Bachelor of Technology

(Electronics & Communication Engineering)

Scheme & Syllabus

(2nd year to 4th year)

w.e.f.

(2018 Scheme)

2018-19

Dean FET.

Department of Electronics & Communication Engg.
Guru Jambheshwar University of Sc. & Tech.
HISAR- 125001
HARYANA

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR
(Established by State Legislature Act 17 of 1995)
'A' Grade, NAAC Accredited State Govt. University

Acad./AC-III/Fac-1 Vol.3/2019/ 4199
Dated 20/8/19

To

The Controller of Examinations
GJUS&T, Hisar.

Sub: Approval of scheme of examination & syllabi of various B.Tech. programme(s) being run in University Teaching Departments as well as affiliated Engineering College(s)/Institute(s).

AND

Recommendations of Faculty of Engineering & Technology regarding Open Elective, Format of Minor Question Paper, MOOC Courses, minimum strength for Programme Elective, Semester Registration etc.

Sir,

I am directed to inform you that the Vice-Chancellor, on the recommendations of the Faculty of Engineering & Technology, vide resolutions no. 2 to 13 in its meeting held on 18.07.2019, is pleased to approve the following scheme & syllabi of B.Tech. programme(s) w.e.f. the academic session / batch mentioned against each being run in University Teaching Departments as well as affiliated colleges/institutions and recommendations of Faculty of Engineering & Technology, regarding Open Elective, format of Minor Question Paper, MOOC Courses, minimum strength for Programme Elective, Semester Registration etc. under Section 11(5) in anticipation of approval of the Academic Council of the University Act, 1995:-

1. B.Tech. (Printing Technology), B.Tech (Packaging Technology) & B.Tech. (Printing & Packaging Technology)-4th year for University Teaching Departments and affiliated colleges for 2016-17 batch onwards.
2. B.Tech. (Printing & Packaging Technology) (Part-time)-3rd & 4th year for affiliated colleges for 2017-18 batch onwards.
3. B.Tech. (CSE) & B.Tech. (IT)-2nd to 4th year for University Teaching Departments and affiliated colleges for 2018-19 onwards batch.
4. B.Tech. (ECE)- 2nd to 4th year for University Teaching Departments and affiliated colleges for 2018-19 onwards batch.
5. B.Tech. (EE)- 2nd to 4th year for University Teaching Departments and affiliated colleges for 2018-19 onwards batch.

Condt..p2/-

6. B.Tech. (Printing Technology), B.Tech (Packaging Technology) & B.Tech. (Printing & Packaging Technology)-- 2nd to 4th year and syllabi of 2nd year only for University Teaching Departments and affiliated colleges for 2018-19 onwards batch.
7. B.Tech. (Agricultural Engg.) & B.Tech (Aeronautical Engineering)- 2nd to 4th year for affiliated colleges for 2018-19 onwards batch.
8. Scheme and syllabi of B.Tech. (Mechanical Engineering)- 2nd to 4th year for University Teaching Departments and affiliated colleges for 2018-19 onwards batch.
9. B.Tech. (Civil Engg.)- 2nd to 4th year for University Teaching Departments and affiliated colleges for 2018-19 onwards batch.
10. B.Tech. (Food Technology) 2nd to 4th year for University Teaching Departments for 2018-19 onwards batch.
11. The list and syllabus of Open Electives and Mandatory programmes for B.Tech. courses w.e.f. 2018-19 batch onwards.
12. The format of Minor Question paper for students of 2018-19 batch onwards (B.Tech 2nd to Final Year) and level of Assignment in light of Outcome based Education.
13. The students of B.Tech 2018-19 batch (2nd to Final year) will have choice to opt for MOOC course (not more than one in each semester) which he/she had not studied earlier, in lieu of Courses mentioned in every Programme Electives of equal credit with the prior approval of Chairperson within 15 days of start of semester.
14. The minimum 30% of existing class strength should opt for any Programme elective. Decimal part will be truncated in case 30% is not whole number.
15. The Semester Registration process being followed in FET. Faculty appreciated the process of Semester Registration in FET as it has helped in timely start of classes and has improved attendance in classes. Faculty further recommended that student should not be allowed to register after passage of one month of start of classes.

A copy of the scheme and syllabi of aforementioned B.Tech. programmes and other recommendations of Faculty of Engineering and Technology are enclosed herewith.

This is for your information and further necessary action at your end.

20/8/19

DA: As above

Deputy Registrar (Academic)
For Registrar

Endst. No.Acad./ AC-III//Fac-1 Vol.3/ 4200-4211 Dated: 20/8/19

A copy of the above is forwarded to the following for information and necessary action:-

1. Dean Academic Affairs, GJUS&T, Hisar.
2. Dean of Colleges, GJUS&T, Hisar.

contd.p/3

Semester wise credit Assigned									
	I	II	III	IV	V	VI	VII	VIII	Total Credits
HSMC	9.5	9.5	3						22
BSC		3			2	2			7
ESC	8	8	7		6				29
PCC			12	17	10	12	13		64
PEC					3	3	3		9
OEC						3	4	10	17
PROJ							4	6	10
INT					1		1		2
MC									
Total Credits	17.5	20.5	22	17	22	20	25	16	160

Subject Area	Abbreviation
Humanities and Social Sciences including Management courses	HSMC
Basic Science Courses	BSC
Engineering Science Courses	ESC
Professional Core Courses	PCC
Professional Elective Courses	PEC
Open Elective Courses	OEC
Project Work	PROJ
Pratical Training	INT
Mandatory Courses	MC

B.Tech., ECE - Total Credits	
Semester	Credits
1	17.5
2	20.5
3	22
4	17
5	22
6	20
7	25
8	16
Total	160

1.7.19 01-VII-2019

B.Tech. , ECE, Semester-3							
Course Code	Course Name	Teaching Schedule L	T	P	Hours/ Week	Credits	Duration of Exam (Hrs)
BSC201-T	Mathematics-III	3	0	0	3	3	3
PCC-ECE201-T	Signals & Systems	3	0	0	3	3	3
PCC-ECE203-T	Digital Electronics	3	0	0	3	3	3
PCC-ECE205-T	Analog Electronics- I	3	0	0	3	3	3
ESC-ECE207-T	Network Analysis and Synthesis	3	0	0	3	3	3
ESC-ME202-T	Elements of Mechanical Engineering	3	0	0	3	3	3
PCC-ECE203-P	Digital Electronics Lab	0	0	2	2	1	3
PCC-ECE205-P	Analog Electronics- I Lab	0	0	4	4	2	3
ESC-ECE207-P	Network Analysis and Synthesis Lab	0	0	2	2	1	3
*MC103-T	Indian Constitution	3	0	0	3	0	3
Total		21	0	8	29	22	

*MC-Mandatory Course, which will be a non-credit course and the student has to get pass marks in order to qualify for the award of degree.

Note: Students will be allowed to use the scientific calculator only.

1-7-19

01-VII-2019

B.Tech. , ECE, Semester-4							
Course Code	Course Name	Teaching Schedule L	T	P	Hours/ Week	Credits	Duration of Exam (Hrs)
PCC-ECE202-T	Electronic Measurements & Instrumentation	3	0	0	3	3	3
PCC-ECE204-T	Analog and Digital Communication	3	0	0	3	3	3
PCC-ECE206-T	Analog Electronics II	3	0	0	3	3	3
PCC-ECE208-T	Electromagnetic Theory	3	0	0	3	3	3
PCC-ECE202-P	Electronic Measurements & Instrumentation Lab	0	0	4	4	2	3
PCC-ECE204-P	Analog & Digital Communication Lab	0	0	2	2	1	3
PCC-ECE206-P	Analog Electronics -II Lab	0	0	4	4	2	3
*MC104-T	Essence of Indian Traditional knowledge	3	0	0	3	0	3
Total		15	0	10	25	17	

Note: The students will have to undergo Practical Training -I of 4 to 6 weeks duration during summer vacations which will be evaluated in 5th sem.

*MC-Mandatory Course which will be a non-credit course and the student has to get pass marks in order to qualify for the award of degree.

Note: Students will be allowed to use the scientific calculator only.

B.Tech. , ECE, Semester-5							
Course Code	Course Name	Teaching Schedule L	T	P	Hours/ Week	Credits	Duration of Exam (Hrs)
HSMC302-T	Fundamentals of Management for Engineers	2	0	0	2	2	3
PCC-ECE301-T	Microwave Engg.	3	0	0	3	3	3
PCC-ECE303-T	Embedded System Design	3	0	0	3	3	3
ESC-ECE307-T	Data Structure & Applications	3	0	0	3	3	3
ESC-ECE309-T	Control System Engg.	3	0	0	3	3	3
Open Elective Course-I		3	0	0	3	3	3
PCC-ECE301-P	Microwave Engg. Lab	0	0	2	2	1	3
PCC-ECE303-P	Embedded System Design Lab	0	0	4	4	2	3
PCC-ECE305-P	Skills & Innovation Lab	0	0	2	2	1	3
*INT-ECE311-P	Practical Training-I Presentation	0	0	2	2	1	3
Total		17	0	10	27	22	

*Assessment of Practical Training-I will be based on presentation/seminar, viva-voce, report and certificate for the practical training taken at the end of 4th sem.

Open Elective Course-I is to be offered by Departments other than ECE.

Note: Students will be allowed to use the scientific calculator only.

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B.Tech. , ECE, Semester-6

Course Code	Course Name	Teaching Schedule L	T	P	Hours/ Week	Credits	Duration of Exam (Hrs)
HSMC301-T	Economics for Engineers	2	0	0	2	2	3
PCC-ECE302-T	Computer Networks and IOT	3	0	0	3	3	3
PCC-ECE304-T	VLSI Design	3	0	0	3	3	3
PCC-ECE306-T	Linear Integrated Circuits & Applications	3	0	0	3	3	3
Program Elective Course-I		3	0	0	3	3	3
Open Elective Course-II		3	0	0	3	3	3
PCC-ECE302-P	Computer Networks and IOT Lab	0	0	2	2	1	3
PCC-ECE304-P	VLSI Design LAB	0	0	2	2	1	3
PCC-ECE306-P	Linear Integrated Circuits & Applications Lab	0	0	2	2	1	3
Total		17	0	6	23	20	

Note: The students will have to undergo Practical Training -II of 4 to 6 weeks duration during summer vacations which will be evaluated in 7th sem.

Open Elective Course-II is to be offered by Departments other than ECE.

Note: Students will be allowed to use the scientific calculator only.

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B.Tech. , ECE, Semester-7							
Course Code	Course Name	Teaching Schedule L	T	P	Hours/ Week	Credits	Duration of Exam (Hrs)
PCC-ECE401-T	Digital Signal Processing	3	0	0	3	3	3
PCC-ECE403-T	Wireless communication	3	0	0	3	3	3
PCC-ECE405-T	Digital System Design	3	0	0	3	3	3
Open Elective Course-III		3	0	0	3	3	3
Program Elective Course-II		3	0	0	3	3	3
PCC-ECE401-P	Digital Signal Processing Lab	0	0	4	4	2	3
PCC-ECE405-P	Digital System Design lab	0	0	4	4	2	3
Program Elective Course-II Lab		0	0	2	2	1	3
*PROJ-ECE413-P	Minor Project	0	0	8	8	4	3
**INT-ECE415-P	Practical Training-II Presentation	0	0	2	2	1	3
***MC-ECE417-P	General Proficiency	0	0	0	0	0	3
Total		15	0	20	35	25	

Open Elective Course-III is to be offered by Departments other than ECE

* The minor project will be completed and evaluated at the end of the 7th semester on the basis of its implementation, presentation, viva-voce and report.

** Assessment of Practical Training-II will be based on presentation/seminar delivered, viva-voce, report and certificate for the practical training taken at the end of 6th sem.

*** A viva of the students will be taken by external examiner and Chairperson of the Department(Internal Examiner) at the end of the semester.

***MC-Mandatory Course which will be a non-credit course and the student has to get pass marks in order to qualify for the award of degree.

Note: Students will be allowed to use the scientific calculator only.

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B.Tech. , ECE, Semester-8							
Course Code	Course Name	Teaching Schedule L	T	P	Hours/ Week	Credits	Duration of Exam (Hrs)
	Program Elective Course-III	3	0	0	3	3	3
	Program Elective Course-IV	3	0	0	3	3	3
	Program Elective Course-V	3	0	0	3	3	3
	Program Elective Course-IV Lab	0	0	2	2	1	3
*PROJ-ECE428-P	Major Project	0	0	12	12	6	3
	Total	9	0	14	23	16	

* The major project will be completed and evaluated at the end of the 8th semester on the basis of its implementation, presentation, viva-voce and report.

Note: Students will be allowed to use the scientific calculator only.

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Program Elective Courses

(The detailed syllabus of program elective subjects in appended in the end)

B.Tech. , ECE, Program Elective Course-1	
Course Code	**Course Name**
PEC-ECE308-T	Consumer & Industrial Electronics
PEC-ECE310-T	Information Theory & Coding
PEC-ECE312-T	Advanced Instrumentation and Control
PEC-ECE314-T	Satellite Communication
PEC-ECE316-T	Computer Architecture & Organization
*Any one MOOC/SWAYAM /equivalent course not studied earlier.	

B.Tech. , ECE, Program Elective Course-2	
Course Code	**Course Name**
PEC-ECE407-T	FPGA Design
PEC-ECE409-T	Antenna & Wave Propagation
PEC-ECE411-T	Artifical Intelligence & Machine Learning
PEC-ECE407-P	FPGA Design Lab
PEC-ECE409-P	Antenna & Wave Propagation Lab
PEC-ECE411-P	Artifical Intelligence & Machine Learning Lab

B.Tech. , ECE. Program Elective Course-3	
Course Code	**Course Name**
PEC-ECE402-T	Power Electronics
PEC-ECE404-T	Database Management System
PEC-ECE406-T	Probability Theory & Stochastic Design
PEC-ECE408-T	Audio & Speech Processing
PEC-ECE410-T	RADAR & SONAR Engg.
*Any one MOOC/SWAYAM /equivalent course not studied earlier.	

B.Tech. , ECE. Program Elective Course-4	
Course Code	**Course Name**
PEC-ECE412-T	Robotics
PEC-ECE414-T	Optical communication
PEC-ECE416-T	Operating systems
PEC-ECE412-P	Robotics Lab
PEC-ECE414-P	Optical communication lab
PEC-ECE416-P	Operating systems Lab

B.Tech. , ECE, Program Elective Course-5	
Course Code	**Course Name**
PEC-ECE418-T	Recent Trends in Comm. System
PEC-ECE420-T	VLSI Tech. & Application
PEC-ECE422-T	ARM
PEC-ECE424-T	MEMS & its Application
PEC-ECE426-T	Digital Image processing
*Any one MOOC/SWAYAM /equivalent course not studied earlier.	

*The MOOC/SWAYAM/equivalent course proposed/shortlisted by the students will be reviewed and finalised by the departmental committee consisting of Chairperson, Class co-ordinator/Incharge and Subject teacher concerned (to be appointed by Chairperson). The committee will ensure that the course content of this course should not overlap (more than 10%) with subjects already covered in the scheme and syllabus.

Detailed Syllabus

of

B.Tech.(ECE)

3rd semester

Mathematics III

General Course Information

Course Code: BSC201-T Course Credits: 3 Type: Basic Sciences Contact Hours: 3hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Two minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end- semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Mathematics I and Mathematics II

About the Course

This is an advanced mathematics course that offers the knowledge of Fourier Series, Fourier Transforms, Functions of Complex Variables. These concepts are essential for students to solve problems in image processing, digital signal processing and other related engineering fields.

Course Outcomes: By the end of the course studentswill be able to:

CO1. **define** concepts and terminology of Fourier Series and Fourier transforms, Functions of complex variables and Power Series etc. (LOTS: Level 1: Remember)

CO2. **solve** problems using Fourier transforms in domains like digital electronics and image processing. (LOTS: Level 3: Apply)

CO3. **apply**principles of functions of complex variables to solve computational problems.(LOTS: Level 3: Apply)

CO4. **compare** various concepts related to Fourier transforms and functions of complex variables.(HOTS: Level 4: Analyse)

CO5. **select** suitablemethod for given computational engineering problems and related domain.(HOTS: Level 4: Evaluate)

CO6. **integrate** the knowledge of Fourier Series and Fourier transforms, Functions of complex variables, and Power Series for solving real world problems. (HOTS: Level 6: Create)

Course Content

Unit I

Fourier Series and Fourier Transforms: Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and cosine series.

Unit II

Fourier integrals, Fourier transforms, Shifting theorem (both on time and frequency axes), Fourier transforms of derivatives, Fourier transforms of integrals, Convolution theorem, Fourier transform of Dirac delta function.

SIGNALS & SYSTEM
PCC-ECE201-T

Course Credits: 3 Mode: Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration: 03 Hours	Course Assessment Methods (Internal: 30; External: 70) Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Physics, Maths.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To describe various signals and their behaviour involved in processing.	L1
CO 2	To classify different systems used for signal processing and operation.	L2
CO 3	To demonstrate the conversion of signals in analog domain to digital domain.	L3
CO 4	To formulate any required system according to different types of applications.	H3

Course Contents

UNIT-I

INTRODUCTION TO SIGNALS: Signal definition, classification of signals, basic/singularity continuous and discrete-time signals, basic operations: time shifting, time reversal, time scaling on signals, signal representation in terms of singular functions, correlation of signals and its properties, representation of a continuous-time signal by its samples: the sampling theorem, reconstruction, aliasing.

UNIT-II

SYSTEM & ITS PROPERTIES: system, classification of systems: linear & nonlinear systems; static & dynamic systems, causal & non-causal system, invertible & noninvertible, stable & unstable system, time variant & time invariant systems with examples, linear time-invariant systems: definition and properties, impulse response, convolution sum/integral and its properties, representation of lti systems using differential and difference equations.

UNIT –III

FOURIER SERIES & FOURIER TRANSFORM: Introduction to Frequency domain Representation, Fourier Series Representation of Periodic Signals, Convergence of Fourier Series, Properties of Fourier Series, Fourier Transform for periodic and Aperiodic signals, Convergence of Fourier Transform, Properties of Fourier Transform, Applications of Fourier Transform.

DISCRETE-TIME FOURIER TRANSFORM: Fourier Transform representation for Discrete –Time Aperiodic & Periodic Signals, Properties of Discrete-Time Fourier Transform, Basic Fourier Transform Pairs.

UNIT-IV

Z-TRANSFORM: Introduction to Z-Transform, Region of Convergence (ROC) for Z-Transform, Z-Transform Properties, Inverse Z-Transform, Analysis of LTI Systems Using Z-Transform, Application of z transform, Introduction to Hilbert Transform.

TEXT BOOKS:

1. A. V. Oppenheim, A. S. Willsky, with S. Nawab "Signals & Systems", Prentice –Hall India.
2. Tarun K. Rawat, "Signal & Systems", Oxford University Press.
3. Farooq Husain, "Signals & Systems", Umesh Publications.

REFERENCE BOOKS:

1. S. Salivahanan, A. Vallavraj, C. Gnanapriya, "Digital Signal Processing", Tata McGraw Hill.
2. J. G. Proakis, D. G. Manolakis, "Digital Signal Processing, Principles, Algorithms, & Applications", Prentice-Hall India.
3. B. Kumar, "Signals and Systems", New Age International Publishers.

Course Articulation Matrix:

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

DIGITAL ELECTRONICS
PCC-ECE203-T

General Information of course

Course Credits: 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	Course Assessment Methods (Internal: 30; External: 70) Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Sr. No.	Course Outcomes: At the end of the semester, students will be able to:	RBT Level
CO 1	Define the fundamental concepts and techniques used in digital electronics.	L1
CO 2	Understand the minimization techniques to simplify the hardware requirements of digital circuits, implement it, design and apply for real time digital systems.	L2
CO 3	Demonstrate the working mechanism and design guidelines of different combinational, sequential circuits & logic families and their role in the digital system design.	L3
CO 4	Develop the nomenclature and technology in the area of memory devices and apply the memory devices in different types of digital circuits for real world application.	H3

Course Contents

UNIT-I

FUNDAMENTALS OF DIGITAL TECHNIQUES: Digital signal, logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra. Review of Number systems.
BINARY CODES: BCD, Excess-3, Gray, EBCDIC, ASCII, Binary arithmetic, Error detection and correction codes.
DIGITAL LOGIC FAMILIES: Switching mode operation of p-n junction, bipolar and MOS devices. Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families, Tristate logic.

UNIT-II

COMBINATIONAL CIRCUIT DESIGN: Circuit design using gates, adder, subtractor, comparator,BCD to seven segment, code converters etc.
COMBINATIONAL DESIGN USING GATES: Karnaugh map and Quine Mcluskey methods of simplification.
COMBINATIONAL DESIGN USING MSI DEVICES: Multiplexers and Demultiplexers and their use as logic elements, Decoders, Encoders, Adders / Subtractors, BCD arithmetic circuits.

UNIT-III

SEQUENTIAL CIRCUITS: S-R, J-K, T, D, master-slave, edge triggered, flip flop conversions. Shift registers, bidirectional shift register, sequence generators, Ring counters and Johnson Counter, Design of Asynchronous and Synchronous Counters.
FINITE STATE MACHINES: Timing diagrams (synchronous FSMs), Moore versus Mealy, - FSM design procedure- State diagram, State-transition table, State minimization, State encoding, Next-state logic minimization, Implement the design.

UNIT-IV

ADC AND DAC: Weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel -comparator, successive approximation, counting type,dual-slope ADC, specifications of ADCs.
MEMORIES AND PLD'S: ROM, PLA, PAL, FPGA and CPLDs, Implementation of combinational circuits using ROM, PLA and PAL.

TEXT BOOKS:

1. Modern Digital Electronics(Edition III) : R. P. Jain; TMH
2. Digital Fundamentals : Thomas L Floyd; Pearson
3. Digital circuits and design : S. Salivahanan; Oxford University Press

REFERENCE BOOKS:

1. Digital Integrated Electronics : Taub & Schilling; MGH
2. Digital Principles and Applications : Malvino & Leach; McGraw Hill.
3. Digital Design : Morris Mano; PHI.

Course Articulation Matrix:

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

ANALOG ELECTRONICS-I
PCC-ECE205-T

Course Credits : 3.0 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** :Two Minor Tests Each of 20 Marks, Class Performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of 70 Marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain 7 short answers type questions. Rest of the eight question is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Physics

Course Outcomes

Sr. No.	At the end of the semester, students will be able:	RBT Level
CO 1	To describe the characteristics of intrinsic and extrinsic semiconductors.	L1
CO 2	To explain the construction and operation of semiconductor devices.	L2
CO 3	To illustrate the use of semiconductor devices in electronic circuits.	L3
CO 4	To examine the analog circuit parameters and defend the usage of various semiconductor devices in it.	H1

Course Contents

UNIT-I

CONDUCTION IN SEMICONDUCTOR: Conductivity of a semiconductor, Carrier concentration in an intrinsic semiconductor, Fermi level in a Intrinsic and extrinsic semiconductor, Carrier lifetime, Continuity equation, Hall effect.

PN JUNCTIONS: Qualitative theory of PN junctions, PN junction as diode, zener diode, voltage doubler, band structure of an open circuited p-n junction, current components in a PN diode, PN diode Switching times, tunnel diode, rectifier with filter circuits, clippers, clampers.

UNIT-II

BJT : Review of BJT : construction – operation - characteristics, Ebers moll model, BJT as an amplifier and switch, limits of operation, thermal runaway, stability factor, bias stability of self bias-emitter bias- collector to base bias , bias compensation: thermistor and sensistor compensation, Ac and dc load line for a CE amplifier, Transistor hybrid model, h-parameter (CE, CB, CC), analysis of transistor amplifier circuit using h-parameter, simplified CE hybrid model, frequency response of RC coupled amplifier.

UNIT –III

MOSFET: Review of device structure- operation and V-I characteristics of JFETs and MOSFET (depletion and enhancement). MOSFET as a switch and amplifier, FET small signal model, common source amplifier, source follower, biasing the FET, FET as a voltage variable resistor.

UNIT-IV

SPECIAL SEMICONDUCTOR DEVICES: Gun diode, P-I-N diode, Schottky diodes, varactor diode, tunnel diode, photodiode, power diodes, photoconductive cell, IR emitters and receivers, LCD.

REGULATED POWER SUPPLIES: Series and shunt voltage regulators, three terminal fixed IC voltage regulator (78xx/79xx), adjustable voltage regulator (LM 317), SMPS.

TEXT BOOKS:

1. Electronics devices and Circuits(4e): Millman, Halkias and Jit ; McGrawHill
2. Electronics Devices & Circuits: Boylestad & Nashelsky ; Pearson
3. Electronic circuit analysis and design (Second edition): D.A.Neamen; TMH.

REFERENCE BOOKS:

1. Electronics Principles: Malvino ; McGrawHill
2. Electronics Circuits: Donald L. Schilling & Charles Belove ; McGrawHill
3. Microelectronics Circuits, theory and applications:Sedra & Smith;OXFORD

Course Articulation Matrix:

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

NETWORK ANALYSIS & SYNTHESIS
ESC-ECE207-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	Course Assessment Methods (Internal: 30; External: 70) Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Mathematics, Physics, Electrical Technology

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To relate time domain linear network with equivalent network in frequency domain using transformation technique.	L1
CO 2	To explain graph theory concepts for solving electrical networks.	L2
CO 3	To examine behaviour of electrical network on the basis of its transfer function.	H1
CO 4	To design two port networks for given transfer function.	H3

Course Contents

UNIT I

LAPLACE TRANSFORM: Introduction to Laplace transform & its properties, Laplace transform of special signal waveforms, Inverse Laplace transform, Use of Laplace Transform in solving electrical networks.
TRANSIENT RESPONSE: Initial Conditions of resistive, inductive & capacitive Elements, Time domain analysis of simple linear circuits: Transient & Steady state Response of RC, RL, RLC Circuits to various excitation signals such as step, ramp, impulse and sinusoidal excitations using Laplace transform.

UNIT II

NETWORK FUNCTIONS: Terminal pairs or Ports, Network functions for one-port and two-port networks, poles and zeros of Network functions, Restrictions on pole and zero Locations for driving point functions and transfer functions, Time domain behaviour from the pole-zero plot.
PARAMETERS OF TWO PORT NETWORKS: Relationship of two-port variables, short-circuit Admittance parameters, open circuit impedance parameters, Transmission parameters, hybrid parameters, relationships between parameter sets, Inter-connection of two port networks.

UNIT III

NETWORK SYNTHESIS: Concept & significance of Positive real functions, concept ofnetwork synthesis, driving point immittance function structure of LC network, LC network synthesis using foster and cauer form, driving point immittance function structure of RC & RL network, RC & RL network synthesis by Foster and Cauer form.

UNIT IV

NETWORK GRAPH THEORY: Concept of network graph , terminology used in network graph, relation between Twigs and Links, properties of tree in a graph, formation of incidence Matrix[Ai], number of trees in a graph, Graph matrices: cut-set matrix, tie set matrix, formulation of network equilibrium equations, network analysis using graph theory.

FILTERS: Introduction to filters, Characteristics of filters, Filter Classification, Passive Filters: Analysis & Design of prototype HPF, LPF, BPF, & BSF, introduction to m-derived filters, Active Filters: Introduction of active filters.

TEXT BOOKS:

1. Engineering Network Analysis & Filter Design: G.G Bhise, P.R Chadha, D.C Kulshreshtha;Umesh Publication.
2. Circuit Theory: A Chakrabarty; Dhanpat Rai Publication.
3. Network Analysis: Van Valkenburg; PHI.

REFERENCE BOOKS:

1. Network Analysis & Synthesis: S.P Ghosh; McGraw Hill.
2. Network Analysis & Synthesis: K.M. Soni;S.kKataria& Sons Publication.
3. Network Analysis & Synthesis:F.F.Kuo; John Wiley & Sons Inc.

Course Articulation Matrix:

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

ELEMENTS OF MECHANICAL ENGINEERING
ESC-ME202-T

General Course Information

Course Credits: 3.0 Contact Hours: 3 hours/week Mode: Lectures Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Two minor tests each of 20 marks, Class Performance measured through percentage of lectures attended (4 marks) Assignment and quiz (6 marks), and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the remaining four units. All questions carry equal marks.

Sr. No.	Course Outcome **At the end of the semester students will be able:**	RBT Level
CO1	To define and tell about basic mechanical engineering devices/machines.	L1
CO2	To classify and explain elements of mechanical engineering.	L2
CO3	To demonstrate the working operations of various basic mechanical engineering devices/machines.	L3
CO4	To examine the performance of various basic mechanical engineering devices/machines.	H1

Course Contents

UNIT-I

Properties of Steam & Boilers: Introduction, Formation of steam at constant pressure, Thermodynamics properties of steam, Steam boilers, Requirements of a good boiler, Classification of boilers, Constructional and operational details of Cochran and Babcock and Wilcox boilers, Comparison of water and fire tube boilers, mounting and accessories with their functions.

Steam Turbines and Condensers: Working principle of steam turbine, Classification of steam turbines, Comparison of impulse and reaction turbines, Compounding of impulse turbine, Steam condensers: Elements of steam condensing plant, Types of steam condensers, Cooling ponds and cooling towers.

UNIT-II

I.C. Engines: Introduction, Classification, I.C. Engines basic terminology, engine parts and their functions, Constructional details and working of two-stroke and four-stroke diesel and petrol engines, Otto and Diesel cycles, comparison of petrol and diesel engines.

Water Turbines and Pumps: Introduction, Classification of hydraulic turbines, Construction details and working of Pelton, Francis and Kaplan turbines, Classification of water pumps, constructional and working of centrifugal and reciprocating pumps.

UNIT-III

Simple Lifting Machines: Introduction, Basic concepts and definition, reversible and irreversible machines, Laws of machines, Simple wheel and axle, Single and double purchase winch crabs, Simple and differential screw jacks, Problems.

Power Transmission Devices: Introduction, Belt drive, Rope drive, Chain drive, Gear drive, Types of gears, gear trains, Clutches: single plate and multi plate clutches.

UNIT-IV

Stresses and Strains: Introduction, types of Stresses and strains, elastic limit, Hooks law, stress-strain diagram, factor of safety, Poison's ratio, Elastic constants & their relationships, thermal stresses, stress and strains in simple and compound bars under axial loading, Problems.

Shear Force and Bending Moment: Introduction, types of beams, types of loads, SF and BM diagrams for cantilever and simply supported beam, Calculation of maximum SF, BM and point of contra-flexure under the loads of (i) concentrated load (ii) uniformly distributed load (iii) combination of concentrated and uniformly distributed loads, Problems.

Text and Reference Books:

1. Elements of Mechanical Engineering – Mahesh Kumar, I.K. International, 2013
2. Elements of Mechanical Engineering- R.K. Rajput; Laxmi Publications
3. Basics of Mechanical Engineering - Mridual Singal and R. K. Singal; I.K International
4. Basics of Mechanical Engineering- D.S. Kumar, Pub. – Kataria & Sons, New Delhi.
5. Basics of Mechanical Engineering – Sadhu Singh; S.Chand
6. Hydraulic Machines – Jagdish Lal, Pub.- Metropolitan, Allahbad.
7. Thermal Science and Engineering – D.S. Kumar, Pub. – Kataria & Sons, New Delhi.

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

DIGITAL ELECTRONICS LAB
PCC-ECE203-P

Course Credits: 1 Contact Hours: 2/week per group(L-T-P: 0-0-2) Mode: Lab Work	Course Assessment (Internal: 30; External: 70)

Course Outcomes:

Sr. No.	At the end of the semester, students will be able to:	RBT Level
CO 1	Describe the various digital IC's and understand their operation.	L1
CO 2	Understand Boolean Laws to simplify the digital circuits.	L2
CO 3	Demonstrate basic combinational circuits and verify their functionalities.	L3
CO 4	Develop the design procedures to design basic sequential circuits.	H3

List of Experiments

1. Study of TTL gates – AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR. Realization of basic gates using Universal logic gates.
2. Design & realize a given function using K-maps and verify its performance.
3. Design and realize adder and subtractor circuits.
4. Design and realize comparator and parity generator circuits.
5. Design and realize 3 bit binary to gray code converter.
6. Implementation of multiplexer encoder using logic gates.
7. Implementation and verification of Decoder/De-multiplexer.
8. To verify the truth tables of S-R, J-K, T & D type flip flops.
9. Design a 4-bit shift-register and verify its operation.
10. Design, and verify the 4-bit synchronous counter.
11. Design, and verify the 4-bit asynchronous counter.
12. Design, and verify the 4-bit ring counter and twisted ring counter.
13. To design and verify the operation of synchronous decade counter using J K flip-flops.
14. To design and verify the operation of asynchronous decade counter using T flip-flops.
15. Simple project (Any topic related to the scope of the course).

NOTE:
At least eight experiments are to be performed in the semester, out of which atleast six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

ANALOG ELECTRONICS-I LAB
PCC-ECE205-P

Course Credits: 2 Contact Hours: 4/week (L-T-P: 0-0-4) Mode : Lab Work	**Course Assessment Method : (Internal: 30; External: 70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To trace the characteristics of semiconductor devices.	L1
CO 2	To identify the various electronic components and differentiate them based upon their characteristics.	L2
CO 3	To demonstrate simple applications of semiconductor devices.	L3
CO 4	To test the electronic component and circuits; and to carry experimentation with them	L4

List of Experiments

1. To study V-I characteristics of diode.
2. To design and study the characteristics of half wave rectifier with filter circuit.
3. To design and study the characteristics of full wave rectifiers with filter circuit.
4. To study of Zener diode as a voltage regulator.
5. To design clipper circuits and observe their output waveforms.
6. To design the clamper circuits and observe their output waveforms.
7. To design the dc voltage doubler.
8. To study the characteristics of CB configurations of a transistor.
9. To study the characteristics of CE configurations of a transistor.
10. Study of CC amplifier as a buffer.
11. Study of transistor as a constant current source in CE configuration.
12. To study the V-I characteristics of FET in CS configuration.
13. To study the V-I characteristics of FET in CD configuration.
14. To study the frequency response of RC coupled amplifier.
15. To study the 3-terminal IC voltage regulators.
16. Study of IR diode (IR-emitter) and photodiode (IR receiver).
17. Study of opto-coupler (opto-isolator).
18. Simple project (Any topic related to the scope of the course).

Note: Atleast 12 experiments are to be performed in the semester, out of which minimum 8 experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

NETWORK ANALYSIS & SYNTHESIS LAB
ESC-ECE207-P

Course Credits: 1 Contact Hours: 2 week per group (L-T-P: 0-0-2) Mode : Lab Work	**Course Assessment Methods (Internal: 30; External: 70)**

Pre-requisites: Electrical Technology.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	To relate theoretical concepts with practical experiments.	L1
CO 2	To apply theoretical concepts related to two-port network parameters on hardware.	L3
CO 3	To examine theoretical concepts related to transient response on hardware.	H1
CO 4	To evaluate and judge performance of various active filters.	H2

List of Experiments

1. To study the step response of series RC circuit.
2. To study the step response of series RL circuit.
3. To study of phenomenon of resonance in RLC series circuit.
4. To calculate and verify "Z" parameters of a two port network.
5. To calculate and verify "Y" parameters of a two port network.
6. To calculate and verify "ABCD" parameters of a two port network.
7. To calculate and verify "H" parameters of a two port network.
8. To determine equivalent parameter of parallel connections of two port network.
9. To plot the frequency responses of low pass filter (LPF) and determine half-power frequency.
10. To plot the frequency responses of high pass filter (HPF) and determine the half-power frequency.
11. To plot the frequency responses of band-pass filters (BPF) and determine the band-width.
12. To synthesize a network of a given network function and verify its response.

Note: At least eight experiments are to be performed in the semester, out of which atleast six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

Detailed Syllabus

of

B.Tech.(ECE)

4th semester

01-VII-2019

1/7/19

ELECTRONIC MEASUREMENTS & INSTRUMENTATION
PCC-ECE202-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	Course Assessment Methods (Internal: 30; External: 70) Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Knowledge of basic electronic components.

Sr. No.	Course Outcomes **At the end of the semester, students will be able to:**	RBT Level
CO 1	Define the fundamental concepts and techniques used in electronic measurements and instrumentation.	L1
CO 2	Understand and explain construction and working of various measuring instruments.	L2
CO 3	Execute the knowledge of waveform generators, waveform analyzers, transducers.	L3
CO 4	Compare and categorize waveform generators, waveform analyzers, transducers.	H1

Course Contents

UNIT-1

INTRODUCTION: Introduction of Measurement, Classification of Measurement Errors, Instrument Accuracy, accuracy & Precision, Resolution, Significant Figures, Analog Multimeter, digital Multimeter, digital Frequency meter, Digital measurement of time, Digital measurement of frequency(Mains), Digital tachometer, Digital pH meter.Q meter

UNIT-II

OSCILLOSCOPES: Block Diagram based Study of CRO, vertical amplifier, Horizontal Deflecting System, Role of Delay Line, Typical CRT connections, Dual-Trace CROs, Measurement using Oscilloscope-Measurement of Voltage, Frequency, Phase Difference, Rise Time, Fall Time, Lissajous Figures in Detection of Frequency and Phase, Digital Storage Oscilloscope (DSO), Applications of DSO.

UNIT –III

GENERATION & ANALYSIS OF WAVEFORMS: Low frequency Signal Generators, function generators, pulse generators, R.F signal generators, Sweep frequency generators, frequency synthesizer, Basic wave analyzer, Frequency selective wave analyzer, heterodyne wave analyzer, harmonic distortion analyzers, spectrum analyzer.

UNIT-IV

TRANSDUCERS: Introduction, Electrical transducer, Selection Criteria of Transducers, Transducers types: Resistive transducer, Inductive transducer, capacitive transducer, Thermal transducer, optoelectronic transducer, Piezoelectric transducers. Introduction to Analog and Digital Data Acquisition Systems and Telemetry.

TEXT BOOKS:

1. Electronic Instrumentation and Measurements : David A Bell; Oxford
2. Electronic Instrumentation : H.S.Kalsi ;TMH,2ndEdition
3. A course in Electrical & Electronics Measurements & Instrumentation : A.K.Sawhney; Dhanpat Rai .

REFERENCE BOOKS:

1. Electronic Instrumentation And Measuring Techniques: W.D. Cooper; PHI
2. Modern Electronic Instrumentation & Measuring Techniques: Helfrick & Copper ; PHI
3. Measurement Systems: E.O.doebilin ; McGraw Hill

Course Articulation Matrix:

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

ANALOG & DIGITAL COMMUNICATION
PCC-ECE-204-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	Course Assessment Methods (Internal: 30; External: 70) Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Basics of Electronic circuits and introductory concepts of communication science.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To describe the basic principles of communication system.	L1
CO 2	To explain the generation & detection of modulated signals.	L2
CO 3	To evaluate the performance of signal under effects of noise.	H1
CO 4	To examine information signals against various impairments & limitations.	H2

Course Contents

UNIT-I

AMPLITUDE MODULATION: Basic block diagram, Modulation, Amplitude (Linear) Modulation: Linear Modulation Schemes, Generation of AM, Envelope Detector, DSB-SC Product Modulator, Coherent Detection, VSB Modulator and Demodulator, Noise in AM Receiver using Envelope detection, Threshold Effect.

UNIT-II

ANGLE MODULATION: Types of Angle Modulation, Relation between FM and PM, Narrow Band FM, Wideband FM, Transmission Bandwidth of FM Signals, Generation of FM using Direct and Indirect method, Pre-emphasis and De-emphasis in FM. FM Demodulators: Slope detector, Balanced Slope Detector, Foster-Seeley Discriminator, Ratio Detector, PLL demodulator.

UNIT –III

PULSE MODULATION: Sampling Process, PAM, PWM, PPM, Quantization, PCM, DPCM, ADPCM, Noise in PCM System, Companding, Comparison of the Noise Performance of AM,FM,PCM and DM.

NOISE ANALYSIS: External Noise, Internal Noise, White Noise, Narrow Band Noise, Representation of Narrow Band noise in-phase and Quadrature Components, Noise Figure, Noise Bandwidth, Noise Temperature.

UNIT-IV

DIGITAL MODULATION: General description of ASK, FSK and PSK. Transmission, Reception and Signal space representation: BPSK, DPSK, QPSK, M-ary PSK, ASK, QASK, BFSK, M-ary FSK, MSK. Power spectra of digitally modulated signals. Performance comparison of different digital modulation schemes.

TEXT BOOKS:

1. B.P. Lathi, Modern Digital & Analog Communication Systems, 3rd Edn, Oxford University Press, Chennai, 1998.
2. A Bruce Carlson, PB Crilly, JC Rutledge, Communication Systems, 4 th Edn, MGH, New York, 2002.
3. George Kennedy, Bernard Davis& SRM Prasanna, "Electronic Communication Systems", 5th Edition, McGraw Hill.

REFERENCE BOOKS:

1. John G. Proakis, Digital Communication, PHI.
2. Taub & Schilling, Principles of Communication, TMH.
3. Simon Haykin, "Communication Systems", 4th Edition, Wiley.

Course Articulation Matrix:

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

ANALOG ELECTRONICS II
PCC-ECE206-T

Course Code : Course Credits : 3.0 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	Course Assessment Methods (Internal: 30; External: 70) Two Minor Tests Each Of 20 Marks, Class Performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of 70 Marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain 7 short answers type questions. Rest of the eight question is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Analog Electronics-I.

Sr. No.	Course Outcomes At the end of the semester, students will be able:	RBT Level
CO 1	To describe various amplifiers and oscillator circuits.	L1
CO 2	To explain the construction and operation of semiconductor devices and to demonstrate their use in electronics circuits.	L2
CO 3	To operate the different circuits for amplifiers, power amplifiers and oscillator categories.	L3
CO 4	To design the various analog circuits based upon their performance.	H1

Course Contents

UNIT-I

AMPLIFIER: Distortions in amplifier, General frequency consideration, frequency response of an amplifier, RC coupled amplifier, frequency response of an RC coupled stage, Cascaded CE transistor stages, Gain and bandwidth considerations, step response of an amplifier, bandpass of cascaded stages, effect of an emitter(or a source) bypass capacitor on low frequency response.

UNIT –II

POWER AMPLIFIERS: Class A, B, and C operations; Class A large signal amplifiers, Second and higher order harmonic distortion, efficiency, transformer coupled power amplifier, Class B amplifier: efficiency & distortion, push-pull amplifiers, class AB operation.

UNIT-III

FEEDBACK AMPLIFIERS: Classification of amplifiers, Feedback concept, transfer gain with feedback, general characteristics of negative feedback amplifiers, effect of negative

feedback on input and output resistance, voltage series feedback, current series feedback, current shunt feedback, voltage shunt feedback.
OSCILLATORS: Sinusoidal oscillators, Barkhausen criteria, R-C phase shift oscillator, resonant circuit oscillator, general form of oscillator circuit, wien-bridge oscillator, and crystal oscillator.

UNIT-IV

PNPN DEVICES: Thyristor, SCR, SCS, GTO, light activated SCR, Shockley diode, DIAC, TRIAC, UJT, phototransistor, opto-isolator.
FREQUENCY RESPONSE OF TRANSISTORS: Emitter Follower, Miller's theorem, Hybrid –pi common emitter transistor model, CE emitter short circuit current gain, frequency response, beta cut-off frequency, gain bandwidth product.

TEXT BOOKS:
1. Electronics devices and Circuits (4e): Millman, Halkias and Jit ; McGrawHill
2. Electronics Devices & Circuits: Boylestad & Nashelsky ; Pearson
3. Electronic circuit analysis and design (Second edition): D.A.Neamen; TMH.

REFERENCE BOOKS:
1. Electronics Principles: Malvino ; McGrawHill
2. Electronics Circuits: Donald L. Schilling & Charles Belove ; McGrawHill
3. Microelectronics Circuits, theory and applications:Sedra & Smith;OXFORD

ANALOG ELECTRONICS II
PCC-ECE206-T

Course Articulation Matrix:

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

ELECTROMAGNETIC THEORY
PCC-ECE208-T

Course Code : Course Credits : 3.0 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	Course Assessment Methods (Internal: 30; External: 70) Two Minor Tests Each Of 20 Marks, Class Performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of 70 Marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain 7 short answers type questions. Rest of the eight question is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Microprocessor, Digital electronics.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To define and recognize different coordinate systems and vector calculus to describe the spatial variations of the physical quantities dealt in electromagnetic field theory as they are functions of space and time.	L1
CO 2	To explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields (Field intensity, Flux density etc.) in different media using the fundamental laws.	L2
CO 3	To apply Maxwell's equations to find solution of EM Wave for Homogeneous, Isotopic Dielectric and Conducting medium.	L3
CO 4	To evaluate various transmission line parameters using Smith Chart.	H2

Course Contents

UNIT-I

STATIC ELECTRIC FIELDS: Coulomb's Law, Gauss's Law, potential function, field due to a continuous distribution of charge, equi-potential surfaces, Gauss's Theorem, Poison's equation, Laplace's equation, method of electrical images, capacitance, electro-static energy, boundary conditions, the electro-static uniqueness theorem for field of a charge distribution, Dirac-Delta representation for a point charge and an infinitesimal dipole.

UNIT-II

STEADY MAGNETIC FIELDS: Faraday Induction law, Ampere's Work law in the differential vector form, Ampere's law for a current element, magnetic field due to volume distribution of current and the Dirac-delta function, Ampere's Force Law, magnetic vector potential, vector potential (Alternative derivation), far field of a current distribution, equation of continuity.

UNIT-III

TIME VARYING FIELDS: Equation of continuity for time varying fields, inconsistency of Ampere's law, Maxwell's field equations and their interpretation, solution for free space conditions, electromagnetic waves in a homogeneous medium, propagation of uniform planewave, relation between E & H in a uniform plane-wave, wave equations for conducting medium, Maxwell's equations using phasor notation, wave propagation in a conducting medium, conductors, dielectrics, depth of penetration, polarization, linear, circular and elliptical.

UNIT-IV

REFLECTION AND REFRACTION OF EM WAVES: Reflection and refraction of plane waves at the surface of a perfect conductor & perfect dielectric (both normal incidence as well as oblique incidence), Brewester's angle and total internal reflection, reflection at the surfaces of a conductive medium, surface impedance, poynting theorem, interpretation of E x H, power loss in a plane conductor.

TRASMISSION LINE THEORY: Transmission line as a distributed circuit, transmission line equation, travelling, standing waves, characteristic impedance, input impedance of terminated line, reflection coefficient, VSWR, Smith's chart and its applications.

TEXT BOOKS:

1. Electro-magnetic Waves and Radiating System: Jordan & Balmain, PHI.
2. Anteena & Wave Propagation: K.D. Prasad, Satya Prakashan.
3. Field and Wave Electromagnetics: David K. Cheng, Pearson, Second Edition.

REFRENCE BOOKS:

1. Engineering Electromagnetics by William Hayt, TATA McGraw-Hill.
2. Engineering Electromagnetics: Umran S. Inan & Aziz S. Inan, Pearson.
3. Electro-Magnetics: Krauss J.DF: Mc Graw Hill.

Course Articulation Matrix:

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

ELECTRONIC MEASUREMENTS & INSTRUMENTATION LAB
PCC-ECE202-P

Course Credits : 2 Contact Hours : 4 per week per group (L T P : 0 0 4) Mode : Lab Work	**Course Assessment (Internal: 30; External: 70)**

Pre-requisites: Knowledge of basic electronic components.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able to :**	**RBT Level**
CO 1	Describe measuring instruments.	L1
CO 2	Understand and explain working of waveform generators, waveform analyzers, and transducers.	L2
CO 3	To operate various measuring instruments.	L3
CO 4	To analyze performance of waveform generators, waveform analyzers, transducers.	H1

List of Experiments

1. To find Resolution, accuracy & Precision for analog multi meter.
2. To analyze digital multimeter for various measurements.
3. To study the front panel controls of CRO.
4. To find frequency, time and phase difference for waveforms of choice using CRO
5. To find rise time and fall time for waveforms of choice using CRO
6. To study and observe Lissajous Figures on CRO.
7. To study the front panel controls of function generator.
8. To find and observe harmonics of waveforms of choice using spectrum analyzer.
9. To study measurement of different components & parameters like Q of a coil etc using LCR Q meter.
10. To find least count of micrometer.
11. To study and analyze working of LVDT.
12. To measure distance using LDR.
13. To measure temperature using R.T.D.
14. To measure temperature using Thermocouple.
15. To measure strain using Strain Gauge.
16. To measure pressure using Piezo-Electric Pick up.
17. To measure distance using Capacitive Pick up.
18. To measure distance using Inductive Pick up.
19. To measure speed of DC Motor using Magnetic Pick up.
20. To measure speed of DC Motor using Photo Electric Pick up.

NOTE: At least twelve experiments are to be performed in the semester, out of which at least eight experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

ANALOG AND DIGITAL COMMUNICATION LAB
PCC-ECE204-P

Course Code Course Credits : 1 Contact Hours: 2 hours/week Mode : Lab Work	Course Assessment Methods (Internal: 30; External: 70)

Sr. No.	**Course Outcomes** ***At the end of the semester, students will be able:***	***RBT Level***
CO 1	To describe the modulation and demodulation process in analog and digital communication system.	L1
CO 2	To illustrate simple analog communication systems	L2
CO 3	To compare digital modulation signals for ASK, BPSK, QPSK and FSK and perform their detection	H1
CO 4	To design a simple project on the digital communication system	H2

List of Experiments

1. Familiarization with the control panel and various measurements using CRO & Function Generator.
2. Study of Amplitude Modulation & Demodulation and determination of Modulation index.
3. Study of Frequency Modulation and Demodulation.
4. Study of Pulse Amplitude Modulation and Demodulation.
5. Study of Pulse Width Modulation and Demodulation.
6. Study of Pulse Code Modulation.
7. Study of ASK Modulation Technique.
8. Study of FSK Modulation Technique.
9. Study of BPSK Modulation Technique.
10. Study of QPSK Modulation Technique
11. Simple project (Any topic related to the scope of the course).

Note: Atleast eight experiments are to be performed in the semester, out of which minimum six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

ANALOG ELECTRONICS - II LAB
PCC-ECE206-P

Course Credits: 2 Contact Hours: 4/week per group (L-T-P: 0-0-4) Mode: Lab Work	Course Assessment(Internal: 30; External: 70)

Pre-requisites: Analog Electronics-I Lab.

Sr. No.	Course Outcomes At the end of the semester, students will be able:	RBT Level
CO 1	To trace the characteristics of semiconductor devices.	L1
CO 2	To identify the various electronic components and differentiate among them based upon their characteristics.	L2
CO 3	To demonstrate the applications of semiconductor devices.	L3
CO 4	To design various analog circuits and evaluate their parameters.	H2

List of Experiments

1. To study the characteristics of UJT.
2. To study the characteristics of DIAC.
3. To study the characteristics of TRIAC.
4. To study the characteristics of SCR.
5. To design a BJT Darlington emitter follower and determine the gain.
6. To design and study Class A power amplifier.
7. To design and study Class B power amplifier.
8. To design and study Class A-B push-pull power amplifier.
9. To design and study class C power amplifier.
10. To design and study the frequency response of a RC coupled amplifier.
11. To study the effect of BJT voltage series feedback amplifier and determine the gain, frequency response, input and output impedance with and without feedback.
12. To study the effect of FET voltage series feedback amplifier and determine the gain, frequency response, input and output impedance with and without feedback
13. To study the RC phase shift oscillator circuit.
14. To study the Wein bridge oscillator circuit.
15. To study the Hartley's oscillator circuit.
16. To study the Colpitt's oscillator circuit.
17. Simple project (Any topic related to the scope of the course).

NOTE: At least 12 experiments are to be performed in the semester, out of which at least 8 experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

Detailed Syllabus

of

B.Tech.(ECE)

5th semester

MICROWAVE ENGINEERING
PCC-ECE301-T

Course Credits : 3.0 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Electromagnetic Theory

Sr. No.	Course Outcomes At the end of the semester, students will be able:	RBT Level
CO 1	To define the basic concepts of waveguide & wave propagation	L 1
CO 2	To Illustrate the operations and principals of various microwave components and devices	L 2
CO 3	To describe the microwave component layouts.	L 3
CO 4	To examine the performance of different microwave devices.	H 1
CO 5	To design different microwave component structures for various applications.	H 2
CO 6	To Evaluate the performance of active microwave devices.	H 3

Course Contents

UNIT-1

WAVEGUIDES & MICROWAVE COMPONENTS: Introduction, propagation in TE and TM mode, rectangular wave guide, tem mode in rectangular wave guide, characteristic impedance, introduction to circular waveguides and planar transmission lines, s-parameters, scattering matrix and its properties, directional couplers, microwave tees, irises, posts and tuning screws, attenuators, cavity resonators, re-entrant cavities, mixers & detectors, matched load, *phase shifter, wave meter, ferrite devices.*

UNIT-II

MICROWAVE TUBES & MEASUREMENTS: Limitation of conventional tubes; Construction and Operation Principal of Two Cavity Klystron amplifier, Reflex Klystron, Magnetron (Cylindrical Magnetron and description of Π mode), TWT, BWO, Crossed field amplifiers, Measurement of Power, VSWR, frequency, attenuation, insertion loss, wavelength and impedance.

UNIT –III

MICROWAVE SOLID STATE DEVICES: Transferred Electron Devices- GUNN EFFECT; Negative Differential Resistance Phenomenon, field domain formation, GUNN diode structure, Varactor diode, Tunnel diode, Schottky diode, IMPATT, TRAPATT, BARITT and PIN diodes. MASER, Parametric amplifiers.

UNIT-IV

MODERN TRENDS IN MICROWAVES ENGINEERING: Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference/ Electromagnetic Compatibility (EMI / EMC), Monolithic Microwave IC fabrication, RF MEMS for microwave components, Microwave Imaging, microwave propagation, microwave Antennas

TEXT BOOKS:

1. Microwave devices and circuits: Samuel Liao; PHI.
2. Microwave devices & Radar Engg: M. Kulkarni; Umesh Publications.
3. Microwave Engineering: Annapurna Das, S. K. Das, MCGraw Hill Education.

REFERENCE BOOKS:

1. Microwaves and Radar: A.K. Maini; Khanna.
2. Microwave Engineering, David M. Pozar, Wiley.
3. Microwave & Radar Engg, Dr. A. K. Gautam, katson Books.

Course Articulation Matrix:

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

EMBEDDED SYSTEM DESIGN
PCC-ECE303-T

Course Credits: 3.0 Contact Hours: 3/week, (L-T-P: 3-0-0) Mode: Lectures and Tutorials Examination Duration: 3 hours	Course Assessment Methods (internal: 30; external: 70) Two minor tests each of 20 marks. Class Performance measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks), and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the remaining four units. All questions carry equal marks.

Pre-requisites: Microprocessor, Digital electronics.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO 1	Describe the evolution of processor architectures.	L1
CO 2	Describe the instruction set of Microcontroller.	L2
CO 3	Apply instruction set in writing assembly language programs.	L3
CO 4	Evaluate the performance of timers and counters in real-time response.	H1
CO 5	Design an Embedded System for various applications.	H2

Course Contents

UNIT-I

PIC MICROCONTROLLER ARCHITECTURE: Introduction to PIC Microcontrollers, Processor Architectures: Harvard vs. Von Neumann, CISC vs. RISC, Comparison between PIC10, PIC12, PIC14, PIC16, PIC18 devices. PIC 16 Microcontroller, Architecture and pipelining, Block diagram, program memory considerations, Addressing modes, CPU Registers, Instruction set, simple operations.

UNIT-II

INTERRUPT AND I/O PORTS OF PIC MCU: Interrupt logic, Timer2 scalar initialization, Interrupt service routine, Loop time subroutine, External interrupts and timers, Synchronous serial port module, Serial peripheral device, Output port expansion, Input port expansion, UART.

UNIT-III

PROGRAMMING WITH PIC MICROCONTROLLER: Arithmetic operations, Bit addressing, Loop control, stack operations, subroutines, RAM direct addressing, State machines, Oscillators, Timer interrupts, memory mapped input/output. Development tools/environments, assembly language programming style, interpreters, high level languages, Intel hex format object files. Debugging.

UNIT-IV

DESIGNING WITH PIC MICROCONTROLLER: PWM Motor control, Temperature sensor, Pressure sensor, DC Motor, Stepper motor, Servo motor, Analog to digital converter, Digital to analog converter, seven segment display, LCD interfacing with PIC 16 Microcontroller.

Text Books:

1. "Design with PIC Microcontroller", by John B. Peatman, Pearson.
2. "PIC Microcontroller and Embedded Systems: using assembly and C for PIC 18" by Muhammad Ali Mazidi, Pearson.

Reference Books:

1. "Microcontroller Programming: the Microchip PIC", by Julio Sanchez, Maria P. Canton, CRC Press.
2. "Embedded C programming and the microchip PIC" by Richard H. Barnett, Larry O' Cull, Delmar Cengage Learning.

Course Articulation Matrix:

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

DATA STRUCTURES AND APPLICATIONS
ESC-ECE307-T

General Course Information

Course Credits : 3.0 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor Tests Each of 20 Marks, Class Performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of 70 Marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain 7 short answers type questions. Rest of the eight question is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Programming in C

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	Describe various types of data structures and operations that can be implemented on these data structures.	L1
CO 2	Demonstrate the use of various data structures and their related operations.	L2
CO 3	Apply data structure to solve computational problems.	L3
CO 4	Compare the suitability of alternative data structures and prescribed operations for various problem situations.	H2
CO 5	Defend solutions with respect to effective storage of data and efficiency of the required operations for solving real world problems.	H3

Course Content

UNIT I

Introduction to data structures and their types. Abstract data types, linear lists: Arrays and linked lists: memory representations, implementing operations like traversing, searching, inserting and deleting etc. Applications of arrays and linked lists. Representing sets and polynomials using linked lists.

UNIT II

Stack and Queue: Static and linked implementations. Operations and Applications. Circular queues. Tress. Binary trees and related terminology. Tree traversals (Recursive), Threaded Binary Trees, Binary Search Trees implementation and operations, Priority queues.

UNIT III

Height Balanced or AVL trees and B trees. Graph definitions and related terminology, memory representations and related operations (traversal, insertion, deletion, search), Path Matrix, Warshall's Shortest path algorithm Hashing, Hash tables, hash function and collision resolution.

UNIT IV

Sequential and binary search. Sorting algorithms: Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Count sort, Heap sort. Comparison of searching and sorting techniques based on their complexity analysis, Time and space complexity of algorithms: Asymptotic analysis, Big O, Omega, Theta notations.

Text Books:

1. Aho, A. V., Ullman, J. D., and Hopcroft, J. E., Data Structures and Algorithms, Addison-Wesley, 1983.
2. LangsamYedidyah, Augenstein J Moshe, Tenenbaum M Aaron, Data Structures using C and C++, 3rd edition, PHI, 2009.
3. Cormen, T. H., Leiserson, C. E., Rivest, R. L. and Stein, C., Introduction to Algorithms, MIT Press, 2009.

Reference Books:

1. Robert L. Kruse, Data Structure and Program Design in C, Pearson Education India, 2007.
2. Weiss, M. A., Data Structures and Algorithm Analysis in C++, Addison-Wesley, 2007.
3. Sahni, S., Data Structures, Algorithms, and Applications in C++, WCB/McGraw-Hill, 2001.

Course Articulation Matrix:

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

CONTROL SYSTEM ENGINEERING
ESC-ECE309-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Mathematics, Physics, Electrical Technology

Sr. No.	Course Outcomes At the end of the semester, students will be able:	RBT Level
CO 1	To define various types of control systems and feedback control mechanism.	L1
CO 2	To describe various time domain and frequency domain tools used for the analysis and design of linear control systems.	L2
CO 3	To illustrate and interpret time domain analysis of 2[nd] order system.	L3
CO 4	To test the stability of the system using techniques based on transfer function of system.	H1
CO 5	To evaluate and design compensation networks and controllers.	H2

Course Contents

UNIT I

INPUT / OUTPUT RELATIONSHIP: System / Plant model, illustrative examples of plants & their inputs and outputs, open loop & closed loop control system & their illustrative examples, mathematical modeling and representation of physical systems, Concept of transfer function, relationship between transfer function and impulse response, order of a system, block diagram algebra, signal flow graphs: Mason's gain formula & its application, characteristic equation, derivation of transfer functions of electrical and electromechanical systems.

UNIT II

TIME DOMAIN ANALYSIS: Typical test signals, time response of first order systems to various standard inputs, time response of 2nd order system to step input, time domain specifications, steady state error and error constants, concept of stability, pole-zero configuration and stability, necessary and sufficient conditions for stability, Hurwitz stability criterion, Routh stability criterion and relative stability. Root locus concept, development of root loci for various systems, stability considerations.

UNIT III

FREQUENCY DOMAIN ANALYSIS: Relationship between frequency response and time-response for 2nd order system, polar, Nyquist, Bode plots, stability, Gain-margin and Phase Margin, relative stability, frequency response specifications.

UNIT IV

COMPENSATION: Necessity of compensation, compensation networks, application of lag and lead compensation, basic modes of feedback control, proportional, integral and derivative controllers.

CONTROL COMPONENTS: Synchros, servomotors, stepper motors, magnetic amplifier.

TEXT BOOK:

1. Control System Engineering: I.J. Nagrath & M. Gopal; New Age Publishers.
2. Automatic Control Systems: B.C. Kuo, PHI. Publishers.
3. Control System Engineering: U.A. Bakshi,V.U. Bakshi;Technical Publications

REFERENCE BOOKS:

1. Modern Control Engg: K. Ogata; PHI. Publishers.
2. Control Systems - Principles & Design: Madan Gopal; Tata Mc Graw Hill. Publishers.
3. Modern Control Engineering, R.C. Dorf & Bishop; Addison-Wesley Publishers.

Course Articulation Matrix:

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

MICROWAVE ENGINEERING LAB
PCC-ECE301-P

Course Credits :1 Contact Hours: 2Hours/week Mode : Lab Work	**Course Assessment Methods (Internal: 30; External: 70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To state the practical concepts of generation of microwave signal	L1
CO 2	To describe the various parameters related to microwave components.	L2
CO 3	To classify various microwave components	L3
CO 4	To Examine the microwave frequency signals and how it is measured.	H1
CO 5	To evaluate microwave systems for different practical application.	H2
CO 6	To create a model for microwave frequency generation.	H3

List of Experiments

1. Study of wave guide components.
2. To study the characteristics of Reflex Klystron and determine its tuning range.
3. To measure frequency of microwave source and demonstrate relationship among guide dimensions, free space wave length and guide wavelength.
4. To measure VSWR of unknown load and determine its impedance using a smith chart.
5. To match impedance for maximum power transfer using slide screw tuner.
6. To measure VSWR, insertion losses and attenuation of a fixed and variable attenuator.
7. To measure coupling and directivity of direction couplers.
8. Study of Power Division in Magic Tee.
9. To measure insertion loss, isolation of a three port circulator.
10. To measure the Radiation Pattern and Gain of Waveguide Horn Antenna.
11. To study the V-I characteristics of GUNN diode.

Note: At least eight experiments are to be performed in the semester, out of which minimum six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

EMBEDDED SYSTEM DESIGN LAB
PCC-ECE303-P

General Course Information:

Course Credits: 2 Contact Hours: 4/week per group(L-T-P: 0-0-4) Mode: Lab Work	**Course Assessment** **(Internal: 30; External: 70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	Describe the procedure to write a program on MP Lab software.	L1
CO 2	Recognize the various modules available with the development board of PIC Microcontroller.	L2
CO 3	Apply instructions set to write assembly language programs.	L3
CO 4	Analyze real-time response of embedded systems.	H1
CO 5	Design and develop an embedded system using PIC Microcontroller.	H2

LIST OF EXPERIMENTS

1. Write an assembly language program to perform addition, subtraction, multiplication and division operation using PIC 16 Microcontroller.
2. Write an assembly language program to perform 16-bit addition and subtraction operation using PIC Microcontroller.
3. Write an assembly language program to perform the addition of a series of numbers using PIC Microcontroller.
4. Write an assembly language program to perform logical operations using PIC Microcontroller.
5. Write an assembly language program for delay calculation using PIC Microcontroller.
6. Write a program for the blinking of LED's using PIC Microcontroller.
7. Write an assembly language program to find the largest number from a given series.
8. Write an assembly language program to find the smallest number from a given series.
9. Write an assembly language program to sort a given number of series in ascending order.
10. Seven segment display interfacing with PIC Microcontroller.
11. LCD Interfacing with PIC Microcontroller.
12. DC Motor interfacing with PIC Microcontroller.
13. Stepper motor interfacing with PIC Microcontroller.
14. Servo motor interfacing with PIC Microcontroller.
15. Temperature sensor interfacing with PIC Microcontroller.
16. Accelerometer sensor interfacing with PIC Microcontroller.
17. Simple project (Any topic related to the scope of the course).

NOTE: At least twelve experiments are to be performed in the semester, out of which at least eight experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

Course Articulation Matrix:

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

Practical Training-I

General Course Information:

Course Code: INT-ECE311-P Course Credits: 1.0 Type: Compulsory Contact Hours: 2 hours per week (L-T-P: 0-0-2) Mode: Practical	**Course Assessment Methods (Internal: 100)** Assessment of Practical Training-I will be based on presentation/seminar delivered, viva-voce, report and certificate for the practical training taken at the end of 4th sem.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able to:**	RBT Level
CO 1	outline technical documents and give oral presentations related to the work completed	L1
CO 2	recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the industry	L2
CO 3	acquire and apply fundamental principles of engineering and an ability to work in actual working environment.	L3
CO 4	analyze practical application of the subjects taught during the course	H1
CO 5	develop social, cultural , global and environmental responsibilities as an engineer	H2
CO 6	identify, formulate and model problems and find engg. Solution based on a system approach	H3

Detailed Syllabus

of

B.Tech.(ECE)

6th semester

1.7.19

01-VII-2019

COMPUTER NETWORKS and IOT
PCC-ECE302-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questionsare to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Sr. No.	Course Outcomes At the end of the semester, students will be able:	RBT Level
CO 1	To understand networking of devices & describe the concepts of IOT.	L1
CO 2	Identify the different technologies used for information transfer.	L2
CO 3	Apply IOT to different applications.	L3
CO 4	Analysis and evaluate protocols used in IOT.	H1
CO 5	To analyze the data transfer on networks and troubleshooting of various possible errors.	H2
CO 6	Design and develop smart city in IOT.	H3

Course Contents

Unit-I

Uses of Computer Networks, History of computer networks, Introduction to models and layers: OSI & TCP/IP model.

Data Link Layer & LAN: Error-detection and correction techniques, Multiple access protocols, addressing, Ethernet, switches.

Unit-II

Transport Layer: Connection less transport (UDP), Principles of reliable data transfer, Connection oriented transport (TCP), Congestion control.

Network Layer: Introduction, Virtual and Datagram networks, study of router, IP protocol and addressing in the Internet

Application Layer: Web and HTTP, E-mail, DNS

Unit-III

Internet of things overview: Internet of Things definition evolution, IoT architectures, Resource management, IoT data management and analytics, Communication protocols, Internet of Things applications, Security, Identity management and authentication, Privacy, Standardization and regulatory limitations

Open source semantic web infrastructure for managing IoT resources in the cloud: Background/related work, Open IoT architecture for IoT/cloud convergence, Scheduling process and IoT services lifecycle, Scheduling and resource management, Validating applications and use cases, Future research directions

Unit-IV

The foundations of stream processing in IoT, Continuous Logic Processing System, Challenges and future directions

Distributed data analysis for IoT: Preliminaries, Anomaly detection, Problem statement and definitions, Distributed anomaly detection, Efficient incremental local modelling

Security & Reliability: Concepts, IoT security overview, Security frameworks for IoT, Privacy in IoT networks, IoT characteristics and reliability issues, Addressing reliability

TEXT BOOKS:

1. Data Communications and Networking (4th edition), Behrouz Forouzan, McGraw Hill
2. Internet of Things, Principles and Paradigms; Rajkumar Buyya, Elsevier

REFERENCE BOOKS:

1. Computer Networks; By: Tanenbaum, Andrew S; Pearson Education Pte. Ltd., Delhi,4th Edition
2. Computer Networks- A Top-Down approach, Behrouz Forouzan, McGraw Hill
3. The Internet of Things: From RFID to the Next-Generation Pervasive Networked LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning
4. Internet of Things (A Hands-on-Approach) , Vijay Madisetti , ArshdeepBahga
5. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally
6. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

Course Articulation Matrix:

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

VLSI DESIGN
PCC-ECE304-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor Tests Each Of 20 Marks, Class Performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of 70 Marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain 7 short answers type questions, Rest of the eight question is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Analog Electronics and Digital Electronics

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	Describe the MOS technology and its applications for VLSI design.	L1
CO 2	Illustrate the design equations and their analysis for VLSI circuit system.	L2
CO 3	Demonstrate the importance of CMOS design in VLSI system design.	L3
CO 4	Compare the various circuit topologies for digital VLSI design	H1
CO 5	Define and evaluate the layout of VLSI circuits.	H2
CO 6	Develop or create CMOS system for VLSI design.	H3

Course Contents

UNIT-I

REVIEW OF MOS TECHNOLOGY: Introduction to IC technology, MOS Transistor enhancement mode and depletion mode operations, fabrication of NMOS, CMOS and BiCMOS devices. Equivalent circuit for MOSFET and CMOS.

VLSI FABRICATION: Crystal growth, oxidation, diffusion, ion implantation, epitaxy, photo-lithography, etching, dielectric and polysilicon film deposition, metalization.

UNIT-II

MOS TRANSISTOR THEORY: MOS device design equations, Evaluation aspects of MOS transistor, threshold voltage, MOS transistor trans conductance & output conductance, figure of merit, Channel Length Modulation, Body Effect

MOS INVERTER: Introduction, nMOS inverter: resisive load, enhancement load, depletion load, determination of pull -up to pull-down ratio for an nMOS inverter driven by another nMOS inverter & by one or more pass transistor, CMOS inverter: DC characteristics, circuit model, Bi-CMOS logic, latch up in CMOS circuitry and BiCMOS , Latch up susceptibility.

UNIT –III

CMOS DESIGN: Gate Logic: inverter, nand gate, nor gate. Ratioed logic, pseudo NMOS logic, DCVSL Logic, Switch Logic: pass transistor and transmission gate, dynamic logic, charge sharing logic, domino logic. Combination logic: Parity generator, multiplexer. Sequential logic: two phase clocking, memory-latches and registers, setup and hold time violations, causes, effects and remedies.

CIRCUIT CHARACTERIZATION AND PERFORMANCE ESTIMATION: Sheet resistance, resistance estimation, capacitance estimation, inductance estimation, switching characteristic, propagation delays, CMOS gate transistor sizing, power dissipation: static and dynamics.

UNIT-IV

SCALING OF MOS CIRCUITS: Scaling models and scaling factors for device parameters, limitations of scaling: substrate doping, limits of miniaturization, limit of interconnect and contact resistance.

MOS CIRCUIT DESIGN PROCESS: MOS layer, stick diagram: NMOS Design style, PMOS Design style, CMOS design style, design rules and layout: lambda based design rule, layer representation, contact cuts, double metal MOS process rules, CMOS lambda based design rules.

DESIGN EXAMPLE USING CMOS : Incrementer/ decrementer, left/right shift serial/parallel register, comparator for two n-bit number, a two phase non-overlapping clock generator with buffered output on both phases, design of an event driven element for EDL system.

TEXT BOOKS :

1. Introduction to Digital Integrated Circuits : Rabaey,Chandrakasan & Nikolic.
2. Principles of CMOS VLSI Design : Neil H.E. Weste and Kamran Eshraghian; Pearson.
3. Integrated Circuits: K.R. Botkar; Khanna

REFERENCE BOOKS :

1. Introduction to Digital Circuits : Rabaey LPE (PHI)
2. VLSI Fabrication: S.K.Gandhi.; Wiley
3. VLSI Technology: S.M. Sze; McGraw-Hill.

Course Articulation Matrix:

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

LINEAR INTEGRATED CIRCUITS & APPLICATIONS
PCC-ECE306-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Analog Electronics I, Analog Electronics II

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able to :**	RBT Level
CO 1	To describe linear integrated circuits and their application circuits.	L1
CO 2	To understand and explain operational amplifier circuits and their application circuits.	L2
CO 3	To apply the knowledge of linear integrated circuits.	L3
CO 4	To compare and analyze operational amplifier circuits and their application circuits.	H1
CO 5	To design operational amplifier based comparators and converters.	H3

Course Contents

UNIT I

INTRODUCTION: Block diagram, Op-Amp equivalent circuit and its analysis, Types and development of integrated circuits, IC package types, Device Identification, Power supplies for ICs.

INTERPRETATION OF DATA SHEETS: Interpretation of data sheets, Ideal Op-Amp and its equivalent circuit, Ideal voltage transfer curve, open loop op-amp configurations.

UNIT II

FEEDBACK CIRCUITS: Block diagram representation of feedback configurations. Voltage series feedback amplifier, Voltage shunt feedback amplifier, differential amplifiers.

PRACTICAL OP-AMP: Input offset voltage, input bias current, input offset current, total output offset voltage, thermal drift, effect of variation in power supply voltages on offset voltage, change in input offset voltage and input offset current with time, temperature and supply voltage sensitive parameters, Noise, Common -Mode configuration and common mode rejection ratio.

UNIT III

FREQUENCY RESPONSE: Frequency response of internally compensated and non compensated Op-Amps, High frequency Op-Amp equivalent circuit, open loop voltage gain as a function of frequency, closed loop frequency response, circuit stability, and slew rate.
APPLICATIONS: DC and AC amplifier, Peaking Amplifier, summing, scaling and averaging amplifiers, Instrumentation amplifier, Differential input and output amplifier. Voltage to current converter with floating and grounded load, Very high input impedance circuit. Integrator and differentiator circuit.

UNIT IV

FILTERS & OSCILLATORS: First and second order low pass and high pass Butterworth filter. Band pass and band reject filters. Phase shift and Wien bridge oscillator, square wave generator.
COMPARATOR & CONVERTORS: Basic comparator, Schmitt trigger, comparator characteristics and limitations. Voltage limiters, window detector, voltage to frequency and frequency to voltage converters, A/D and D/A converters, Clippers and clampers, peak detector.

Text Books:

1. Ramakant A. Gayakwad, Op-Amps and linear integrated circuits, 4th edition, Pearson

Reference Books:

1. Bruce Carter and Ron Mancini, Op Amps for Everyone, 5th edition, Elsevier
2. Sergio Franco, Design with operational amplifiers and analog integrated circuits, 3rd edition, McGraw Hill

Course Articulation Matrix:

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

COMPUTER NETWORKS & IOT LAB
PCC-ECE302-P

Course Credits: 1 Contact Hours: 2/week, (L-T-P: 0-0-2) Mode: Lab work Examination Duration: 3 hours	**Course Assessment(Internal: 30; External:70)**

Pre-requisites: Basic knowledge of the inter-computer, internet connections and addressing.

Sr. No.	Course Outcomes At the end of the semester, students will be able:	RBT Level
CO 1	To understand the concept of internetworking of devices.	L1
CO 2	To describe application of IOT.	L2
CO 3	To make use of Devices, Gateways and Data Management in IOT.	L3
CO 4	To design the computer links among different networks to transfer the information.	H1
CO 5	To evaluate the Market perspective of IOT.	H2
CO 6	To design state of the art architecture in IOT.	H3

List of Experiments

1. Configure a network topology using packet tracer software.
2. To establish a Web Server Connection Using the PC's Web Browser.
3. Viewing Device Tables and Resetting the Network.
4. To establish a full duplex network using routers.
5. Hands on experience on Node MCU board(installation, install ESP8266 board in Arduino IDE, flashing NodeMCU firmware on the ESP8266).
6. To control LED using IoT on Node MCU board.
7. To study PIR Motion Sensor using Node MCU board.
8. To study web server with Arduino IDE.
9. To publish Temperature Readings using ADC.
10. To study Weather Forecaster.
11. To study Door Status Monitor.
12. To study Servo motor control using Node MCU board.
13. To study RGB Color Picker using Color Sensor
14. Hands on experience on Raspberry Pi.

NOTE: Eight experiments are to be performed out of which at least Six experiments should be performed from above list. The remaining experiments may be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

COMPUTER NETWORKS & IOT LAB
PCC-ECE302-P

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	3	1	1	2	2	2	2	3	3	2
CO2	3	3	2	2	2	3	1	-	2	2	2	2	3	3	2
CO3	3	3	2	2	3	3	2	1	3	2	2	2	3	3	2
CO4	3	3	3	2	3	3	2	2	2	3	3	2	3	3	3
CO5	3	3	3	2	3	3	-	2	3	3	3	2	3	3	3
C06	3	3	3	2	2	3	2	2	2	3	3	2	3	3	3

VLSI DESIGN LAB
PCC-ECE304-P

Course Credits : 1 Contact Hours: 2/week per group (L-T-P: 0-0-2) Mode : Lab Work	**Course Assessment Methods (Internal: 30; External: 70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	Describe the CMOS technology and its applications for VLSI design.	L1
CO 2	Illustrate the VLSI circuit design techniques practically.	L2
CO 3	Demonstrate the importance of CAD tools in VLSI system design.	L3
CO 4	Compare the various circuit topologies for digital VLSI design.	H1
CO 5	Design and evaluate the layout of VLSI circuits.	H2
CO 6	Develop or create CMOS system using VLSI CAD tools.	H3

<u>List of Experiments</u>

1. To plot the output characteristics and transfer characteristics of an n-channel and p-channel MOSFET.
2. To design and plot the static (VTC) and dynamic characteristics of digital CMOS inverter.
3. To design and plot the characteristics of 2-input NAND and NOR CMOS digital logic gate.
4. To design and plot the characteristics of 2-input XOR CMOS digital logic gate.
5. To design and plot the characteristics of 2x1 digital multiplexer using pass transistor logic.
6. To design and plot the characteristics of a positive and negative latch based on multiplexers.
7. To design and plot the characteristics of a master slave positive and negative edge triggered flip-flop based on multiplexers.
8. To design and plot the characteristics of a CMOS 1-bit full adder.
9. To design and plot the characteristics of a CMOS Non-Overlapping two phase Clock.
10. To design and plot the characteristics of a CMOS comparator.
11. To design and plot the characteristics of a CMOS SRAM Cell.
12. Simple project (Any topic related to the scope of the course).

Note: At least eight experiments are to be performed in the semester, out of which minimum six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

VLSI DESIGN LAB
PCC-ECE304-P

Course Articulation Matrix:

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

LINEAR INTEGRATED CIRCUITS & APPLICATIONS LAB
PCC-ECE306-P

General course information

Course Credits : 1 Contact Hours : 2 per week per group (L T P : 0 0 2) Mode : Lab Work	**Course Assessment (Internal: 30; External: 70)**

Pre-requisites: Linear Integrated Circuits and Applications

Sr. No.	Course Outcomes **At the end of the semester, students will be able:**	RBT Level
CO 1	To describe linear integrated circuits and their application circuits.	L1
CO 2	To understand and explain operational amplifier circuits and their application circuits.	L2
CO 3	To operate various operational amplifier based circuits	L3
CO 4	To compare and analyze operational amplifier circuits and their application circuits.	H1
CO 5	To design operational amplifier based oscillators, filters, comparators and converters.	H3

List of Experiments

1. Design and simulate PSpice model of inverting amplifier and obtain plots of input signal voltage versus time and output signal voltage versus time.
2. Design and simulate PSpice model of noninverting amplifier and obtain plots of input signal voltage versus time and output signal voltage versus time.
3. Design and simulate PSpice model of differential amplifier and obtain plots of input signal voltages versus time and output signal voltage versus time.
4. Design and simulate PSpice model of inverting amplifier with feedback and obtain plots of input signal voltage versus time and output signal voltage versus time.
5. Create and simulate PSpice model of inverting averaging circuit and measure output voltage.
6. Create and simulate PSpice model of noninverting summing amplifier circuit and measure voltage at inverting, noninverting and output terminals.
7. Create and simulate PSpice model of voltage to current converter with grounded load and measure voltage at inverting, noninverting and output terminals. Also measure load current.
8. Create and simulate PSpice model of second order low pass Butterworth filter and obtain plot of output voltage versus frequency.
9. Create and simulate PSpice model of second order high pass Butterworth filter and obtain plot of output voltage versus frequency.

10. Create and simulate PSpice model of square wave generator and obtain plots of capacitor voltage versus time and output signal voltage versus time.
11. Design and simulate PSpice model of noninverting comparator and obtain plots of input signal voltage versus time and output signal voltage versus time.
12. Design and simulate PSpice model of inverting comparator and obtain plots of input signal voltage versus time and output signal voltage versus time.
13. Simple project (Any topic related to the scope of the course).

NOTE: At least eight experiments are to be performed in the semester, out of which at least six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

Detailed Syllabus

of

B.Tech.(ECE)

7th semester

1.7.19

01-VII-2019

Digital Signal Processing
PCC-ECE401-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule :3 hour/week Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: signals and systems

Sr. No.	Course Outcomes At the end of the semester, students will be able:	RBT Level
CO 1	To understand the concept and advantages of digital signal processing.	L1
CO 2	To summarize differences between time domain and frequency domain analysis tools.	L2
CO 3	To apply DFT and FFT tools to determine the spectral components of a discrete time signal.	L3
CO 4	To examine the realization of digital filters using different realization structures.	H1
CO 5	To design and implement Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) digital filters for processing of discrete time signals.	H3

Course Contents

UNIT-I

DISCRETE FOURIER TRANSFORM (DFT): Frequency Domain Sampling and Reconstruction of Discrete-Time signals, Discrete Fourier Transform, DFT as a Linear Transformation, Properties of DFT, Linear filtering methods based on DFT: use of DFT in linear filtering, Filtering of long data Sequences.

FAST FOURIER TRANSFORM (FFT): Fast Fourier Transform Algorithms, Radix-2 and Radix-4 FFT Algorithms, Applications of FFT Algorithms: Efficient Computation of the DFT of Two Real Sequences, Efficient Computation of the DFT of a 2N-Point Real Sequence, use of FFT in Linear filtering and correlation.

UNIT-II

STRUCTURES FOR FIR SYSTEMS: Direct Form Structures, Cascade Form Structures, Frequency Sampling Structures, Lattice Structure.

STRUCTURES FOR IIR SYSTEMS: Direct Form Structures, Signal Flow graphs & Transposed Structures, Cascade Form Structures, Parallel Form Structures; Lattice & Lattice-Ladder Structures for IIR Systems.

UNIT –III

FIR & IIR FILTER DESIGN: FIR and IIR filters properties, Design of FIR filters: importance of Linear Phase response, Design of linear phase FIR filters using Windows, Desirable Window function properties for FIR filter design, Frequency Sampling method for Linear Phase FIR Filter Design. Design steps for IIR Filter design. Design of IIR low pass analog filters: Butterworth, Chebyshew, Elliptic; Conversion of analog system to digital system by: Approximation of Derivatives, Impulse Invariance, Bilinear Transformation, Frequency Transformations.

UNIT-IV

MULTIRATE DIGITAL SIGNAL PROCESSING: Introduction to Multirate digital signal processing, interpolation and decimation, sampling rate conversion by rational factor, filter design and implementation for sampling rate conversion, multistage decimator and interpolators, Applications of Multirate Signal Processing.

TEXT BOOKS:

1. J. G. Proakis, D. G. Manolakis, "Digital Signal Processing, Principles, Algorithms, & Applications", Prentice – Hall India.
2. T.K. Rawat, "Digital Signal Processing" Oxford University Press.
3. S. Mitra, "Digital Signal Processing- A computer based approach" TMH.

REFERENCE BOOKS:

1. L. R. Rabiner & B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall India.
2. A. V. Oppenheim, R. W. Schafer, J. R. Buck, "Discrete-Time Signal Processing", Prentice Hall India.
3. A. V. Oppenheim, R. W. Schafer, "Digital Signal Processing", Prentice Hall India.
4. Salivahanan, Vallavaraj and Gnanapriya, "Digital Signal Processing", TMH.

Course Articulation Matrix:

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

WIRELESS COMMUNICATION
PCC-ECE403-T

Course Credits : 03 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Basics of communication engineering and antenna & wave propagation.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To describe the evolution & advancements in wireless networks.	L1
CO 2	To explain the operation of cellular networks.	L2
CO 3	To define the channel behaviour and associated losses.	L3
CO 4	To evaluate the performance of cellular networks.	H1
CO 5	To formulate efficient cellular radio resource planning.	H2

Course Contents

UNIT-I

INTRODUCTION: Introduction to Generation of Wireless communication systems- 1G, 2G, 3G, 4G, 5G. Examples of various wireless communication systems: paging system, Wireless Local Loop, Bluetooth, Introduction to frequency bands for radio transmission, Applications of wireless communication.

UNIT-II

CELLULAR SYSTEM: The Cellular concept, Frequency Reuse, basic theory of hexagonal cell layout, Frequency Management and Channel Assignment, Call drops, hand off, types of handoff, Method to improve capacity, Call Control, Mobility Management and location Tracing, Erlang capacity comparison.

UNIT –III

PATH LOSS ANALYSIS: Models for Path loss: Free space propagation, Okumura model, Hata model, Longley-Rice model, PCS extension to Hata model, Partition loss modelling, Log distance path loss model, Ericsson multiple breakpoint model. Concept of coherence bandwidth, coherence time & Doppler spread. Types of fading: Flat fading, frequency selective fading, fast fading, slow fading. Diversity techniques in mobile radio.

UNIT-IV

MULTIPLE ACCESS TECHNIQUES & WIRELESS STANDARDS: Multiple Access Techniques used in Mobile Wireless Communications: FDMA, TDMA, CDMA, SSMA, cellular CDMA & its capacity, Rake receiver.

GSM & GPRS STANDARD: Architecture, channels, RF specifications. IS-95 standard: architecture, channels, RF specifications. Introduction to WCDMA, OFDM, LTE, 5G Technology: Basic architecture/ block diagram, RF specifications, applications.

TEXT BOOKS:

1. Theodore S. Rappaport, Wireless Communications Principles and Practice, IEEE Press, Prentice Hall.
2. William C.Y.Lee, Mobile Cellular Telecommunications, Analog and Digital Systems, McGraw Hill Inc.

REFERENCE BOOKS:

1. Mobile Communication Hand Book, 2nd Ed., IEEE Press.
2. Wireless Communications, TL Singal, McGraw Hill (India).
3. Wireless and personal Communication Systems by VK Garg and JE Wilkes; Prentice Hall, 1996.
4. Mobile and Personal Communication Systems and Services, Raj Pandya, Wiley IEEE Press.

Course Articulation Matrix:

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

DIGITAL SYSTEM DESIGN
PCC-ECE405-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor Tests Each Of 20 Marks, Class Performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of 70 Marks For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain 7 short answers type questions. Rest of the eight question is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Analog & Digital Circuits, Microprocessor and its Applications

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able to:**	RBT Level
CO 1	Describe digital system design process.	L1
CO 2	Explain various design methodologies for digital system design.	L2
CO 3	Apply the knowledge of digital design techniques for system design.	L3
CO 4	Demonstrate the use of HDL in Digital systems design.	H1
CO 5	Evaluate and compare different design techniques available for digital logics	H2
CO 6	Design the specifications for the system to be created/implemented using HDL	H3

Course Contents

UNIT I

Benefits of CAD, Design abstractions, Digital system design process, Computer aided design tools for digital systems, Hardware Description Languages, introduction to VHDL/Verilog and its capabilities, VHDL-data objects, classes and data types, operators, overloading, logical operators, types of delays, Entity and Architecture declaration. Introduction to behavioral, dataflow and structural models, Hierarchical Modeling Concepts: Design Methodologies.

UNIT II

Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

UNIT III

VHDL Models and Simulation of combinational circuits such as Multiplexers, De-multiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits, Shift Registers, Counters etc.

UNIT IV

Design with PLDs, Programmable logic devices: ROM, PLAs, PALs, CPLDs and FPGA. Design implementation using ROM, PLA, PAL, CPLDs and FPGAs. Basic components of a computer, specifications, architecture of a simple microcomputer system, implementation of a simple microcomputer system using VHDL

Text Books:

1. Introduction to Digital Systems: Milos Ercegovac, T Lang, and J H Moreno, Wiley-2014
2. VHDL Modular design and synthesis of Cores and systems: Z Navabi, McGraw Hill, 2014
3. VHDL Analysis and Modeling of Digital system : Z Navabi, McGraw Hill, 2nd Ed

References Books:

1. A VHDL Primer: J Bhaskar, PHI 1995.
2. Digital Design with introduction to HDL: Mano and Ciletti, Pearson 2013.
3. VHDL Synthesis: A Practical Primer; J Bhaskar, BS Publication 2001
4. Digital System Design Using VHDL: Charles H Roth, Jr. Thomson Books/Cole 1998
5. Verilog Digital system Design: Z Navabi; McGraw Hill, 2nd Ed 2006.

DIGITAL SYSTEM DESIGN
PCC-ECE405-T

Course Articulation Matrix:

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

DIGITAL SIGNAL PROCESSING LAB
PCC-ECE401-P

Course Credits :2 Contact Hours: 4/week Mode : Lab Work	**Course Assessment Methods (Internal: 30; External: 70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To understand the basic operations of signal processing & plot basic discrete/digital signals using MATLAB.	L2
CO 2	To demonstrate interpolation and decimation operations using MATLAB.	L3
CO 3	To analyze and examine the sampling theorem.	H1
CO 4	To evaluate magnitude and phase spectrum of a discrete time signal using DFT to determine the spectral components of the signal.	H2
CO 5	To develop and design IIR and FIR band pass, band stop, low pass and high pass filters using MATLAB.	H3

List of Experiments

1. To represent basic signals (Unit step, unit impulse, ramp, exponential, sine and cosine) in MATLAB.
2. To generate triangular, saw tooth and square waveform using MATLAB program.
3. To develop program for discrete convolution.
4. To develop program for discrete correlation.
5. To develop program for sampling of a continuous time signal with different sampling frequency in order to study aliasing effect.
6. To develop a program to determine the impulse response of a system for which input sequences and output sequences are given.
7. To design Butterworth IIR filters (low-pass, high pass, band-pass, band-stop).
8. To design digital FIR filters using windows technique. (Rectangular window, Blackman window, Hamming window, Hanning window.
9. To plot the magnitude and phase spectrum of a signal using DFT.
10. To perform interpolation and decimation using MATLAB.
11. To develop program for computing linear and circular convolution.
12. To develop program for finding magnitude and phase response of LTI system described by system function H(z).
13. To generate DTMF signals using MATLAB.
14. To develop program for stability test using MATLAB.
15. To develop a program for computing inverse Z-transform of a rational transfer function.
16. To develop a program for computing parallel realization values of IIR digital filter.
17. To develop a program for computing cascade realization values of IIR digital filter.

Note: At least twelve experiments are to be performed in the semester, out of which minimum eight experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

DIGITAL SYSTEM DESIGN LAB
PCC-ECE405-P

Course Credits: 2 Contact Hours: 4/week, (L-T-P: 0-0-4) Mode: Lab work Examination Duration: 3 hours	**Course Assessment (Internal: 30; External:70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able to:**	**RBT Level**
CO 1	Describe the use of HDLs for VLSI digital system design.	L1
CO 2	Illustrate the various CAD tools available for Digital system design.	L2
CO 3	Demonstrate the importance of HDL and CAD tools in VLSI digital system design.	L3
CO 4	Compare the various design techniques for digital system design.	H1
CO 5	Design and evaluate the performance of digital systems.	H2
CO 6	Develop or create digital system using HDLs and FPGAs.	H3

List of Experiments

1. Familiarization with VHDL/Verilog and CAD tools.
2. Design all digital logic gates using VHDL.
3. Design a half adder digital logic using VHDL.
4. Design a 3-to-8 Decoder using 1-to-2 Decoder using VHDL.
5. Design a 8-to-1 MUX using 2-to-1 MUX using VHDL.
6. Design 1-bit full adder using 2x1 Multiplexer in VHDL.
7. Design a 4-Bit Comparator using VHDL.
8. Design all logic gates and 4-bit Full Adder using VHDL.
9. Design a 4-bit Full Adder-Subtractor using VHDL.
10. Design a 4-bit ALU using VHDL.
11. Design a D-latch D-FF using VHDL.
12. Design register, shifter and counter using VHDL.
13. FPGA implementation of 4bit Counter using VHDL.
14. FPGA implementation of Finite state machine using VHDL.
15. FPGA implementation of 7-segment decoder using VHDL.
16. Write VHDL code to display messages on an alpha numeric LCD display.

NOTE: At least twelve experiments are to be performed out of which at least eight experiments should be performed from above list. The remaining experiments may be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

MINOR PROJECT
PROJ-ECE413-P

Course Credits :4 Contact Hours: 8/week Mode : Lab Work	**Course Assessment Methods (Internal: 30; External: 70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able to**	**RBT Level**
CO 1	Relate practical knowledge within the chosen area of technology for project development	L1
CO 2	Understand methodologies and professional way of documentation and communication.	L2
CO 3	Illustrate the key stages in development of the project.	L3
CO 4	Identify, analyze, formulate and handle projects with a comprehensive and systematic approach	H1
CO 5	Contribute as an individual or in a team in development of technical projects	H2
CO6	Develop effective communication skills for presentation of project related activities	H3

NOTE: The minor project will be completed and evaluated at the end of the 7th semester on the basis of its implementation, presentation, viva-voce and report.

Course Articulation Matrix:

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

Practical Training-II

General Course Information:

Course Code: INT-ECE415-P Course Credits: 1.0 Type: Compulsory Contact Hours: 2 hours per week (L-T-P: 0-0-2) Mode: Practical	**Course Assessment Methods (Internal: 100)** Assessment of Practical Training-II will be based on presentation/seminar delivered, viva-voce, report and certificate for the practical training taken at the end of 6th sem.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO 1	outline technical documents and give oral presentations related to the work completed	L1
CO 2	recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the industry	L2
CO 3	acquire and apply fundamental principles of engineering and an ability to work in actual working environment.	L3
CO 4	analyze practical application of the subjects taught during the course	H1
CO 5	develop social, cultural , global and environmental responsibilities as an engineer	H2
CO 6	identify, formulate and model problems and find engg. Solution based on a system approach	H3

Course Articulation Matrix:

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

Detailed Syllabus

of

B.Tech.(ECE)

8th semester

MAJOR PROJECT
PROJ-ECE428-P

Course Credits :6 Contact Hours: 12/week Mode : Lab Work	**Course Assessment Methods (Internal: 30; External: 70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	Extend or use the idea in mini project for major project.	L1
CO 2	Describe a through and systematic understanding of project contents	L2
CO 3	Use effectively oral, written and visual communication	L3
CO 4	Identify, analyze, and solve problems creatively through sustained critical investigation.	H1
CO 5	Demonstrate an awareness and application of appropriate personal, societal, and professional ethical standards.	H2
CO6	Know the key stages in development of the project.	H3

NOTE: The major project will be completed and evaluated at the end of the 8th semester on the basis of its implementation, presentation, viva-voce and report.

MAJOR PROJECT
PROJ-ECE428-P

Course Articulation Matrix:

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

MAJOR PROJECT
PROJ-ECE428-P

Detailed Syllabus

of

B.Tech.(ECE)

Program Elective Course-1

CONSUMER & INDUSTRIAL ELECTRONICS
PEC-ECE308-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites:

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	Name different types of Audio/Video devices	L1
CO 2	Explain the devices on component level.	L2
CO 3	Illustrate state of the art technology in consumer items	L3
CO 4	Examine proper transducer and other constituent components on the basis of particular application.	H1
CO 5	Judge the faults in consumer electronic items	H2
CO 6	Develop the idea of troubleshooting in consumer electronics items	H3

Course Contents

UNIT-1

AUDIO SYSTEMS: Basic characteristics of sound signal: level and loudness, pitch, frequency response, fidelity and linearity, Reverberation; Audio level metering, decibel level in acoustic measurement; Microphone: working principle, sensitivity, nature of response, directional characteristics; Types: carbon, condenser, crystal, electrets, tie-clip, wireless; Loud speaker: working principle, characteristic impedance, watt capacity, Types: electrostatic, dynamic, permanent magnet etc , woofers and tweeters; Sound recording: Optical recording, stereophony and multichannel sound, MP3 standard; Audio system: CD player, home theatre sound system, surround sound; Digital console: block diagram, working principle, applications.

UNIT-II

VIDEO SYSTEMS: Basic block diagram and working of the following: Digital TVs, LCD, LED, PLASMA, HDTV, 3-D TV, projection TV, DTH receiver; Video interface: Composite, Component, Separate Video, Digital Video, SDI, HDMI Multimedia Interface), Digital Video Interface; CD and DVD player: working principles, interfaces; Touch screen

UNIT –III

OFFICE GADGETS: Basic block diagram and working of the following: Desktop computer, Mouse, Keyboard, Laptop, Digital Storage Devices; Printer (inkjet, laser and 3D), Scanner, FAX machine, Photocopier, EPABX, Online and Offline UPS, LCD Projector, Bar Coding Machine

UNIT-IV

HOME GADGETS: Basic block diagram and working of the following: Air Conditioner, Digital Camera/ Camcoder, Refrigerator, Microwave Oven, Mobile Phone Handset, Mobile Charger, RO system, Different types of Batteries, Inverter, Home security and CCTV

TEXT BOOKS:

1. S.P Bali, "Consumer Electronics", Pearson Education Asia Pvt., Ltd.
2. R Bali and S.P Bali, "Audio Video Systems: Principle Practice & Troubleshooting, Khanna Publisher.
3. Philip Hoff, "Consumer Electronics for Engineers", Cambridge University Press

REFERENCE BOOKS:

1. W, Jerry and B. Blair, "Standard Handbook of Audio Engineering", Mc Graw Hill Professional
2. Millman, "Integrated Circuits", Tata Mc Graw Hill Publishers
3. Boylsted, "Electronic Devices and Circuit Theory", Pearson

Course Articulation Matrix:

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

INFORMATION THEORY AND CODING
PEC-ECE310-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Probability theory.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To describe information theory methods as well as advanced techniques of digital signal processing to communication systems	L1
CO 2	To derive equations for entropy mutual information and channel capacity for all types of channels	L2
CO 3	To apply various source and error control codes and their properties.	L3
CO 4	To compare block codes, convolution codes etc. For error detection and correction.	H1
CO 5	To design various cryptography algorithms & standards.	H3

Course Contents

UNIT-1

INTRODUCTION TO INFORMATION THEORY: Review of Probability Theory, Introduction to Information Theory, Uncertainty and Information, Entropy, Rate of Information, Joint Entropy, Conditional Entropy, Mutual Information, Channels: Noise Free Channel, Binary Symmetric Channel (BSC), Binary Erasure Channel (BEC), Channel Capacity, Shannon's Theorem, Continuous Channel, Capacity of a Gaussian Channel: Shannon-Hartley Theorem, Bandwidth and S/N Trade-off.

UNIT-II

SOURCE CODING: Source Coding Theorem, Shannon- Fano Coding, Huffman Coding, The Lempel-Ziv Algorithm, Lossy Data Compression: Rate Distortion Function, Introduction to Image Compression.

ERROR CONTROL CODING: Introduction to Error Control Coding, Type of Codes, General Description of Basic ARQ Strategies, Hybrid ARQ Schemes.

UNIT –III

LINEAR BLOCK CODES: Linear Block Codes: Properties, Specific Linear Block Codes, Hamming Code, Cyclic Codes, B.C.H Codes, Reed-Solomon Codes, Decoding of Linear Block Codes, Maximum Likelihood Decoding, Error Detecting and Correcting Capabilities of a Block Code.

UNIT-IV

CONVOLUTIONAL CODES: Transfer Function of a Convolutional Code, Viterbi Decoding, Distance Properties of Binary Convolutional Codes, Burst Error Correcting Convolutional Codes.

INFORMATION THEORY AND CRYPTOGRAPHY: Introduction to cryptography, Encryption Techniques, Encryption Algorithms, Symmetric Key Cryptography, Asymmetric Key Algorithms, Data Encryption Standard (DES).

TEXT BOOKS:

1.J G Proakis, "Digital Communications", Tata McGraw Hill, 2001.
2. Ranjan Bose, "ITC and Cryptography", Tata McGraw-Hill.
3. ArijitSaha, Nilotpal Manna, SurajitMandal, "Information Theory, Coding and cryptography", Pearson Education, 2013.

REFERENCE BOOKS:

1. Thomas M. Cover, Joy A. Thomas, "Elements of Information Theory", Wiley Publication.
2. R.P. Singh and S.D. Sapre, "Communication System: Analog and Digital", Tata McGraw-Hill.
3. Simon Haykin, "Digital communication", John Wiley.

INFORMATION THEORY AND CODING
PEC-ECE310-T

Course Articulation Matrix:

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

ADVANCED INSTRUMENTATION and CONTROL
PEC-ECE312-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	Course Assessment Methods (Internal: 30; External: 70) Two Minor Tests Each of 20 Marks. Class Performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of 70 Marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain 7 short answers type questions. Rest of the eight question is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: EMI

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able to:**	RBT Level
CO 1	Describe the various types of instruments and their characteristics.	L1
CO 2	Understand the criteria for selection of transducers.	L2
CO 3	Illustrate the various types of signal conditioning techniques.	L3
CO 4	Analyze the various types of A/D converters and D/A converters.	H1
CO5	Design the various Modes of data transmission.	H3
CO6	Develop and analyze state space models.	H3

Course Content

UNIT- I

Introduction: Functional block diagram of generalized Instrumentation system. Input-output configuration, specifications under steady and transient state & their performance characteristics. **Review of Sensors and Transducers:** Temperature, pressure, displacement, velocity, acceleration, strain and torque type.

UNIT-II

Signal Conditioning: Instrumentation Amplifier characteristics, CMRR, balanced modulator and demodulator, filters, voltage sensitive bridge and current sensitive bridge. Push-pull transducers, Blumlein bridge, integration, differentiation and sampling, A/D and D/A conversion, choppers, voltage to time A/D conversion, voltage to frequency conversion concept and methods.

UNIT –III

Telemetry: Modes of data transmission, DC telemetry system, voltage telemetry system, current telemetry system, AC telemetry system, AM, FM, Phase modulation, pulse telemetry system.

PAM, Pulse frequency system, pulse duration modulation(PDM), digital telemetry, pulse code modulation, transmission channels and media, wire line channels, radio channels, micro wave channels, power line carrier channels, multiplexing in telemetry systems, TDM.

UNIT- IV

Nonlinear Control System: Introduction to Nonlinear systems and their properties, Common Non-linearity, Describing functions, Phase plane method, Lyapounov's method for stability study, concept of Limit Cycle.

State Space Analysis: The Concept of State and State Models, State Diagram, State Space and State Trajectory, State Space Representation using Phase Variable and Canonical Variables, Solution of State Equation, State Transition Matrix and its Properties, Eigen Values, Eigen Vectors, Model Matrix, Diagolization, Generalized Eigen vectors, Computation of State Transition Matrix using Laplace Transformation, Power Series Method, Cayley-Hamilton Method, Similarity Transformation Method. Controllability and Observability Tests: Kalman's test, Gilbert's Test, Controllability and Observability Canonical Forms.

Text Books:

1. A.K. Sawhney, A Course in Electrical & Electronics Measurement & Instrumentation, Pub.: Dhanpat Rai & Sons.
2. A K Ghosh: Introduction to Instrumentation and Control, Prentice Hall of India, New Delhi 2004.
3. C.S. Rangan, G.R. Sarma, V.S.V. Mani, Instrumentation Devices & Systems, New Delhi: Tata McGraw-Hill Pub. Co. Ltd.

Reference Books:

1. Oliver & Cage, Electronic Measurement & Instrumentation.
2. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition, 1996
3. E.O. Doeblin, "Measurement System : Applications and Design", McGraw Hill Publications

ADVANCED INSTRUMENTATION and CONTROL
PEC-ECE312-T

Course Articulation Matrix:

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

SATELLITE COMMUNICATION
PEC-ECE314-T

Course Credits : 03 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Basics of communication engineering and wave propagation.

Sr. No.	Course Outcomes At the end of the semester, students will be able:	RBT Level
CO 1	To describe the revolving mechanism of satellites.	L1
CO 2	To explain the working principle and operation of satellites.	L2
CO 3	To illustrate the various performance affecting factors.	L3
CO 4	To evaluate the various types of satellite links.	H2
CO 5	To design different satellite links and application systems.	H3

Course Contents

UNIT-1

SATELLITES & MODULATION: Basic block diagram of satellite communication, Satellite frequency allocation & Band spectrum, Advantages of satellite communication, Active & Passive satellites, Analog FM Transmission by Satellite, S/N Ratios for FM Video Transmission, Generation of Quadrature Phase Shift Keying (QPSK) Signals, Transmission of QPSK Signals through a Bandlimited Channel, Signal-to-Noise Ratio in Digital Voice Systems.

UNIT-II

SATELLITE LINK DESIGN: Basic link analysis, Interference analysis, terrestrial interference, System Noise temperature and G/T ratio, G/T ratio for earth stations, Uplink & downlink design, Design for Specified C/N: Combining C/N and C/I Values in Satellite Links , system design examples.

UNIT –III

ORBITAL MECHANISM & MULTIPLEXING: Satellite orbit and orbital equations, Kepler's laws of planetary motion, Look angle calculation, coverage angle and slant range, orbital perturbations, Orbital Elements, Apogee and Perigee Heights. TDMA, TDMA-Frame structure, Multiple Beam (Satellite switched) TDMA satellite system, Beam Hopping (Transponder Hopping) TDMA, TDMA compared to FDMA, CDMA & hybrid access techniques.

UNIT-IV

SATELLITE BASED NAVIGATION SYSTEM: Basic principles of satellite navigation, Signal travel time, Determining position, functional segments of GPS, Improved GPS: DGPS, SBAS, A-GPS and HSGPS.

TEXT BOOKS:

1. Tri, T.Ha, "Digital Satellite Communications, " (Second Edition) Tata McGraw Hill.
2. Timothy Pratt, Jeremy E., "Satellite Communications," Willey.
3. G S Rao, "Global Navigation Satellite Systems," Tata McGraw Hill.

REFERENCE BOOKS:

1. D. Roddy, Satellite Communication (4/e), McGraw- Hill, 2009.
2. B.N. Agrawal, Design of Geosynchrons Spacecraft, Prentice- Hall,1986.

Course Articulation Matrix:

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

COMPUTER ARCHITECTURE & ORGANIZATION

PEC-ECE316-T

General Course Information

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Digital Electronics and computer systems.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	Outline the general concepts of digital electronics and computer organisation and architecture	L1
CO 2	Discuss the basic components and their interfacing.	L2
CO 3	Apply instructions for performing different operations	L3
CO 4	Analyse the effect of addressing modes on the execution time of a program	H1
CO 5	Evaluate the performance of different types of memory, processing and access methods	H2
CO 6	Design of simple computer with different instruction sets.	H3

Course Content

UNIT I

INTRODUCTION: Boolean algebra and Logic gates, Combinational logic blocks (Adders, Subtractors, Multiplexers, Encoders, Decoders, Demultiplexers, K-Maps), Sequential logic blocks (Flip-Flops, Registers, Counters).

REGISTER TRANSFER & MICRO OPERATIONS: Register transfer language, register transfer, bus and memory transfer, Micro-operation (Arithmetic, Logic and Shift microperations), Arithmetic logic shift unit.

UNIT II

COMPUTER ORGANIZATION AND DESIGN: Store program control concept, computer registers and instruction, timing and control, instruction cycle, memory reference instruction, input-output and interrupt, design of basic computer and accumulator logic.

MICRO PROGRAMMED CONTROL: Control memory, address sequencing, microinstruction formats, micro-program sequencer, Implementation and design of control unit.

UNIT III

CPU & PARALLEL PROCESSING: Introduction of central processing unit, general register organization, stack organization, instruction format, addressing mode and its type (register, immediate, direct, indirect, indexed), operations in the instruction set, Instruction set based classification of processors (RISC, CISC, and their comparison), parallel processing, introduction of Pipelining and its type (Arithmetic, Instruction and RISC pipelining), vector and array processing.

UNIT IV

MEMORY HIERARCHY & I/O TECHNIQUES: The need for a memory hierarchy, Type of Memory: Main memory (Semiconductor RAM & ROM organization, memory expansion, Static & dynamic memory types), Auxiliary memory (Magnetic tape and Magnetic Disk), Cache memory (Associative & direct mapped cache organizations), Virtual memory and Associate memory. Memory parameters: (Access/ cycle time, cost per bit), Memory management, input-output interface, mode of transfer, DMA (Direct memory transfer).

Text and Reference Books:

1. Mano, M. Morris, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd., 1981.
2. M. Morris Mano, Computer System Architecture, Prentice Hall of India Pvt. Ltd., 1993.
3. Milles J. Murdocca, Vincent P. Heuring, Computer Architecture and Organization, An Integrated Approach, JohnWiley & Sons Inc., 2007.
4. William Stallings, 10th edition, Computer Organization and Architecture, Prentice Hall, 2016.
5. Heuring, V.P., Jordan, H.F., Computer Systems Design and Architecture, Addison Wesley, 1997.
6. R.P Jain, Modern Digital Electronics, 3rd Edition, Tata McGraw Hill., 2003.

12/07/19

Course Articulation Matrix:

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

Detailed Syllabus

of

B.Tech.(ECE)

Program Elective Course-2

1.7.19 01-VII-2019

FPGA DESIGN
PEC-ECE407-T

General Information of Course:

Course Credits : 3.0 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor Tests Each Of 20 Marks, Class Performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of 70 Marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain 7 short answers type questions. Rest of the eight question is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Analog & Digital Circuits.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able to:**	**RBT Level**
CO 1	Describe different IC design approaches and tools.	L1
CO 2	Explain the requirements of FPGA implementation.	L2
CO 3	Apply the knowledge of digital design techniques for efficient resource utilization in FPGA design.	L3
CO 4	examine the use of scripts SDF format, user constraint file in FPGA Design.	H1
CO 5	Evaluate and compare design techniques for FPGA implementation of combinational and sequential circuits.	H2
CO 6	Design the specifications for the digital system/circuits to be created/implemented using FPGA.	H3

Course Contents

UNIT-I

Introduction to ASICs and FPGAs, FPGA's and its Design Flows, Reconfigurable Devices, FPGA's/CPLD's, Fundamentals of digital IC design, FPGA & CPLD Architectures, Architectures of XILINX, ALTERA Devices, FPGA Programming Technologies

UNIT-II

FPGA Logic Cell Structures, FPGA Programmable Interconnect and I/O Ports, Designing with FPGAs, Architecture based coding , Efficient resource utilization, Constrains based synthesis False paths and multi cycle paths, UCF file creation, Timing analysis/Floor Planning, Back annotation, Gate level simulation, SDF Format, Scripts, industry Standard FPGA Tools

UNIT-III

FPGA Implementation of Combinational Circuits, FPGA implementation of Sequential Circuits, Timing Issues in FPGA Synchronous Circuits

UNIT-IV

Introduction to Verilog HDL, FPGA design flow with Verilog HDL, FPGA Arithmetic Circuits, FPGAs in DSP Applications, FPGA Microprocessor design, Design FPGA systems at high-level

TEXT BOOKS:

1. Bob Zeidman, Designing with FPGA and CPLDs, BSP publications @2011.
2. Chan & Murad Digital Design using FPGA, BSP @1994
3. Stephen M Trimberger, FPGA Technology, BSP @2015

REFERENCE BOOKS:

1. Wayne Wolf, "FPGA-Based System Design," Prentice Hall, 2004
2. M. D. Ciletti, "Advanced Digital Design with Verilog HDL," Prentice Hall, 2002
3. Michael Smith, "Application-Specific Integrated Circuits," Addison-Wesley, 1997

Course Articulation Matrix:

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

ANTENNA & WAVE PROPAGATION
PEC-ECE409-T

Course Credits :3.0 Mode :Lectures (L) Teaching schedule L T P :3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Electromagnetic Theory

Sr. No.	Course Outcomes **At the end of the semester, students will be able:**	RBT Level
CO 1	To define the basic fundamental concepts of antenna.	L1
CO 2	To understand the various types of antenna in transmission and reception of signals.	L2
CO 3	To use different wave propagation theories in communications.	L3
CO 4	To compare antennas depending upon modes of propagation and their applications.	H1
CO 5	To evaluate the Gain of antenna for various types of applications.	H2
CO 6	To design an antenna for various applications in communication.	H3

Course Contents

UNIT-I

RADIATION OF ELECTROMAGNETIC WAVES: Short Electric Dipoles, Retarded potential,Radiation from a Small Current Element, field of short dipole, Power Radiated by a Current Element and Its Radiation Resistance, Linear antenna, half wave dipole, Radiation from a Half Wave Dipole, Antenna impedance, Effect of ground on antenna pattern, Input impedance, Mutual Impedance.

UNIT-II

ANTENNA PARAMETERS: Antenna Pattern, Antenna Parameters: Front to Back Ratio, Gain, Directivity, Radiation Resistance, Radiation Patterns, Radiation Power Density, Radiation Intensity Efficiency, Aperture Area, Impedance, Effective Length and Beam width, Reciprocity Theorem for Antenna and Its Applications

UNIT –III

ANTENNA ARRAYS AND TYPES OF ANTENNAS: Types of Antenna Array: Broadside Array, End Fire Array, Collinear Array and Parasitic Array, Two element array, array of point sources, pattern multiplication, Linear Array, Phased Array, Tapering of Arrays, Binomials Arrays, Isotropic Antenna ,Yagi-Uda, Microwave antenna, parabolic feeds, conical, helix, log periodic, horn, Microstrip Antenna and Patch Antenna, Frequency independent concept, RUMSEY'S Principle, Frequency independent planar log spiral antenna, Frequency independent conical spiral Antenna.

UNIT-IV

PROPAGATION: Modes of Propagation, Space wave and Surface Wave, Reflection and refraction of waves by the ionosphere, Tropospheric Wave propagation, bending mechanism of waves by ionosphere, Virtual Height, MUF, Critical frequency, Skip Distance, Duct Propagation, Space wave.

TEXT BOOKS:

1. Antennas by J.D. Kraus, TMH.
2. Antenna & Wave Propagation by K.D Prasad., Satya Prakash
3. Electromagnetic Waves, R.K. Shevgaonkar, Tata McGraw Hill

REFERENCE BOOKS:

1. Antenna & Radiowave Propogation by Collin,TMH.
2. Electromagnetic Waves & Radiating Systems by Jordan & Balman, PHI.
3. Electromagnetic Waves, R.L. Yadav, Khanna Publishing House.

Course Articulation Matrix:

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

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
PEC-ECE411-T

Course Credits : 3.0 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor Tests Each Of 20 Marks, Class Performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of 70 Marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain 7 short answers type questions, Rest of the eight question is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Probability Theory, Mathematics.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To relate what the AI is.	L1
CO 2	To discuss theoretical concepts behind ANN algorithms.	L2
CO 3	Apply ANN and FNN for knowledge representation and reasoning.	L3
CO 4	To compare utility of various artificial intelligence techniques in various applications.	H1
CO 5	To evaluate and compare performance of pattern recognition algorithms.	H2

Course Contents

UNIT-I

Introduction: Introduction to Artificial Intelligence, Machine learning, and Artificial Neural Networks, Foundations and History of Machine Learning and Neural Networks, Applications of Artificial Intelligence.

Artificial Neural Networks: Neural networks: Biological Neural Network, Artificial Neural Network, Comparison, Artificial Neural Network terminology and definitions, Model of an artificial neural Network,

UNIT-II

Artificial Neural Networks Architectures: Mc-Culloch-Pitts Neuron Model, Learning Rules, Rosenblatt's Perceptron, Examples of learning of AND/OR gate by perceptron, XOR problem, Back Propagation Neural Networks: Architecture of a backpropagation network, Model for multi-layer perceptron, Back propagation learning, Delta or gradient descent learning rule and effect of learning rate, Back propagation learning algorithm.

UNIT –III

Fuzzy Logic: Fuzzy Logic: Basic concepts of Fuzzy logic, Fuzzy vs Crisp set, Linguistic variables, membership functions, operations of Fuzzy sets, Fuzzy if-then rules, Variables inference techniques, defuzzification techniques, basic Fuzzy interference algorithm, application of fuzzy logic , Fuzzy system design implementation , useful tools supporting design.

UNIT-IV

Machine Learning using Pattern Recognition: Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.

TEXT BOOKS:

1. Elaine Rich, Kevin Knight and Shivashankar B Nair, Artificial intelligence, McGraw Hill Education, 3rd edition, 2009.
2. S N Sivanandam, S Sumathi, S N Deepa, Introduction to Neural Networks using MATLAB 6.0 , McGraw Hill Education.
3. S. Rajasekaran & G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, PHI, 2003.
4. Tom M. Mitchell , Machine Learning , McGraw-Hill, 1997
5. J-S. R. Jang, C.-T. Sun, E. Mizutani, Neuro-Fuzzy and Soft Computing, PHI, 1997.

REFERENCE BOOKS:

1. S. N. Sivanandam & S. N. Deepa, Principles of Soft Computing, Wiley - India, 2007.
2. Deepak Khemani, A first course in Artificial Intelligence, McGraw Hill Education. 3rd edition, 1st edition, 2013.
3. Stuart Russel and Peter Norvig, Artificial intelligence: A modern Approach, Pearson Education, 3rd edition, 2015
4. E Charniak and D McDermott, Introduction to Artificial Intelligence, Pearson Education.
5. Bishop Christopher, Pattern Recognition and Machine Learning, Springer Verlag, 2006.

Course Articulation Matrix:

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

FPGA DESIGN LAB
PEC-ECE407-P

Course Credits: 1 Contact Hours: 2/week, (L-T-P: 0-0-2) Mode: Lab work Examination Duration: 3 hours	**Course Assessment (Internal: 30; External:70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	Describe the use of HDL for FPGA implementation.	L1
CO 2	Illustrate the various CAD tools available for FPGA design and implementation.	L2
CO 3	Demonstrate the importance of HDL and CAD tools in VLSI digital system design.	L3
CO 4	Compare the various design techniques for digital system design.	H1
CO 5	Evaluate the performance of digital systems on FPGA.	H2
CO 6	Develop or create digital system using HDL and FPGA.	H3

List of Experiments

1. FPGA design with HDLs-familiarization.
2. FPGA implementation of 4-bit adder using HDL.
3. FPGA implementation of ALU using HDL.
4. FPGA implementation of Counter using HDL.
5. FPGA implementation of Finite state machine using HDL.
6. FPGA implementation of 7-segment decoder using HDL.
7. Write HDL code to display messages on an alpha numeric LCD display.
8. Write HDL code to interface Hex key pad and display the key code on seven segment display.
9. Write HDL code to control speed, direction of DC and stepper motor.
10. Write HDL code to accept 8 channel analog signal, Temperature sensors and display the data on LC panel or seven segment display
11. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.) using DAC change the frequency and amplitude.
12. Write HDL code to simulate Elevator operation

NOTE: Ten experiments are to be performed out of which at least six experiments should be performed from above list. The remaining experiments may be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

ANTENNA AND WAVE PROPAGATION LAB
PEC-ECE409-P

Course Credits :1.0 Contact Hours: 2 Hrs/week Mode : Lab Work	**Course Assessment Methods (Internal: 30; External: 70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	To define and describe basic antenna parameters like radiation pattern, directivity and gain.	L1
CO 2	To apply basic theorems to analyze the variation of field strengths of radiated waves.	L2
CO 3	To demonstrate the structure and operation of various antennas and describe their performance.	L3
CO 4	To examine performance parameters of uniform linear and planar antenna arrays.	H1
CO 5	To design and implement special type of antennas like microstrip antennas.	H3

List of Experiments

1. To study different Antenna parameters and their importance.
2. To analyze the performance parameters of dipole antenna.
3. To analyze the performance parameters folded dipole antenna
4. To analyze the performance parameters of monopole antenna.
5. To analyze the performance parameters of Yagi-Uda antenna.
6. To study the different performance parameters of N element antenna array.
7. To analyze the different performance parameters of Horn antenna.
8. To analyze the performance parameters of reflector antenna.
9. To design a coaxial feed rectangular microstrip antenna using FR4 substrate with dielectric constant 4.4, h=1.6 mm resonating at 2.4 GHz.
10. To design inset feed microstrip antenna using FR4 substrate with dielectric constant 4.4, h=1.6 mm resonating at 2.4 GHz.

Software Required: HFSS/Scilab/CST

Note: Atleast eight experiments are to be performed in the semester, out of which minimum six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING LAB
PEC-ECE411-P

Course Credits : 1 Mode : Practical (P) Teaching schedule L T P : 0 0 2 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	To relate theoretical concepts with practical experiments.	L1
CO2	To use modern software based tools.	L3
CO 3	To examine theoretical concepts related to ANN on software.	H1
CO 4	To evaluate and compare performance of various pattern classification algorithms on real world problems.	H2
CO 5	To develop an application oriented pattern classification system using modern software based tools.	H3

List of Experiments

1. To familiarize with MATLAB software.
2. To write a program for classification of linearly separable data with a perceptron model.
3. To write a program for classification of an XOR problem with a multilayer perceptron network.
4. To write a program for classification of a 4-class problem with a multilayer perceptron network.
5. To write a program for classification of an XOR problem using Radial basis function networks.
6. To familiarize with Neural Network Toolbox.
7. To familiarize with Fuzzy Toolbox.
8. To design a fuzzy inference model by using Fuzzy Toolbox.
9. To familiarize with Classification Learner App.
10. To compare performance of various classification algorithms using Classification Learner App.

Software Required: MATLAB/PYTHON

NOTE: At least eight experiments are to be performed in the semester, out of which at least six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

Detailed Syllabus

of

B.Tech.(ECE)

Program Elective Course-3

1.7.19 01-VII-2019

Priti Prabhakar 1/7/19

POWER ELECTRONICS
PEC-ECE402-T

General Course Information:

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 1 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Basics of Electronics

Course Outcomes:

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	To define the basics operations and characteristics of power electronics devices.	L1
CO 2	To compare the performance of various power semiconductor devices, passive components and switching circuits.	L2
CO 3	To the use of power converters and inverters in commercial and industrial applications.	L3
CO 4	To analyze various single phase and three phase power converter circuits and understand their applications	H1
CO 5	To develop skills to build, and troubleshoot power electronics circuits.	H2
CO 6	To design the SCR controlled devices, firing and commutating circuit, inverters, choppers and drivers.	H3

Course Contents

UNIT-I

Power Semiconductor Devices: Role & applications of power electronics, Construction & Static V-I characteristics of Thyristors, Thyristor turn on methods, switching characteristics of Thyristor, two transistor model of Thyristor, Thyristor Protection, Series and parallel connection of Thyristor, Gate Turn-off Thyristor, Multilayer devices: Construction & characteristics of DIAC, TRIAC.

SCR Commutating Circuits: Thyristor Turn-off methods: Line commutation, Load commutation, forced commutation, Commutating circuits, Voltage commutation, current Commutation & Pulse commutation.

12/07/19

UNIT-II

Converters : Principal of phase controlled rectifiers: single phase half wave circuit with RL load, single phase half wave circuit with RL load and freewheeling diode, Single phase Full wave controlled converters: Mid-Point and Bridge converters, Dual converter: Ideal and Practical dual converter.

UNIT-III

Inverters: Basic circuit, 120 degree mode and 180 degree mode conduction schemes, Force commutated Thyristor inverters: modified McMurray half bridge and full bridge inverters, McMurray -Bedford half bridge and bridge inverters, brief description of parallel and series inverters, current source inverter (CSI).

UNIT-IV

Choppers: Principal of Chopper operation, output voltage control techniques, step-up chopper, one, two, and four quadrant choppers, Thyristor Chopper Circuit: voltage commutated chopper, current commutated chopper and Load Commutated chopper.
Cycloconverters: Basic principle of cycloconverter operation, Types of cycloconverter: non-circulating and circulating types of cycloconverters.

TEXT BOOK:

1. Power Electronics: P.S Bhimra; Khanna Publisher.
2. Power Electronics : MH Rashid; PHI.
3. Power Electronics and Introduction to Drives: A.K.Gupta and L.P.Singh;Dhanpat Rai.

REFERENCE BOOKS:

1. Power Electronics: PC Sen; TMH
2. Power Electronics: HC Rai; Galgotia
3. Thyristorised Power Controllers: GK Dubey, PHI

12/07/19

Course Articulation Matrix:

	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	3	1	-	2	1	-	3	3	3	2
CO2	3	3	2	2	1	3	2	-	2	2	-	3	3	2	2
CO3	3	3	2	2	1	3	2	-	2	2	-	3	3	2	3
CO4	3	3	3	3	2	3	1	1	2	1	-	3	3	3	3
CO5	3	3	3	3	2	3	1	1	2	1	-	3	3	3	2
C06	3	3	3	3	2	3	2	1	2	1	-	3	3	2	3

DATABASE MANAGEMENT SYSTEM
PEC-ECE404-T

General Course Information

Course Credits : 03 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Prerequisite: Knowledge of UNIX, Windows, a programming language and data structures

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO 1	Describe fundamental elements of Database Management System.	L1
CO 2	Discuss principles of relational Database modelling.	L2
CO 3	Apply SQL for designing queries for Relational Databases.	L3
CO 4	Contrast various concurrency control and recovery techniques with concurrent transactions in DBMS.	H2
CO 5	Design models of databases using ER modelling and normalization for real life applications.	H3

Course Content

UNIT - I

OVERVIEW: Database, File Systems vs. DBMS, Characteristics of the Data Base Approach, Database users, Advantages and Disadvantages of a DBMS, Responsibility of Database Administrator.

DATA BASE SYSTEMS CONCEPTS AND ARCHITECTURE: Data Models, Schemas and Instances, DBMS architecture and various views of Data, Data Independence, Database languages.

UNIT - II

E-R MODEL: Entity Types, Attributes & Keys, Relationships, Roles and Structural Constraints, E-R Diagrams, Reduction of an E-R Diagram to Tables. Relational Data Model: Relational Algebra & various operations.

UNIT - III

SQL: Data Definition, Constraints, Insert, Delete & Update statements in SQL, Queries in SQL. **RELATIONAL DATABASE DESIGN:** Functional Dependencies, Integrity Constraints, Decomposition, Normalization (Up to 4NF).

UNIT - IV

CONCURRENCY CONTROL TECHNIQUES: ACID properties of a Transaction, Locking Techniques, Time-stamp ordering, Multi-version Techniques, Deadlock, Recovery Techniques in centralized DBMS.
DDBMS DESIGN: Replication and Fragmentation Techniques.

Text and Reference Books:

1. Elmasri, R., and Navathe,S. B., Fundamentals of Database Systems, 3rd Edition, Addison Wesley, 2002.
2. Silberschatz, A., Korth, H. F., and Sudarshan, S., Database System Concepts, McGraw Hill, 2011.
3. Pannerselvam R., Database Management Systems, 2ndEdition, PHI Learning, 2011.
4. Desai, B. C., An Introduction to Database System, Galgotia Publication, 2010.
5. Leon, A., and Leon, M.,Database Management Systems,First Edition, Vikas Publishing, 2009.
6. Mata-Toledo, R., Cushman, P., Sahoo, D., Database Management Systems, Schaums' Outline series, TMH, 2007.

Course Articulation Matrix:

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

PROBABILITY THEORY AND STOCHASTIC DESIGN
PEC-ECE406-T

Course Credits : 03 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Basics of information theory and engineering mathematics.

Sr. No.	Course Outcomes **At the end of the semester, students will be able:**	RBT Level
CO 1	To describe the significance of probability & random variables in communication theory.	L1
CO 2	To explain the concept of distribution, density & stochastic theory.	L2
CO 3	To illustrate the significance of random variables & functions in communication engineering.	L3
CO 4	To examine the temporal & spectral characteristics of various functions & signals.	H1
CO 5	To judge the distribution of different variables in the real world applications.	H2

Course Contents

UNIT-1

PROBABILITY & RANDOM VARIABLE: Probability introduced through Sets and Relative Frequency, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Joint Probability, Conditional Probability, Total Probability, Baye's Theorem, Independent Events. Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous, and Mixed Random Variables.

UNIT-II

DISTRIBUTION & DENSITY FUNCTIONS: Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh and Conditional Distribution, Methods of defining Conditional Event, Conditional Density, and Properties. 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, Characteristic Function, Moment Generating Function.

UNIT –III

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

UNIT-IV

STOCHASTIC PROCESSES: Stochastic Processes, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationary and Statistical Independence, First-Order Stationary Processes, Second-Order and Wide-Sense Stationary, Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, 4 Ed., 2001, TMH.
2. Probability and Random Processes – Scott Miller, Donald Childers, 2 Ed, Elsevier, 2012.
3. Theory of Probability and Stochastic Processes- Pradip Kumar Gosh, University Press

REFERENCE BOOKS:

1. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, 4 Ed., TMH.
2. Random Processes with Application to Signal Processing – Henry Stark and John W. Woods, 3 Ed., PE
3. Statistical Theory of Communication - S.P. Eugene Xavier, 1997, New Age Publications.

Course Articulation Matrix:

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

AUDIO & SPEECH PROCESSING
PEC-ECE408-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 1 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To Define speech signal modelling	L1
CO 2	To Illustrate the structure of human ear	L2
CO 3	To Apply various speech quantizers	L3
CO 4	To Compare different speech production models	H1
CO 5	To Evaluate filter coefficients	H2

Course Contents

UNIT-I

INTRODUCTION: Speech production and modelling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid; Requirements of speech codec's –quality, coding delays, robustness, Audio synthesis and Audio effects.

SPEECH SIGNAL PROCESSING: Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

UNIT-II

LINEAR PREDICTION OF SPEECH: Basic concepts of linear prediction; Linear Prediction Analysis of non-stationary signals-prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

UNIT –III

SPEECH QUANTIZATION: Scalar quantization-uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization–distortion measures.

[illegible] quantization based on LSF.

UNIT-IV

LINEAR PREDICTION CODING: LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model

CODE EXCITED LINEAR PREDICTION: *CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders.*

SPEECH CODING STANDARDS *- An overview of ITU-T G.726, G.728 and G.729standards.*

TEXT BOOKS:

1. "Digital Processing of Speech Signals", Pearson Education, L.R. Rabiner and R.W. Schafer, Delhi, India. [illegible]
2. "Digital Speech", A.M.Kondoz, Second Edition (Wiley Students Edition), 2004.
3. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, WileyInter science, 2003.

REFERENCE BOOKS:

1. "Discrete-Time Processing of Speech Signals", J. R. Deller, Jr., J. H. L. Hansen and J. G. Proakis, Wiley, IEEE Press, NY, USA, 1999.
2. "Multimedia signal processing", Vaseghi, SaeedV, England John Wiley&Sons 2007

SCALAR QUANTIZATION OF LPC: Spectral distortion measures. Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

UNIT-IV

LINEAR PREDICTION CODING: LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.
CODE EXCITED LINEAR PREDICTION: CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders.
SPEECH CODING STANDARDS - An overview of ITU-T G.726, G.728 and G.729standards.

TEXT BOOKS:

1. "Digital Processing of Speech Signals", Pearson Education, L.R. Rabiner and R.W. Schafer, Delhi, India, 2004.
2. "Digital Speech", A.M.Kondoz, Second Edition (Wiley Students Edition), 2004.
3. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, WileyInter science, 2003.

REFERENCE BOOKS:

1. "Discrete-Time Processing of Speech Signals", J. R. Deller, Jr., J. H. L. Hansen and J. G. Proakis, Wiley, IEEE Press, NY, USA, 1999.
2. "Multimedia signal processing", Vaseghi, SaeedV, England John Wiley&Sons 2007

Course Articulation Matrix:

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

RADAR & SONAR ENGINEERING
PEC-ECE410-T

Course Credits :3.0 Mode :Lectures (L) Teaching schedule L T P :3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Antenna & Wave Propagation, Microwave & Radar Engineering

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	To define basic principal of radar system.	L1
CO 2	To compare various tracking system used in radar.	L2
CO 3	To illustrate different types of radars and their applications	L3
CO 4	To compare various types of radar systems.	H1
CO 5	To select detection theory to radar and sonar systems.	H2
CO 6	To design basic sonar, radar, and navigation systems	H3

Course Contents

UNIT-1

INTRODUCTION TO RADAR: Radar Block Diagram & operation, Radar Frequencies, Radar development, Application of Radar, Simple form of Radar Equation, Prediction of Range performance, Minimum detectable signal, Receiver noise, Signal to Noise ratio,Transmitter Power, Pulse repetition frequency & range ambiguities, System losses, Propagation effects.

UNIT-II

CW & MTI RADAR: The Doppler effect, CW Radar, Frequency-modulated CW Radar, Multiple Frequency CW, Radar, Delay Line Cancellors, Multiple or staggered, Pulse repetition frequencies, Range-Gated Doppler Filters, Digital Signal Processing, Other MTI delay line, Limitation of MTI performance, Noncoherent MTI, Pulse Doppler Radar, MTI from a moving platform.

UNIT –III

RECEIVERS &TRACKING RADAR: Tracking with Radar, Sequential Lobbing, Conical Scan, Monopulse Tracking Radar, tracking in range, Acquisition, Radio Navigational Aids: Radio direction finding system, Direction finding using loop antenna & Adcock antenna, LORAN, radar Antennas, Radar Receivers, Noise Figure, Mixer, Low-noise Front ends, Displays, Duplexer, Receiver protectors.

UNIT-IV

SONAR: Introduction to Sonar, Block diagram& Working, Active & Passive Sonar, Performance Factors, Effect of Sonar on Marine Life, Applications

TEXT BOOKS:

1. Skolnik, Merrill," Introduction to Radar Systems", Tata McGraw-Hill, 3rd Edition, 2001.
2. Laurence J. Ziomek, "An Introduction to Sonar" CRC Press.
3. K. K. Sharma, fundamentals of Radar, Sonar and Navigation Engineering, S K Kataria & Sons.

REFERENCE BOOKS:

1. Electronic Communication Systems: Kennedy; TMH.
2. M. Kulkarni, Microwave & Radar Engineering, Umesh Publications.
3. Microwave & Radar Engg. Dr. A. K. Gautam, Katson Books.

Course Articulation Matrix:

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

Detailed Syllabus

of

B.Tech.(ECE)

Program Elective Course-4

ROBOTICS
PEC-ECE412-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To describe the history, concepts and key components of robotics technologies.	L1
CO 2	To describe and compare various robot sensors and their perception principles that enable a robot to analyse their environment, reason and take appropriate actions toward the given goal.	L2
CO 3	To apply the learned knowledge and skills in practical robotics applications.	L3
CO 4	To analyse the problems in spatial coordinate representation and spatial transformation, robot locomotion, kinematics, motion control, localization and mapping, navigation and path planning.	H1
CO 5	To plan, design and implement robotic systems, algorithms and software capable of operating in complex and interactive environments.	H2
CO 6	To develop robotic path motions and to use hydraulics and pneumatics in industrial robots.	H3

Course Contents

UNIT-I

BASICS OF ROBOTICS: Robots and their applications: Robot subsystems, classification of robots, industrial applications.
Actuators and grippers: Electric actuators, hydraulic actuators, pneumatic actuators, selection of motors, grippers.
Sensors, vision and Signal conditioning: Sensor classification, internal sensors, external sensors, vision, signal conditioning, sensor selection

UNIT-II

KINEMATICS AND DYNAMICS OF ROBOT: Kinematics: Forward position analysis, inverse position analysis, velocity analysis, link velocities, Jacobian computation, DeNOC, forward and inverse velocity analysis, acceleration analysis.

Dynamics: Inertia properties, Euler-Lagrange formulation, Newton-Euler formulation, recursive Newton- Euler algorithm, dynamic algorithms Recursive robot dynamics: Dynamic modelling, analytical expressions, recursive inverse dynamics of robo analyser, recursive forward dynamics and simulation

UNIT –III

LINEAR AND NONLINEAR CONTROLS FOR ROBOTS: Linear control: Control techniques, dynamic systems, transfer function and state space representation, robotic joint, performance and stability of feedback control, PID control of a moving block.
Nonlinear controls: Control of a moving block, multivariable robot control, stability of multi-DOF robot, linearized control, PD position control, computed torque control, feed forward control, robust control, adaptive control, Cartesian control.

UNIT-IV

MOTION PLANNING AND CONTROL HARDWARE: Motion planning: Joint space planning, cartecian space planning, path primitives, cartesian trajectories, point to point vs continuous path planning. Control hardware: Control considerations, hardware architecture, hardware for joint controllers, computational speed.

TEXT BOOKS:

1. S.K Saha, "Introduction to Robotics", McGraw Hills
2. Mittal and Nagrath, 'Robotics and Control", McGraw Hills
3. N. Odrey, "Industrial Robotics - SIE: Technology - Programming and Applications", McGraw Hills

REFERENCE BOOKS:

1. S.K. Saha, "Dynamics of Three-Type Robotic Systems", Springer
2. I.J. Nagrath, "Control System Engineering", New Age International
3. R.S. Khurmi, "A Text Book of Engineering Mechanics", S. Chand

Course Articulation Matrix:

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

OPTICAL COMMUNICATION
PEC-ECE414-T

Course Credits : 3.0 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Dual nature of light, basics of communication

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To define the principles of optical fiber communication.	L1
CO 2	To classify various components and advantages of optical communication.	L2
CO 3	To demonstrate the operation of LASERs, LEDs and detectors.	L3
CO 4	To compare and differentiate various components and parts of optical communication system according to their application	H1
CO 5	To select the appropriate fiber for communication according to the requirements	H2
CO 6	To analyse and design optical network and understand optical communication systems and networks.	H3

Course Contents

UNIT-I

INTRODUCTION TO OPTICAL COMMUNICATION SYSTEMS : Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model, Different types of optical fibers, Electromagnetic spectrum used for optical communication, block diagram of optical communication system, Advantages of optical fiber communication.

UNIT-II

OPTICAL FIBERS: Optical fibers structures and their types, fiber characteristics : attenuation, scattering, absorption, fiber bend loss, dispersion, material, waveguide, polarized mode dispersion, intermodal and intramodal dispersion, fiber couplers and connectors, Signal degradation on optical fiber due to dispersion and attenuation, OTD.

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UNIT –III

OPTICAL SOURCES AND SWITCHES: LEDs and LASERs, Photo-detectors - PIN-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties, internal and external quantum efficiency, Optical switches - coupled mode analysis of directional couplers, electro-optic switches, optical cross connects, Fiber Bragg grating.

UNIT-IV

AMPLIFIERS AND OTHER SYSTEMS: Optical amplifiers - EDFA, Raman amplifier, WDM and DWDM systems. Principles of WDM networks, Non-linear effects in fiber optic links. Concept of self-phase modulation, solutions, SONET, ROF, XPM, FWM, SBS, SRS, fiber to home, fiber to premises, optical transport networks.

TEXT BOOKS:

1. J. Keiser, Fiber Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997
3. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

REFERENCE BOOKS:

1. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
2. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
3. S.E. Miller and A.G. Chynoweth, eds., Optical fibers telecommunications, Academic Press, 1979.
4. G. Agrawal, Nonlinear fiber optics, Academic Press, 2nd Ed. 1994.

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Course Articulation Matrix:

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

OPERATING SYSTEMS
PEC-ECE416-T

Course Credits: 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: programming in C and knowledge of computer fundamentals.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able to:**	**RBT Level**
CO 1	List various functions and design characteristics of operating systems	L1
CO 2	Explain fundamental concepts of operating systems.	L2
CO 3	Apply operating system design concepts for solving problems regarding scheduling, memory management, disk management and deadlocks etc.	L3
CO 4	Analyze the issues related to various operating systems.	H1
CO 5	Design solutions for the memory and process management problems	H3

Course Content

UNIT I

INTRODUCTORY CONCEPTS: Operating systems functions and characteristics, operating system services and systems calls, system programs, operating system structure. Operating systems generation, operating system services and systems calls. Types of Operating systems: Batch operating system, Time-sharing OS, Distributed operating system, Real-time systems.

FILE SYSTEMS: Types of Files and their access methods, File allocation methods, Directory Systems: Structured Organizations, directory and file protection mechanisms, disk scheduling and its associated algorithms.

UNIT II

PROCESSES: Process concept, Process Control Block, Operations on processes, cooperating processes. CPU scheduling: Levels of Scheduling, scheduling criteria, Comparative study of scheduling algorithms, Algorithm evaluation, multiple processor scheduling. Critical-section problem, Semaphores.

UNIT III

STORAGE MANAGEMENT: Storage allocation methods: Single contiguous allocation, non-contiguous memory allocation, Paging and Segmentation techniques, segmentation with paging, Virtual memory concepts, Demand Paging, Page replacement Algorithms, Thrashing.

UNIT IV

DEADLOCK: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock. Case Studies: Comparative study of WINDOW, UNIX & LINUX system.

Text and Reference Books:

1. Silberschatz, Peter B. Galvin and Greg Gagne, Operating System Concepts, 8th Edition, WileyIndian Edition, 2010.
2. Andrew S Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall India, 2008.
3. Naresh Chauhan, Principles of Operating Systems, Oxford Press, 2014.
4. D.M. Dhamdhere, Operating Systems, 2nd edition, Tata McGraw Hill, 2010.
5. William Stallings, Operating Systems– Internals and Design Principles, 5th Edition, Prentice Hall India, 2000.

Course Articulation Matrix:

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

ROBOTICS LAB
PEC-ECE412-P

Course Credits : 1 Contact Hours: 2 Hours Mode : Lab Work	**Course Assessment Methods (Internal: 30; External: 70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To describe the functionality and limitations of robot actuators and sensor.	L1
CO 2	To generate programs for a robot to perform a specified task (e.g obstacle avoidance or wall following) in a target environment.	L2
CO 3	To employ automation by programmable controllers	L3
CO 4	To examine effect of electronics, circuits and sensors on automation controls.	H1
CO 5	To judge faults in robotic systems	H2
CO 6	To develop robotic path motions and to use hydraulics and pneumatics in industrial robots	H3

List of Experiments

1. ADC and DAC interfacing with Micro-Controller
2. Temperature control using Micro-Controller interface
3. Stepper motor Interfacing with Micro-Controller
4. Servo motor Interfacing with Micro-Controller
5. LCD interfacing with Micro-Controller
6. Interfacing of PMW with DC motor using Micro-Controller interface
7. Study and selection of Gripper.
8. Study of robotic arm and its configuration
9. Study the robotic end effectors
10. Study of different types of hydraulic and pneumatic valves
11. Study of different actuators and end effector for robot.
12. Robot programming and simulation for pick and place
13. Robot programming and simulation for Shape identification
14. Robot programming and simulation for Colour identification
15. Robot programming and simulation for multi process.

Note: Atleast eight experiments are to be performed in the semester, out of which minimum six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

OPTICAL COMMUNICATION LAB
PEC-ECE414-P

Course Credits : 1.0 Contact Hours: 3 Mode : Lab Work	**Course Assessment Methods (Internal: 30; External: 70)**

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To define the principles of optical fibre communication.	L1
CO 2	To classify various components and advantages of optical communication.	L2
CO 3	To demonstrate the operation of LASER, LEDs and detectors.	L3
CO 4	To compare and differentiate various components and parts of optical communication system through simulation.	H1
CO 5	To select the appropriate fibre for communication according to the requirements	H2
CO 6	To assemble and design optical network through simulation.	H3

List of Experiments

1. To study the characteristics and parameters of Single mode and multi mode fibers.
2. To calculate the numerical aperture of fiber.
3. To calculate acceptance angle in fiber.
4. To set up 8- 16 channel WDM systems.
5. To study Optsim simulator.
6. To study optical RoF link on Optsim.
7. To set up an optical communication link using Optsim.
8. To study non linear affects using Optsim.
9. To ascertain BER for various data rates for single and multimode fibers using Optsim
10. To design optical amplifier using Optsim.

Note: Atleast eight experiments are to be performed in the semester, out of which minimum six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

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Course Articulation Matrix:

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

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OPERATING SYSTEMS LAB
PEC-ECE416-P

Course Credits : 1 Mode : Lab Work Teaching schedule L T P : 0 0 2 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)**

Pre-requisites: Basic programming skills.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	Describe various memory allocation strategies and analysing their performance.	L3
CO 2	Discuss the performances of different process scheduling, protection and security mechanisms.	L3
CO 3	Apply the basic concepts of file system and management, process control, scheduling and communication, as well as memory management.	L3
CO 4	Analyze and implementing various deadlock handling strategies.	H1
CO 5	Evaluate the performance of various page replacement policies by implementing them.	H2
CO 6	Develop and test page fault for different page replacement algorithm.	H3

List of experiments

1. Write a program to implement CPU scheduling for first come first serve.
2. Write a program to implement CPU scheduling for shortest job first.
3. Write a program to perform priority scheduling.
4. Write a program to implement CPU scheduling for Round Robin.
5. Write a program for page replacement policy using a) LRU b) FIFO c) Optimal.
6. Write a program to implement first fit, best fit and worst fit algorithm for memory management.
7. Write a program to implement reader/writer problem using semaphore.
8. Write a program to implement Banker's algorithm for deadlock avoidance.
9. Write a program to implement Banker's algorithm for deadlock prevention.
10. Write a program to implement the following the following file allocation methods: (a) contiguous (b) Linked (c) Indexed .
11. Write a program to simulate the following techniques of memory management: a) Paging b) Segmentation
12. Write a program to simulate the following File organization techniques: a) Single level directory b) Two level c) Hierarchical.

Note: Atleast eight experiments are to be performed in the semester, out of which minimum six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed and set by concerned institution as per the scope of the syllabus.

Course Articulation Matrix:

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

Detailed Syllabus

of

B.Tech.(ECE)

Program Elective Course-5

1.7.19 01-VII-2019

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RECENT TRENDS IN COMMUNICATION SYSTEMS
PEC-ECE418-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Sr. No.	**Course Outcomes** **At the end of the semester:**	RBT Level
CO 1	Students will be able to define the wireless network Fundamentals and future evaluation	L1
CO 2	Students will be able to understand about Cognitive Radio and wireless sensor network.	L2
CO 3	Students will be able to apply application of Cognitive Radio in Communication	L3
CO 4	Students will be able to compare the Wireless sensor and Optical network.	H1
CO 5	Students will be able to formulate the LTE based project.	H3

Course Contents

UNIT-1

Wireless Network Fundamentals & Future Evolution: Introduction to 4G, OFDM, MIMO, Massive MIMO, Long Term Evaluation (LTE) Technologies, Need of LTE, LTE System Architecture, LTE Operations, LTE communication protocol. LTE-Advanced and VoLTE., Fundamentals of 5G Mobile Communication, Evolving LTE to 5G capability, 5G Standardization, 5G Spectrum, 5G Architecture & Applications.

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UNIT-II

Wireless Sensor Network: Introduction of Wireless Sensor Networks, Design Issues, Unique constraints and Challenges, Applications of WSN, MAC layers and routing protocols in WSN, Topology Control in WSNs, Data Retrieval Techniques in WSNs: Sensor databases, distributed query processing, Data dissemination and aggregation schemes, Operating Systems for WSN, Security issues in WSN, Future direction of WSNs.

UNIT-III

Cognitive Radios: Cognitive Radio – functions, components and design rules, Challenges to Implement Cognitive Radio, Cognitive Radio Products and Applications. Cognition cycle - orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture.

UNIT-IV

Optical Networks: WDM, DWDM, CWDM, Radio over fiber: Introduction the concept of radio over fiber, categories, performance and application of radio over Fiber, link design issues in radio over Fiber, MM waves: Introduction, Generation and detection of MM waves , All optical networks, Sub carrier multiplexing and CATV applications.

TEXT BOOKS:

1. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley and Sons, 2006.
2. Christopher-Cox, "An Introduction to LTE: LTE, LTE-Advanced, SAE, VoLTE and 4G Mobile Communications", Wiley, 1st Edition.
3. Huseyin Arslan, "Cognitive Radio, SDR and Adaptive System", Springer, 2007.
4. Optical Fiber Communications, Gerd Keiser, 2nd Edition.

REFERENCE BOOKS:

1. Erik Dahlman , Stefan Parkvall and Jhoan Skold "5G NR: The Next Generation Wireless Access Technology" Academic Press, 2018.
2. Optical Fiber Communications, John M. Senior, 3rd Edition.
3. Alexander M. Wyglinski, Maziar Nekovee , Thomas Hou, "Cognitive Radio Communications and Networks: Principles and Practice", Elsevier, Ist addition.
4. Markus Dillinger, Kambiz Madani, Nancy Alonistioti, "Software Defined Radio", John Wiley, 2003.
5. Kazem, Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Network: Technology, Protocols and Application", John Wiley and Sons 1st Ed., 2006

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RECENT TRENDS IN COMMUNICATION SYSTEMS

PEC-ECE418-T

Course Articulation Matrix:

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

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RECENT TRENDS IN COMMUNICATION SYSTEMS

PEC-ECE418-T

VLSI TECHNOLOGY AND APPLICATIONS
PEC-ECE420-T

General Course Information:

Course Credits: 3 Contact Hours: 3/week, (L-T-P: 3-0-0) Mode: Lectures Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Two minor tests each of 20 marks, Class Performance measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks), and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the remaining four units. All questions carry equal marks.

Pre-requisites: Analog & Digital Circuits, Electronics Semiconductor Devices.

Sr. No.	**Course Outcomes:** **At the end of the semester, students will be able to:**	**RBT Level**
CO 1	Describe methodology to fabricate an IC.	L1
CO 2	Understand the diffusion of materials using different techniques.	L2
CO 3	Use thorough knowledge on design tools to draw layouts for the transistor structures.	L3
CO 4	Analyze the characterization of different materials.	H1
CO 5	Design VLSI circuits starting from PMOS, NMOS, and CMOS technology based design	H3

Course contents

UNIT I

Microelectronics processing: Introduction, Clean Room, Pure Water System, Vacuum Science and Technology, Practical vacuum systems, Operating principle: Rotary Pump, Diffusion pump, Cryo Pump and Turbo Pump, Vacuum Gauges: Sources for vacuum deposition, Sputtering (DC, RF and RF Magnetron), Chemical Vapor Deposition, reactors for chemical vapor deposition, CVD Applications, PECVD, Metallization, Epitaxy: Introduction, Vapor phase epitaxy, Liquid phase epitaxy and Molecular beam epitaxy, Hetroepitaxy.

UNIT II

Thermal Oxidation of Silicon, Oxide Formation, Kinetics of Oxide Growth, Oxidation Systems, Properties of Thermal Oxides of Silicon, Impurity Redistribution during Oxidation, Uses of Silicon Oxide, Basic diffusion process, Diffusion Equation, Diffusion Profiles, Evaluation of

Diffused Layers, Diffusion in Silicon, Emitter-Push Effect, Lateral Diffusion, Distribution and Range of Implanted Ions, Ion Distribution, Ion Stopping, Ion Channeling, Disorder and Annealing, Multiple Implantation and Masking, Pre-deposition and Threshold Control.

UNIT III

Photolithography, Negative and Positive Photoresist, Resist Application, Exposure and Development, Photolithographic Process Control, E-Beam Lithography, X-Ray Beam Lithography and Ion Beam Lithography. Wet Chemical Etching, Chemical Etchants for SiO2, Si3N4, Polycrystalline Silicon and other microelectronic materials, Plasma Etching, Plasma Etchants, Photoresist Removal, Lift off process, Etch Process Control.

UNIT IV

Fundamental considerations for I.C processing, PMOS and NMOS IC Technology, CMOS I.C technology, Packaging design considerations, Special package considerations, Yield loss in VLSI, Reliability requirements for VLSI.

Text Books:

1. VLSI Fabrication Principles: Silicon and Gallium Arsenide by Sorab K. Ghandhi (John Wiley & Sons).
2. VLSI Technolog, S.M.Sze (2nd Edition); TMH.
3. Microelectronic Processing: An Introduction to the Manufacture of Integrated Circuits by W. Scot Ruska (McGraw Hill International Edition).

Reference Books:

1. Microchip Fabrication: A Practical Guide to Semiconductor Processing by Peter Van Zant (2nd Edition) (McGraw Hill Publishing Company).
2. Semiconductor Devices: Physics and Technology by S.M. Sze; Wiley.
3. Thin Film Processes Part I & II by John L. Vossen and Wirner Kern (Academic Press).

Course Articulation Matrix:

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

ARM

PEC-ECE422-T

General Course Information:

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Embedded System Design

Course Outcomes:

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	To define ARM basic architecture, Operating modes and its Pipeline structure	L1
CO 2	To understand ARM assembly instructions and their formats and usage.	L2
CO 3	To analyze various peripherals used with ARM core and it basic functioning.	H1
CO 4	To develop skills to build ARM controlled based devices.	H2
CO 5	To design an ARM interfacing with other coprocessor.	H3

Course Contents

UNIT-I

INTRODUCTION: Processor architecture and organization, Abstraction in hardware design, MU0 - a simple processor, Instruction set design, Processor design trade-offs, The Reduced Instruction Set Computer, Design for low power consumption.

ARCHITECTURE: The Acorn RISC Machine, Architectural inheritance, The ARM programmer's model, and ARM development tools.

UNIT-II

INSTRUCTION SET: Introduction, Exceptions, Conditional execution , Branch and Branch with Link (B, BL), Branch with Link and exchange (BX, BLX), Software Interrupt (SWI), Multiply instructions, Count leading zeros (CLZ - architecture v5T only), Single word and unsigned byte instructions, Half-word and signed byte instructions, Multiple register transfer instructions, Swap memory and register instructions (SWP), Status register to general register transfer instructions, General register to status register transfer instructions.

UNIT-III

PROGRAMMING: Data processing instructions, Data transfer instructions, Control flow instructions, Writing simple assembly language programs, Examples and exercises.

UNIT-IV

ARM ORGANISATION & IMPLEMENTATION: ARM architecture variants, 3-stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, ARM implementation, The ARM coprocessor interface.

PROCESSOR CORES: ARM7TDMI, ARM8, ARM9TDMI, and ARM10TDMI.

TEXT BOOK:

1. ARM System-on-Chip Architecture, by "Steve Furber", PEARSON.
2. ARM Assembly Language Programming & Architecture by Muhammad Ali Mazidi, Sarmad Naimi, SepehrNaimi, Shujen Chen; MicroDigitalEd.com
3. ARM Programming, CRC Press, Hohl, W., 2009.

REFERENCE BOOKS:

1. ARM Architecture Reference Manual, Addision-Wesley.
2. ARM System Developer Guide by Andrew Sloss, Dominic Symes and Chris Wright, May 2004; Morgan Kaufmann Publisher.
3. The ARM RISC Chip: A Programmers Guide by Alex van Someren and Carol Atack, Addison-Wesley.

Course Articulation Matrix:

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

MEMS & ITS APPLICATIONS
PEC-ECE424-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: IC Fabrication and Technology, VLSI Circuits

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	RBT Level
CO 1	To define the requirements and need of MEMS	L1
CO 2	To describe the MEMS process	L2
CO 3	To demonstrate the principles of sensing and actuations in MEMS design	L3
CO 4	To differentiate MEMS devices according to their application	H1
CO 5	To select MEMS devices according to the requirements	H2
CO 6	To assemble and design MEMS according to need and application	H3

Course Contents

UNIT-I

INTRODUCTION : History of MEMS Development, Characteristics of MEMS, micro electronics integration, evolution of micro sensors and actuators, MEMS Applications.

MEMS FABRICATION: Overview of Micro fabrication Processes- Photolithography ,Thin Film Deposition, Thermal Oxidation of Silicon, Wet Etching, Silicon Anisotropic Etching, Plasma Etching and Reactive Ion Etching, Doping, Wafer Dicing, Wafer Bonding, Microelectronics Fabrication Process Flow, Packaging and Integration.

UNIT-II

ELECTRICAL & MECHANICAL PROPERTIES OF MEMS MATERIALS: Conductivity of semiconductors, crystal plane and orientation, stress and stain – definition – relationship between tensile stress and stain- mechanical properties of silicon and thin films, torsional deflection, intrinsic stress, Dynamic System, Resonant Frequency, and Quality Factor.

15/7/19

UNIT –III

ELECTROSTATIC SENSING & ACTUATION-Introduction to electrostatic sensors and actuators, parallel-plate capacitor, equilibrium position of electrostatic actuator under bias, pull-in effect of parallel-plate actuators, applications of parallel-plate capacitors, inertia sensor, pressure sensor, flow sensor, parallel-plate actuators,

THERMAL SENSING & ACTUATION- Introduction to thermal sensors, thermal actuators, fundamentals of thermal transfer, sensors and actuators based on thermal expansion, thermal bimorph principle, thermal actuators with a single material.

UNIT-IV

TYPES OF SENSORS AND ACTUATORS: Mechanical, Radiation, Magnetic, Optical, Chemical and biological.

MEMS DESIGN: Design issues, Budget planning, Computer aided design, Assembly and System Integration, Packaging issues, Barometer, Gyroscope.

TEXT BOOKS:

1. Chang Liu, "Foundations of MEMS", Pearson International Edition, @2012
2. Tai – Ran Hsu, "MEMS & MICROSYSTEMS: Design and Manufacturing", TATA McGRAW-HILL, 2002
3. V. K. Aatre, K. N. Bhat, G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, "Micro and Smart Systems", Wiley India, 2010
4. N P Mahalik, "MEMS" TMH@2008

REFERENCE BOOKS:

1. Marc J. Madou, "Fundamentals of Microfabrication", 2nd Edition, CRC Press, 2002.
2. Mohamed Gad-el-Hak, "The MEMS Handbook", CRC Press, 2002
3. M.Elwenspock, R.Wiegerink, "Mechanical Microsensors", Springer-Verlag Berlin Heidelberg, 2001.
4. P. Rai-Choudhury, "Handbook of Microlithography, Micromachining & Microfabrication", SPIE, 1997

1/7/19

Course Articulation Matrix:

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

DIGITAL IMAGE PROCESSING
PEC-ECE426-T

Course Credits : 3 Mode : Lectures (L) Teaching schedule L T P : 3 0 0 Examination Duration : 03 Hours	**Course Assessment Methods (Internal: 30; External: 70)** Two Minor tests each of (20 Marks), class performance through percentage of lectures attended (4 Marks), assignments, quiz etc. (6 Marks), and end semester examination of (70 Marks). For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions, rest of the eight questions are to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt other four questions selecting one from each of the four units. All questions carry equal marks.

Pre-requisites: Digital signal processing.

Sr. No.	**Course Outcomes** **At the end of the semester, students will be able:**	**RBT Level**
CO 1	Describe general terminology of digital image processing.	L1
CO 2	Explain various types of images, intensity transformations and spatial filtering.	L2
CO 3	Apply Fourier transform for image processing in frequency domain.	L3
CO 4	Compare the methodologies for image segmentation, restoration etc.	H1
CO 5	Select image processing and analysis algorithms for particular application.	H2
CO 6	Develop image processing algorithms for practical applications.	H3

UNIT-I

INTRODUCTION: What Is Digital Image Processing? The Origins of Digital Image Processing. Examples of Fields that Use Digital Image Processing. Fundamental Steps in Digital Image Processing. Components of an Image Processing System. Elements of Visual Perception. Light and the Electromagnetic Spectrum. Image Sensing and Acquisition. Image Sampling and Quantization. Some Basic Relationships Between Pixels. Linear and Nonlinear Operations.

IMAGE ENHANCEMENT IN THE SPATIAL DOMAIN : Background. Some Basic Gray Level Transformations. Histogram Processing. Enhancement Using Arithmetic/Logic Operations. Basics of Spatial Filtering. Smoothing Spatial Filters. Sharpening Spatial Filters.

UNIT-II

IMAGE ENHANCEMENT IN THE FREQUENCY DOMAIN: Background. Introduction to the Fourier Transform and the Frequency Domain. Smoothing Frequency-Domain Filters. Sharpening Frequency Domain Filters.

IMAGE RESTORATION: A Model of the Image Degradation/Restoration Process. Noise Models. Restoration in the Presence of Noise Only-Spatial Filtering. Periodic Noise Reduction by Frequency Domain Filtering. Estimating the Degradation Function. Inverse Filtering. Minimum Mean Square Error (Wiener) Filtering.

UNIT –III

COLOR IMAGE PROCESSING : Color Fundamentals. Color Models. Pseudocolor Image Processing. Basics of Full-Color Image Processing. Color Transformations. Smoothing and Sharpening. Noise in Color Images.

IMAGE COMPRESSION: Fundamentals. Image Compression Models. Basics of Error-Free Compression and Lossy Compression.

UNIT-IV

IMAGE SEGMENTATION: Detection of Discontinuities. Edge Linking and Boundary Detection. Thresholding. Region-Based Segmentation. Segmentation by Morphological Watersheds. The Use of Motion in Segmentation (in spatial domain).

REPRESENTATION AND DESCRIPTION : Representation. Boundary Descriptors. Regional Descriptors. Relational Descriptors.

TEXT BOOKS:

1. Digital Image Processing; Gonzalez & Woods, PHI
2. Fundamentals of Digital Image Processing by Anil K Jain; Pearson.
3. Digital Image Processing by William K Pratt; Wiley.

REFERENCE BOOKS:

1. Fourier Methods in Imaging; Roger L. Easton, Wiley
2. Digital Signal Processing; Prokis, Pearson
3. Digital Signal Processing; Salivahanan, McGraw Hill

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CO4	3	3	3	3	1	3	1	2	2	2	-	3	2	2	3
CO5	3	3	3	3	2	3	2	2	2	2	-	3	3	3	3
CO6	3	3	3	3	2	3	2	2	2	2	-	3	3	3	3

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CO4	3	3	3	3	1	3	1	2	2	2	-	3	2	2	3
CO5	3	3	3	3	2	3	2	2	2	2	-	3	3	3	3
CO6	3	3	3	3	2	3	2	2	2	2	-	3	3	3	3