	2
EC322.4	1	1	-	1	1	-	-	2	2	2	2	1	2	2	3

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IV Year - I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
DATA COMMUNICATIONS & COMPUTER NETWORKS (PE4)					

Course Objectives:

- To introduce the Fundamentals of data communication networks
- To demonstrate the Functions of various protocols of Data link layer.
- To demonstrate Functioning of various Routing protocols.
- To introduce the Functions of various Transport layer protocols.
- To understand the significance of application layer protocols

UNIT I:

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,

UNIT II:

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.

UNIT III:

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

UNIT IV:

Transport Layer: Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, 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, TCPConnection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control

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UNIT V:

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.

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 - Bhusan Trivedi, Oxford university press, 2016
2. Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education,2003.
3. Understanding Communications and Networks,3rdEdition,W.A.Shay,Cengage Learning,2003.

Course Outcomes:

Upon completing this course, the student will be able to

- Know the Categories and functions of various Data communication Networks
- Design and analyze various error detection techniques.
- Demonstrate the mechanism of routing the data in network layer
- Know the significance of various Flow control and Congestion controlMechanisms
- Know the Functioning of various Application layer Protocols.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2		1									1		2	
CO2			2										2			2
CO3	1	2	2										2		2	2
CO4	2		2										2		2	
CO5		2		2									1			1

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IV Year - I Semester		L	T	P	C
		3	0	0	3
LOW POWER VLSI DESIGN(PE4)					

Course Objectives:

- Known the low power low voltage VLSI design
- Understand the impact of power on system performances.
- Known about different Design approaches.
- Identify suitable techniques to reduce power dissipation in combinational and sequential circuits.

UNIT –I:

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.

UNIT –II:

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 UsingHigh-Level Transformations: Multilevel Voltage Scaling Challenges in MVS Voltage Scaling Interfaces, Static Timing Analysis Dynamic Voltage and Frequency Scaling

UNIT -III

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.

UNIT –IV:

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.

Low-Voltage Low-Power Multipliers: Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh- Wooley Multiplier, Introduction to Wallace Tree Multiplier.

UNIT –V:

Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Pre-charge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

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

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REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press,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.
4. Leakage in Nanometer CMOS Technologies– Siva G. Narendran, Anatha Chandrakasan, Springer,2005.

Course Outcomes:

Upon completing this course, the student will be able to

- Understand the need of Low power circuit design.
- Attain the knowledge of architecturalapproaches.
- Analyze and design Low-Voltage Low-Power combinational circuits.
- Known the design of Low-Voltage Low-Power Memories

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2			1									2		2	1
CO2		2														1
CO3	1		2										1		2	
CO4				1									2			2

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

Course Objectives:
- Familiarize with basic concepts of digital image processing and different image transforms
- Learn various image processing techniques for image enhancement, filtering in spatial and frequency domain.
- Know the image restoration techniques, and color fundamentals and different color models. segmentation and
- Understand the fundamentals of wavelets and multi resolution processing, and various image compression methods.
- Understand the morphological image processing and Image segmentation techniques.

UNIT-I

Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing.
Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD.

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.

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.
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.

UNIT-IV
Wavelets and Multiresolution Processing: Image pyramids, subband coding, Multiresolution 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

UNIT-V
Morphological Image Processing: Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms, gray-scale morphology.
Image segmentation: Fundamentals, point, line, edge detection, thresholding, and region –based segmentation.

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Text Books

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar," Digital Image Processing", Tata McGraw-Hill Education, 2011.

Reference Books

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

Course Outcomes:

After undergoing the course students will be able to

- Identify the scope of digital image processing and compare various image transforms.
- Perform basic operations like intensity transformations and filtering in spatial and frequency domain.
- Demonstrate the restoration techniques on images and apply the basic image processing techniques on color images.
- Analyze the digital Images using wavelets and multiresolution processing and interpret the various image compression methods.
- Apply the various morphological operators and segmentation techniques on digital images

Mapping of course outcomes with program outcomes

	PO 1	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	PSO 4
CO1	2	3	3	2	2	-	-	-	-	-	-	-	-	3	-	3
CO2	3	2	2	3	2	-	-	-	-	-	-	-	-	3	-	3
CO3	3	-	3	-	-	-	-	-	-	-	-	-	-	3	-	3
CO4	2	3	3	2	2	-	-	-	-	-	-	-	-	3	-	3
CO 5	3	3	3	-	2	-	-	-	-	-	-	-	-	-	-	3

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

DSP PROCESSORS AND ARCHITECTURES (PE5)

Course Objectives:

- To recall the various techniques of digital signal processing.
- To introduce the architectural features of programmable DSP Processors of Texas Instruments and Analog devices .
- To understanding the practical examples of DSP Processor architectures.
- To develop programming knowledge by using Instruction set of DSP Processors.
- To know the interfacing techniques to I/O devices and memory.

UNIT-I:

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.

UNIT-II:

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.

UNIT-III:

Programmable Digital Signal Processors

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX Instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54XX Processors.

UNIT-IV:

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,

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Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals

UNIT-V:

Interfacing Memory and I/O Peripherals to Programmable DSP Devices

Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

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, Sen M.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
4. The Scientist and Engineer's Guide to Digital Signal Processing by Steven W. Smith, Ph.D., California Technical Publishing, ISBN 0-9660176-3-3, 1997.

Course Outcomes:

Upon the completion of course, student able to

- Understand the basic concepts of Digital Signal Processing.
- To differentiate the architectural features of General purpose processors and DSP processors.
- Understand the architectures of TMS320C54xx devices and ADSP 2100 DSP devices.
- Write the simple assembly language programs by using instruction set of TMS320C54xx.
- To interface the various devices to DSP Processors.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	-	-	-	-	-	-	-	-	-	2	-	-	3
CO2	-	3	2	2	-	-	-	-	-	-	-	-	-	-	1	3
CO3	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-	3
CO4	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	3	-	-	-	-	-	-	-	-	-	-	-	2	3

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

Course Objectives:

The student will be introduced to:

- The Basic Principle of radar and radar range equation.
- Different types of radars; CW, FM-CW, MTI and pulse Doppler radars.
- Understand the different tracking techniques for radar.
- Understand the characteristics of a matched filter receiver and its performance.
- Understand the different types of displays, duplexers and antennas used in radar systems.

UNIT–I:

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.

UNIT–II:

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.

UNIT-III:

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.

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UNIT –IV:

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.

UNIT –V:

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

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
4. Radar Engineering, G.S.N. Raju, IK publications, New delhi, 2008

Course Outcomes:

After going through this course the student will be able to:

- Derive the radar range equation and solve some analytical problems.
- Understand the different types of radars and its applications.
- Understand the concept of tracking and different tracking techniques.
- Understand the various components of radar receiver and its performance.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2		2	2									2		1	2
CO2	2	1		2									2		1	
CO3	1	1	2										2		2	2
CO4	2	2		1									2		1	

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

Course Objectives:

After going through this course the student will be able to

- Understand the building blocks of typical embedded system and different memory technology and memory types.
- Learn the characteristics of an embedded system, quality attributes of embedded systems, application specific and domain specific embedded system,
- Learn about communication devices and basics about VLSI and integrated circuit design and learn concept of firmware design approaches, ISR concept. Interrupt sources, interrupt servicing mechanism, multiple interrupts,
- Understand the concepts of c versus embedded c and compiler versus cross-compiler.
- Learn about the integrated development environment, software utility tool. Also learn about quality assurance and testing of the design, testing on host machine, simulators.

Unit-I:

Introduction: Embedded System-Definition, History, Classification, application areas and purpose of embedded systems, The typical embedded system-Core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, PCB and passive components. Characteristics, Quality attributes of an Embedded systems, Application-specific and Domain-Specific examples of an embedded system, Main processing elements of embedded system, hardware and software partitions.

Unit-II:

Embedded Hardware Design: Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

Unit-III:

Embedded Firmware Design: Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

Unit-IV:

Real Time Operating System: Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Threads, Processes and Scheduling, Task Scheduling, Communication, Synchronization, Device Drivers, How to choose an RTOS. Electronics and Communication Engineering

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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.

Unit-V:

Embedded System Development: The integrated development environment, Types of files generated on cross-compilation, Deassembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools.

Embedded System Implementation And Testing: The main software utility tool, CAD and the hardware, Translation tools-Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools. Test and evolution of an embedded systems(Build in self test etc).
Case study- typical embedded system design flow with an example.

Text Books:

1. 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.

Course Outcomes:

After going through this course the student will be able to

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	-	-	-	-	-	-	-	-	-	2	-	-	3
CO2	-	3	2	2	-	-	-	-	-	-	-	-	-	-	1	3
CO3	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-	3
CO4	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-	3

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IV Year - I Semester		L	T	P	C
		0	0	3	1.5
MICROWAVE ENGINEERING & OPTICAL LAB					

Minimum Twelve Experiments to be conducted:

Part – A (Any 7 Experiments (8 & 9 compulsory)) :

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation Measurement.
4. Directional Coupler Characteristics.
5. Impedance and Frequency Measurement.
6. Scattering parameters of Circulator.
7. Scattering parameters of Magic Tee.
8. Radiation Pattern of Horn and Parabolic Antennas.
9. Synthesis of Microstip antennas (Rectangular Structure) Using HFSS.

Part – B (Any 5 Experiments) :

10. Characterization of LED.
11. Characterization of Laser Diode.
12. Intensity modulation of Laser output through an optical fiber.
13. Measurement of Data rate for Digital Optical link.
14. Measurement of NA.
15. Measurement of losses for Analog Optical link.

Course Outcomes:

After going through this course the student will be able to

CO1	Verify characteristics of Reflex Klystron.	k2
CO2	Analyze various parameters of Waveguide Components	k3
CO3	Estimate the power measurements of RF Components such as directional Couplers.	k2
CO4	Demonstrate characteristics of various optical sources	k4
C05	Measure data Rate, Numerical Aperture and Losses in Optical Link.	k3

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Correlation Levels as :																
1=LOW 2=MODERATE 3=HIGH																
CO	***PO 1***	***PO 2***	***PO 3***	***PO 4***	***PO 5***	***PO 6***	***PO 7***	***PO 8***	***PO 9***	***PO10***	***PO11***	***PO12***	***PSO 1***	***PSO 2***	***PSO 3***	***PSO 4***
CO 1	3	2	-	-	1	-	-	-	-	-	-	-	1	-	2	3
CO 2	2	3	1	1	1	-	-	-	-	-	-	-	2	-	1	3
CO 3	2	2	1	-	1	-	-	-	-	-	-	-	-	-	2	2
CO 4	1	1	1	1	1	-	-	-	-	-	-	-	1	-	2	2
CO 5	2	2	1	1	-	-	-	-	-	-	-	-	1	-	2	3

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IV Year - I Semester		L	T	P	C
		0	0	3	1.5
INTERNET OF THINGS LAB					

List of Experiments:

1. Introduction to Raspberry Pi Board/ Arduino/Node MCU.
2. Familiarization with ARM keil MDK for programming and debugging an application on the PSoC 4 BLE chip and perform necessary software installation.
3. To interface Push button/Digital sensor (IR/LDR) with ARM keil MDK on PSoC 4 BLE chip and write a program to turn ON LED when push button is pressed or at sensor detection.
4. Set up a Bluetooth Low Energy (namely Bluetooth Smart) connection between the PSoC BLE kit and a smart phone and use an app to send and receive data to and from the BLE Pioneer kit.
5. To interface capacitor sensor (touch sensor) with smart phone and write a program to turn RGB LED ON/OFF when „1"/"0" is received from smart phone using Bluetooth.
6. Automatic street light control to control the street light (Turn on and off based on the light) using Arduino/ Node MCU/Raspberry Pi
7. Smoke Detection using MQ-2 Gas Sensor
8. Detecting obstacle with IR Sensor and Arduino/ Node MCU/Raspberry Pi
9. Arduino board interfacing with the temperature and humidity sensor and prints theoutput on LCD / serial monitor
10. Write an Arduino program for interfacing Arduino board with the Ultrasonicsound sensor and print the output on Serial monitor.

Equipment required for Laboratories:

Arduino/Node MCU/Raspberry Pi + PSoC 4 BLE Bluetooth Low Energy Pioneer Kit + Hardware, MQ-2 Gas Sensor, Ultrasonic sound sensor.

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COURSE OUTCOMES (Cos)

CO 1: Understand the importance of internet of things in present scenario.

CO2: Understand the basics of sensors, its functioning.

CO3: Implement interfacing of various sensors with Arduino/Raspberry Pi.

CO4: Design of direct and alternating type of electrical instruments using arduino/Raspberry Pi.

CO5: Acquire design thinking capability, ability to design a component with realistic constraints, to solve real world engineering problems and analyse the results.

CO6: Recognize the functionality of micro controller, latest version processors and its applications.

CO-PO MATRIX

CO-POs& PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS 04
CO1	3	-	-	-	3	-	-	-	-	-	-	3	3	2	3	2
CO2	3	3	3	3	3	2	-	-	3	3	1	3	3	2	3	2
CO3	3	3	3	3	3	2	-	-	3	3	1	3	3	2	3	2
CO4	3	3	3	3	3	2	-	-	3	3	1	3	3	2	3	2
CO5	3	3	3	3	3	2	-	-	3	3	1	3	3	2	3	2
CO6	3	3	3	3	3	2	-	-	3	3	1	3	3	2	3	2

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IV Year - II Semester		L	T	P	C
		3	0	0	3
SATELLITE COMMUNICATIONS (PE-6)					

Course Objectives:

- Understand the basic concepts, applications, frequencies used and types of satellite communications.
- Understand the concept of look angles, launches and launch vehicles and orbital effects in satellite communications.
- Understand the various satellite subsystems and its functionality.
- Understand the concepts of satellite link design and calculation of C/N ratio.
- Understand the concepts of multiple access and various types of multiple access techniques in satellite systems.
- Understand the concepts of satellite navigation, architecture and applications of GPS.

UNIT I

INTRODUCTION : Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

ORBITAL MECHANICS AND LAUNCHERS[1] : Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.

UNIT II

SATELLITE SUBSYSTEMS : Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Space qualification.

UNIT III

SATELLITE LINK DESIGN: Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example.

UNIT IV

MULTIPLE ACCESS : Frequency division multiple access (FDMA) Intermodulation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure, Examples.

Satellite Switched TDMA Onboard processing, DAMA, Code Division Multiple access (CDMA),Spread spectrum transmission and reception.

UNIT V

EARTH STATION TECHNOLOGY : Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power test methods.

LOW EARTH ORBIT AND GEO-STATIONARY SATELLITE SYSTEMS[1] : Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations, Operational NGSO constellation Designs

SATELLITE NAVIGATION & THE GLOBAL POSITIONING SYSTEM [1] : Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, Satellite signal acquisition, GPS Navigation Message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS.

TEXT BOOKS:

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

REFERENCES :

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

Course Outcomes:

At the end of this course the student can able to:

CO. No	Description	Knowledge Level
CO1	Discuss the basics of orbital mechanics, frequency bands and launch vehicles for satellite communication systems.	K2
CO2	Explain the operations of various sub-systems of communication satellites.	K2

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CO3	Derive the expression for G/T ratio and to solve some analytical problems on satellite link design.	K4
CO4	Differentiate the various types of multiple access techniques	K4
CO5	Explain the architecture of earth station and GPS	K3

CO-PO Mapping

CO	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*	*PSO4*
CO1	3	2	-	-	-	-	-	-	-	-	-	3	2	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-	3
CO3	-	3	2	-	-	-	-	-	-	-	-	-	3	-	-	2
CO4	-	3	2	-	-	-	-	-	-	-	-	-	3	-	-	3
CO5	3	-	3	-	-	-	-	-	-	-	-	-	2	-	-	2

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IV Year - II Semester		L	T	P	C
		3	0	0	3
FPGA Design (PE-6)					

Course Objectives:

- Understand the System Modeling, Virtual Targets, Third Party IP, Common Tools
- Understand Board Design Challenges, Design Flows, Thermal Analysis, Team Based Designs
- Understand the RTL Coding Styles for Synthesis, IP Design, Packaging and Reusability
- Understand the Challenges , Design, Interfacing of Embedded Design
- Understand the Various Methodology, Challenges of Timing Closer

UNIT I

Project Management- The Role of Project Management, Design Specification, System Modeling- Definition of System Modeling, Classes of System-C Models, Software Development Using Virtual Targets, System-C Basics, Resource Scoping- Introduction, Engineering Resources, Third Party IP, Device Selection, Design Environment- Scripting Environment, Interaction with Version Control Software, Use of a Problem Tracking System, Regression Test System, Common Tools in the FPGA Design Environment.

UNIT-II

Board Design-Challenges, Engineering Roles and Responsibilities, Power and Thermal Considerations, Signal Integrity, Design Flows for Creating the FPGA Pin-out , Board Design Check List for a Successful FPGA Pin-out. Power and Thermal Analysis- Power Basics, Key Factors in Accurate Power Estimation, Power Estimation Early in the Design Cycle, Simulation Based Power Estimation. Team Based Design Flow- Recommended Team Based Design Flow, Design Set-up, Team Member Development Flow, Team Leader Design Integration, Working with Version Control Software.

UNIT-III

RTL Design- Common Terms and Terminology, Recommendations for Engineers with an ASIC Design Background, Recommended FPGA Design Guidelines, Writing Effective HDL, RTL Coding Styles for Synthesis, Analyzing the RTL Design. IP and Design Reuse- The Need for IP Reuse, Architecting Reusable IP, Packaging of IP, IP Reuse Checklist.

UNIT-IV

Embedded Design- Definition, Challenges, Embedded Hardware Design, Hardware to Software Interface, Embedded SW Design, Use of FPGA System Integration Tools for Embedded Design. Functional Verification- Introduction, Challenges, RTL Versus Gate Level Simulation, Verifi - cation Methodology, Functional Coverage, Code Coverage, QA Testing, Hardware Interoperability Tests, Hardware/Software Co-verification.

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UNIT-V

Timing Closure- Challenges, Importance, Methodology, Analysis of Common Timing Closure Failures, High Level Design, In-System Debug- Challenges, Plan for Debug, Techniques, Design Sign-off.

Test Books:

1. FPGA Design- Best Practices for Team-based Reuse by Philip Andrew Simpson, Second Edition.

Course Outcomes:

At the end of this course the student can able to:

1. Understand the concepts of project management.
2. Understand about various design flows.
3. Understand the ASIC design.
4. Understand the system integration tools for Embedded design.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1		2									2		2	2
CO2	2														1	
CO3		3		1									2		1	2
CO4	1	1		2											2	

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

SPEECH PROCESSING(PE-6)

Course Objectives:

The main objectives of the course are as follows:

- Understand the mechanism of human speech production and articulation
- Understand time and frequency domain methods of speech processing
- Understand linear predictive analysis for speech signals and LPC
- Study the algorithms and models involved for speaker and speech recognition systems

Unit I

Mechanics of speech

Speech production: Mechanism of speech production, Acoustic phonetics, The Acoustic Theory of Speech Production: Uniform lossless tube, Effects of losses in the vocal tract, Digital models for speech signals: Vocal tract, Radiation, Excitation, Auditory perception: psycho acoustics.
Representations of speech waveform: Sampling of speech signals, Quantization.

Unit II

Time and frequency domain methods for speech processing

Time domain parameters of Speech signal: Short-Time Energy, Average Magnitude, Average Zero crossing Rate, Silence Discrimination using ZCR and energy, Short Time Auto Correlation Function, Pitch period estimation using Auto Correlation Function.
Short Time Fourier analysis: Fourier transform and linear filtering interpretations, Sampling rates in time and frequency, Pitch detection, Analysis by Synthesis, Analysis synthesis systems: Phase vocoder, Channel Vocoder, Median Smoothing, Spectrographic displays

Unit III

Linear predictive analysis of speech

Basic Principles of linear predictive analysis: Auto correlation method, Covariance method, Solution of LPC equations: Cholesky method, Durbin‟s Recursive algorithm, Application of LPC parameters: Pitch detection using LPC parameters, Formant analysis using LPC parameters, VELP. Relations Between the Various Speech Parameters, CELP.

Unit IV

Application of speech processing

Voice response systems: General considerations in the design of voice response

systems, A multiple output digital voice response system, Speaker recognition systems: Speaker verification system, Speaker identification system.

UNIT V

Speech recognition systems: Isolated digit recognition system, Continuous digit recognition system. Typical applications of computer voice response systems: Wiring communication equipment, Information retrieval systems

Text books:

1. L. R. Rabiner and R. W. Schaffer, Digital Processing of Speech signals, Prentice Hall, 2004
2. Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley andSons Inc., Singapore, 2004

References:

1. Quatieri, Discrete-time Speech Signal Processing, Prentice Hall, 2001
2. L.R. Rabiner and B. H. Juang, Fundamentals of speech recognition, Prentice Hall, 1999.

Course Outcomes:

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

- Summarize the mechanism of human speech production and articulation
- Identify the time domain speech signal parameters
- Differentiate time and frequency domain methods of speech processing
- Attribute linear predictive analysis for speech signals
- Explain the solutions for LPC equations
- Implement the different algorithms and models involved for speaker and speech recognition systems

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2															1
CO2	2		2	1									1		2	
CO3		2														2
CO4	1		2										1		2	1
CO5		1											2			1
CO6	1		2												1	2

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

CELLULAR and MOBILE COMMUNICATIONS
(PE-7)

Course Objectives:

- Understand the basic cellular concepts like frequency reuse, cell splitting, cell sectoring etc., and various cellular systems.
- Understand the different types of interference s influencing cellular and mobile communications.
- Understand the frequency management, channel assignment and various propagation effects in cellular environment.
- Understand the different types antennas used at cell site and mobile.
- Understand the concepts of handoff and types of handoffs.
- Understand the architectures of GSM and 3G cellular systems.

UNIT I

CELLULAR MOBILE RADIO SYSTEMS: Introduction to Cellular Mobile System, uniqueness of mobile radio environment, operation of cellular systems, consideration of the components of Cellular system, Hexagonal shaped cells, Analog and Digital Cellular systems.
CELLULAR CONCEPTS: Evolution of Cellular systems, Concept of frequency reuse, frequency reuse ratio, Number of channels in a cellular system, Cellular traffic: trunking and blocking, Grade of Service; Cellular structures: macro, micro, pico and femto cells; Cell splitting, Cell sectoring.

UNIT II

INTERFERENCE: Types of interferences, Introduction to Co-Channel Interference, real time Co-Channel interference, Co-Channel measurement, Co-channel Interference Reduction Factor, desired C/I from a normal case in a omni directional Antenna system, design of Antenna system, antenna parameters and their effects, diversity receiver, non-cochannel interference-different types.

UNIT III

FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT: Numbering and grouping, setup access and paging channels, channel assignments to cell sites and mobile units: fixed channel and non-fixed channel assignment, channel sharing and borrowing, overlaid cells.

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CELL COVERAGE FOR SIGNAL AND TRAFFIC: Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long distance propagation, antenna height gain, form of a point to point model.

UNIT IV

CELL SITE AND MOBILE ANTENNAS : Sum and difference patterns and their synthesis, omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas.

UNIT V

HANDOFF STRATEGIES

Concept of Handoff, types of handoff, handoff initiation, delaying handoff, forced handoff, mobile assigned handoff, intersystem handoff, vehicle locating methods, dropped call rates and their evaluation.

DIGITAL CELLULAR NETWORKS: GSM architecture, GSM channels, multiple access schemes; TDMA, CDMA, OFDMA; architecture of 3G cellular systems.

TEXTBOOKS :

1. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2rd Edn., 2006.
2. Principles of Mobile Communications – Gordon L. Stuber, Springer International 2nd Edition, 2007.

REFERENCES :

1. Wireless Communications – Theodore. S. Rapport, Pearson education, 2nd Edn., 2002.
2. Wireless and Mobile Communications – Lee McGraw Hills, 3rd Edition, 2006.
3. Mobile Cellular Communication – G Sasibhushana Rao Pearson
4. Wireless Communication and Networking – Jon W. Mark and Weihua Zhqung, PHI, 2005.
5. Wireless Communication Technology – R. Blake, Thompson Asia Pvt. Ltd., 2004.

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Course Outcomes:

After learning the course, the student will be able:

CO. No	Description	Knowledge Level
EC4201.1	Identify the limitations of conventional mobile telephone systems.	K2
EC4201.2	Understand the concepts of cellular systems	K2
EC4201.3	Understand the frequency management	K4
EC4201.4	Understand channel assignment strategies and antennas in CS.	K3
EC4201.5	Understand the concept of handoff celular systems	K3
EC4201.6	Understand the concepts architectures of various cellular systems	K4

Correlation Levels as :

1=LOW 2=MODERATE 3=HIGH

CO	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	PSO1	PSO2	PSO3	PSO4
EC4201.1	2	1	2	3	2	-	-	-	1	-	-	-	2	2	3	2
EC4201.2	2	3	1	2	2	2	-	-	2	-	-	-	2	3	3	2
EC4201.3	3	2	3	2	1	1	-	-	1	-	-	-	3	3	2	3
EC4201.4	2	3	2	2	2	1	-	-	2	-	-	-	2	3	2	2
EC4201.5	3	1	1	2	1	-	-		2	-	-	-	2	2	2	2
EC4201.6	3	2	2	1	1	2	-	-	2	-	-	-	3	2	3	3

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		3	0	0	3

TELEVISION ENGINEERING(PE-7)

Course Objectives:

- To study the analysis and synthesis of TV Pictures, Composite VideoSignal, Receiver Picture tubes and Television Camera Tubes.
- To Study the various colour Television systems with a greater emphasis on television standards
- To study the advanced topics in digital television and high definition television

UNIT I

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.

UNIT II

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.

UNIT III

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.

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UNIT-IV

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.

UNIT V

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.

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.
4. "Digital Video and HDTV Algorithms and Interfaces" by Charles Poynton, Morgan Kaufman publishers, 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.

Course Outcomes:

- Able to understand the transmission of video signal and importance of television standards to effectively work with broadcasting application
- Able to acquire sound knowledge of latest topics in digital video transmission
- Able to analyse various colour television system with a greater emphasis on television standards
- Able to understand advanced topics in digital television and high definition television

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2			2									1		2	
CO2	2	2											1			2
CO3	2		2										2		1	
CO4	1			1									1			2

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

BIOMEDICAL SIGNAL PROCESSING(PE-7)

Course Objectives:

- To study about random processes and their properties.
- To Study about various data compression techniques
- To study the various processing techniques of ECG Signal
- To learn about the Modelling of EEG Signal
- To come across various signal averaging techniques

UNIT –I
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.

UNIT –II
Data Compression Techniques: Lossy and Lossless data reduction Algorithms. ECG data compression using Turning point, AZTEC, CORTES, Huffman coding, vector quantisation, DICOM Standards

UNIT –III
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.

UNIT -IV
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.

UNIT –V
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.

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.

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2. Biomedical Signal Processing - Akay M , IEEE Press.
3. Biomedical Signal Processing -Vol. I Time & Frequency Analysis - Cohen.A, 1986, CRC Press

Course Outcomes:

- Able to understand the definition and properties of Random Processes.
- Understand the various data compression techniques
- Able to understand the cardiographical signal processing techniques
- To understand the EEG signal and its processing
- Able to understand the concept of inverse filtering

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3											2			2
CO2				2											1	
CO3	1		2										1			1
CO4		1													1	
CO5	1			1									2			2