M.D. UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Electronics and Communication Engineering)

Common with

B.Tech (Electronics and Tele Communication)

SEMESTER 3rd & 4th

Scheme effective from 2019-20

COURSE CODE AND DEFINITIONS

Course Code	Definitios
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses

PT	Practical Training
S	Seminar

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SCHEME OF STUDIES & EXAMINATIONS

B.TECH (Electronics and Communication Engineering)

Common with

B.Tech (Electronics and Tele Communication)

SEMESTER –3rd w.e.f. 2019-20

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam	Contact Hrs./wk.
			L	T	P		Theory	Practical				
1	PCC-ECE201G	Electronic Devices	3	0	-	25	75	-	100	3	3	3
2	LC-ECE203G	Electronic Devices lab	0	0	2	25	-	25	50	1	3	2
3	PCC-ECE206G	Analog Circuits	3	0	-	25	75	-	100	3	3	3
4	LC-ECE208G	Analog Circuits lab	0	0	2	25	-	25	50	1	3	2
5	PCC-ECE209G	Signals and Systems	3	0	-	25	75	-	100	3	3	3
6	PCC-ECE211G	Network Theory	3	1	-	25	75	-	100	3	3	3
7	LC-ECE-212G	Network Theory Lab	0	0	2	25	-	25	50	1	3	2
8	LC-ECE-213G	PCB & ELECTRONIC WORKSHOP LAB	0	0	2	25	-	25	50	1	3	2
9	HSMC-01G	Economics for Engineers (Common with CSE)	3	0	0	25	75	-	100	3	3	3
10	*MC-106G	Environmental Science	3	0	1	25	75	-	-	-	3	4
Total									**700**	**19**		27

*__MC-106G__ is a mandatory non –credit course in which the students will be required passing marks in theory.

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SCHEME OF STUDIES & EXAMINATIONS
B.TECH (Electronics and Communication Engineering)
Common with
B.Tech (Electronics and Tele Communication)
SEMESTER –4th w.e.f. 2019-20

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam	Contact Hrs./wk.
			L	T	P		Theory	Practical				
1	PCC-ECE202G	Communication System	3	0	-	25	75	-	100	3	3	3
2	LC-ECE204G	Communication System lab	0	0	2	25	-	25	50	1	3	2
3	PCC-ECE205G	Digital Electronics	3	1	-	25	75	-	100	3	3	4
4	LC-ECE207G	Digital Electronics lab	0	0	2	25	-	25	50	1	3	2
5	PCC-ECE210G	Microcontrollers	3	1	-	25	75	-	100	3	3	4
6	LC-ECE-214G	Microcontrollers Lab	0	0	2	25	-	25	50	1	3	2
7	HSMC-02G	Organizational Behavior	3	0	0	25	75	-	100	3	3	3
8	BSC-MATH-202G	Mathematics-III (Partial differential equations and Numerical methods)	3	1	-	25	75	-	100	4	3	4
9	PCC-CSE-221G	Data Structures	3	0	0	25	75	-	100	3	3	3
Total									**750**	**22**		27

NOTE: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

PCC-ECE201G **Electronic Devices**

L	T	P	Credits	Sessional Marks:	25
3	0	-	03	Theory Marks :	75
				Duration of Exams: 3 Hours	

Course Objective: The objectives of this course are as under:

1. To provide explanation about the operation of all the important electronic devices
2. To study and understand the I/O behavior of various electronics devices to variable inputs
3. To demonstrate how electronic devices are used to design efficient electronic applications

Unit 1

Basic Semiconductor And Pn-Junction Theory: Introduction, Atomic Structure, Band Theory of Semiconductors, Covalent Bond, Metals, Insulators & Semiconductors, Effect of Temperature on Conduction, Drift Current ,Donor & Accepter Impurities in Semiconductor, Law Of Mass Action, Hall's Effect, Hall Coefficient & Mobility, Poisson and continuity equation.

Characteristics Of Diode:PN-Junction, Construction Types, Unbiased Junction, Biased Junction, Space Charge Region, Diode Characteristics & Parameters, Diode Capacitance, Diode Resistance, DC And AC Load Lines, Diode Testing, Zener And Avalanche Breakdown Diodes, Tunnel Diode, Temperature Characteristics of Diode, Reverse Recovery Time, Switching Characteristics of Diode.

Unit 2

Diode Applications: Half Wave, Full Wave Center Tapped, Full Wave Bridge(Rectification), Series Clipping Circuit, Shunt Clipping Circuit, Clamping Circuit, Bridge Voltage Doubler, Filtering Circuit Using Capacitor & Inductor.

Junction Transistor: Introduction, Construction Of Junction Transistor, Circuit Symbols, Transistor Operation, Unbiased Transistor, Operation Of Biased Transistor, Transistor Current Components, DC & AC Load Line, Operating Point, Transistor Configuration CB, CE, CC, Input/Output Characteristics, Early Effect(Base Width Modulation), Eber's-Moll-Model of Transistor, Maximum Rating of Transistor, Transistor Testing, Transistor as an Amplifier, Transistor as Oscillator.

Unit 3

Bjt Biasing: Bias Stability, Instability Due To β, Thermal Stability, Stability Factor, Fixed Biased Circuits, Effect of Emitter Resistor, Collector to Base Bias, Voltage Divide Biasing, Advantage & drawbacks of Biasing Techniques, Stability Factor calculation of Biasing Techniques, Bias Compensation by various device, Thermal Runway, Transistor Dissipation, Thermal Resistance, Condition of Thermal Stability

Small Signal Circuit: Two Port Network, Hybrid(H-Parameter)Model, Typical Values of H-Parameter Model, Conversion of CE, CB, CC Configuration to Equivalent Hybrid Model, CB Circuit Analysis, CE circuit with & without R_E analysis, CC circuit analysis, Analysis of CE, CB & CC Configuration with approximate Hybrid Model, Miller's Theorem, Dual of Miller Theorem.

Unit 4

FET: Introduction, The Junction FET, Basic Construction, Operation, P- Channel FET, N-Channel FET, High Frequency Model of FET, Low Frequency FET Amplifiers, Transfer Characteristics of FET, MOSFET, Enhancement Mode, Depletion Mode of FET, Circuit Symbol of MOSFET,V-MOSFET.

Special Semicondutor Devices: Optoelectronic Devices, Photoconductors, Photo Diode, Photo Transistor, Photo Voltaic Sensor, Photo Emission, Solar Cells, LED, LCD, Laser Diode, Schottky Diode, SCR, TRIAC, DIAC, UJT, Single Electron Transistor. Infrared LEDs, IGBT, Opto Coupler.

Text/Reference Books:

1. Basic Electronics By Debashion DE. – Pearson Education.
2. Electronics Device & Circuit, By Robert Boylestad ,Louis Nashelsky, 11th Edition, Pearson Education,2015.
3. Electronics Device Circuit By David.A.Bell -- Oxford
4. Integrated Electronics By Millman Halkias -- TMH.
5. Electronics Device &Circuit By Dharam Raj Cheruku -- Pearson Education.
6. Electronics Device &Circuit By B.P Singh and Rekha Singh 2nd Edition – Pearson Education.

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

1. Understand the operation of all the important electronic devices
2. Understand the I/O behavior of various electronics devices to variable inputs
3. Understand the design of efficient electronic applications

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

LC-ECE203G Electronic Devices Lab

L	T	P	Credits			
-	-	2	1	Class Work	:	25 Marks
				Theory	:	25Marks
				Total	:	50 Marks
				Duration of Exam.	:	3 Hrs.

Course Objective: The objectives of this course are as under:

1. To introduce students to the characteristics of diodes, transistors, JFETs, and op-amps .
2. To provide understanding about the operation and characteristics of different configurations of BJT.
3. To provide understanding about the operation and characteristics of different special semiconductor devices.

LIST OF EXPERIMENTS:

1	Analysis & study of half wave and full wave rectifiers
2	Analysis & study of power supply filter.
3	Analysis & study of diode as a clipper and clamper.
4	Analysis & study of zener diode as a voltage regulator.
5	Analysis & study of CE amplifier for voltage, current and Power gains input, output impedances.
6	Analysis & study of CC amplifier as a buffer.
7	Analysis & study the frequency response of RC coupled amplifier.
8	Analysis & study of transistor as a constant current source in CE configuration .
9	To study characteristics of FET.
10	Analysis & study of FET common source amplifier.
11	Analysis & study of FET common drain amplifier.
12	Study and design of a DC voltage doubler.
13	To study characteristics of SCR.
14	To study characteristics of DIAC.
15	To study UJT as a relaxation oscillator.

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

1. Understand the characteristics of diodes, transistors, JFETs, and op-amps.
2. Understand the operation and characteristics of different configurations of BJT.
3. Understand the operation and characteristics of different special semiconductor devices.

Note:-

1 Total ten experiments are to be performed in the semester.

2 At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed and set by the concerned institution as per the scope of the syllabus.

3 At least 5 experiments have to be simulated and results to be validated with experimental results.

PCC-ECE206G **Analog Circuits**

L	T	P	Credits	Sessional Marks: 25
3	0	-	03	Theory Marks: 75
				Duration of Exams: 3 Hours

Course Objective: The objectives of this course are as under:

1. To understand the characteristics of diodes and transistors
2. To design and analyze various rectifier and amplifier circuits
3. To design sinusoidal and non-sinusoidal oscillators
4. To understand the functioning of OP-AMP and design OP-AMP based circuits
5. To design ADC and DAC

Unit 1

High Frequency Analysis Of Bjt And Multistage Amplifier: Hybrid Pi Model, CE Short Circuit Gain, Frequency Response, Alpha Cut off Frequency, Gain Bandwidth Product, Emitter Follower at High Frequencies. RC Coupled Transistor Amplifier, Lower & Upper Cut off Frequency, Frequency Response curve & Bandwidth, Transformer Coupled Amplifier, Direct Coupled Amplifier, Cascode Amplifier, Darlington Pair Amplifier, Distortion In Amplifiers.

Feedback Amplifiers: Feedback concept , Transfer Gain with Feedback, General Characteristics of Negative Feedback, Advantages & disadvantages, Input And Output Resistance, Voltage Series Feedback topology, Voltage Shunt, Current Series & Current Shunt topology ,Equivalent circuit for each topology, Effects of Negative Feedback.

Unit 2

Oscillators: Introduction, Barkhausen Criterion, Oscillator with RC Feedback circuit (RC Phase Shift, Wien Bridge), Tuned Collector, Tuned Base Oscillator, LC Feedback circuits (Hartley, Colpitts), Condition for Sustained Oscillations & Frequency of Oscillations, Crystal Oscillator.

Power Amplifier: Definition, Application & Types of Power Amplifiers, Amplifier Classes of Efficiency (Class - A, B, AB, C), Push Pull Amplifiers, Distortion in Simple & Push Pull Amplifier, Complementary Push Pull Amplifier, Integrated Circuit Power Amplifier , Introduction to MOSFET & CLASS D Power Amplifier.

Unit 3

Voltage Regulators: Voltage Regulation, Basic Series Regulators, Basic Shunt Regulators, Power Supply Parameters, Basic Switching Regulators, Step up Configuration, Step down Configuration, IC Voltage Regulator, SMPS.

Integrated Circuit Fabrication Process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapour deposition, sputtering, twin-tub CMOS process.

Unit 4

Operational Amplifier Fundamentals: Block Diagram Representation, Ideal OP-AMP, OP-AMP Equivalent Circuit, Ideal Voltage Transfer Curve, Input Offset Voltage, Input Bias Current, Input Offset Current, Output Offset Voltage, Thermal Drift, Effect of Variation in Power Supply Voltages on Offset Voltage, Common Mode Configuration and CMRR, Frequency Response of OP-AMP: Open Loop Response, Close Loop Response, Input and Output Impedances, Effect of Finite Gain Bandwidth Product, Slew Rate.

Operational Amplifier Applications: Linear and non-linear applications-ADC and DAC, Multivibrators, Astable Multivibrator, Monostable Multivibrator, Bistable Multivibrator, 555 Timer, Monostable & Astable Operation with 555 Timer.

Text/Reference Books:

1. Electronics Device &Circuit By David.A. Bell - Oxford University Press.
2. Electronics Device & Circuit By Theodore F. Bogart, Jeffrey.S.Bealey,Guilermo Rico – 6th Edition, Pearson Education.
3. Electronics Device & Circuit By Robert Boylestad ,Louis Nashelsky, 11th Edition, Pearson Education, 2015.
4. Electronics Device By Floyd , 9th Edition, Pearson Education, 2015.
5. Integrated Electronics By Millman Halkias - TMH.
6. Electronic Devices & Circuits By B.P Singh and Rekha Singh, 2nd Edition, Pearson Education.
7. Electronics Device & Circuit By Sanjeev Gupta.
8. Electronics Device & Circuit By I. J. Nagrath - PHI
9. Electronic Principles By Albert Malvino.

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

1. Understand the characteristics of diodes and transistors
2. Design and analyze various rectifier and amplifier circuits
3. Design sinusoidal and non-sinusoidal oscillators
4. Understand the functioning of OP-AMP and design OP-AMP based circuits
5. Design ADC and DAC

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

LC-ECE208G **Analog Circuits Lab**

L	T	P	Credits			
-	-	2	1	Class Work	:	25 Marks
				Theory	:	25Marks
				Total	:	50 Marks
				Duration of Exam.	:	3 Hrs.

Course Objective: The objectives of this course are as under:

- To understand the characteristics and AC analysis of RC coupled amplifier.
- To understand the operation and characteristics of different oscillators, regulators and timers.
- To understand the operation of power supply.

LIST OF EXPERIMENTS:

1 To analyze and study frequency response of RC coupled amplifier.

2 To analyze and study different types of feedback topology.

3 To analyze and study RC phase shift oscillator.

4 To analyze and study wein bridge oscillator.

5 To analyze and study three terminal IC voltage regulator.

6 To draw characteristics of a transistor.

7 To analyze and study CE amplifier and calculate its gain.

8 To analyze and study 555 timer as a square wave generator.

9 To analyze and study SMPS power supply.

10 To analyze and study working of Push-Pull amplifier.

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

1. Understand the characteristics and AC analysis of RC coupled amplifier.
2. Understand the operation and characteristics of different oscillators, regulators and timers.
3. Understand the operation of power supply.

Note:-

1 Total ten experiments are to be performed in the semester.

2 At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed and set by the concerned institution as per the scope of the syllabus.

3 At least 5 experiments have to be simulated and results to be validated with experimental results.

PCC-ECE209G **Signals and Systems**

L	T	P	Credits		
3	0	-	3	Sessional Marks:	25
				Theory Marks `:	75
				Duration of Exams: 3 Hours	

COURSE OBJECTIVES: To bring the Continuous-time and Discrete-time concepts, types of signals and systems.

- To impart knowledge about representation, properties and applications of systems and signals.
- To impart knowledge about transforms and their applications to signals and systems.

Unit 1

Introduction To Signal: Signal Definition, Classification with examples: Continuous –Time & Discrete –Time, Continuous –valued & Discrete –valued, Analog & Digital, Deterministic & Random, One Dimensional & Multi Dimensional, Even/Symmetric & Odd/Anti symmetric signals, Causal, Non causal & Anti causal; Real & Complex, Periodic & Aperiodic, Energy & Power signals; Representation of Discrete –Time signals, Elementary Discrete Time Signals.

Introduction To Discrete-Time Systems And Their Properties: Systems & Their Representation, Independent variable transformations: Time Shifting, Time Reversal, Time Scaling, time shifting and reversal; classification of Systems: Hardware, Software & Mixed Systems; Linear & Nonlinear Systems; Static/without memory & Dynamic/ with memory Systems, Causal & Non causal System; Invertible & Noninvertible; Stable & Unstable System, Time variant & Time Invariant Systems.

Unit 2

Linear-Time Invarient (Lti) Systems And Their Advantages:LTI Systems, Discrete –time Signal representation in terms of impulses, Impulse Response of Discrete Time LTI Systems, Finite Impulse Response System, Infinite Impulse Response System, LTI Systems Properties, LTI systems representation by Constant –Coefficient Difference Equation, LTI System Characterization, Cascade & Parallel Connection of LTI Systems.

Introduction To Frequency Domain Representation: Concept of frequency for analog signals and discrete –time signals, Fourier Series Representation of Periodic Signals, I/P O/P Relationship for LTI Systems using Fourier Series, Filtering Concept. Fourier Transform representation for Discrete –Time Signals, Properties of Discrete –Time Fourier Transform, Systems Characterized by Linear Constant Coefficient Difference Equations.

Unit 3

Laplace Transform: Definition and Region of Convergence, Laplace transform applications to LTI systems, Transfer function of LTI systems, Poles and Zeros in S-plane, Stability in S-domain.

Z-Transform And Its Inverse: Introduction to Z-Transform, Region of Convergence (ROC) for Z-Transform, ROC for: Finite & Infinite Duration; Causal, Anti causal & Noncausal signals; Z-

Transform Properties, Relationship with Fourier Transform, Inverse Z-Transform, Rational Z – Transforms, Poles & Zeros of Signals & Systems, Pole Location and Time Domain behavior for Causal Signals; Applications of Z-Transform: System Function of an LTI System, Causality & Stability of LTI Systems, Pole Zero Cancellation.

Unit 4

State Variable Technique: State Space Representation of Continuous –Time LTI Systems with multi-input, multi-output; Solution of state equation for Continuous –Time Systems.
State Space Representation of Discrete –Time LTI Systems: single input single output and multiple input multiple output systems, Solution of State Equation for Discrete-time LTI Systems, Determining System function H(z).

Text Books:

1. A. V. Oppenheim, A. S. Willsky, with S. Nawab "Signals & Systems", 2nd Edition, Pearson Education, 2015.
2. S. Salivahanan, C. Gnanapriya, " Digital Signal Processing", Second Edition, McGraw Hill Education.
3. J. G. Proakis, D. G. Manolakis, "Digital Signal Processing, Principles, Algorithms, & Applications", 4th Edition, Pearson Education.

Reference Books:

1. Smarajit Ghosh,"Signal & Systems",Pearson Education.
2. Nagrath & R. Ranjan, "Signals & Systems", TMH.
3. Schaum Series, "Signals & Systems",Sue & Ranjan.
4. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th Edition, Pearson Educatio.
5. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
6. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition
7. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- Analyze different types of signals and systems.
- Represent continuous and discrete time signals and systems in time and frequency domain using different transforms.
- Get familiarized with the characteristics and applications of Linear Time Invariant System.
- Analyze LTI systems using Laplace/Z-Transform.

Note:

1. Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

PCC-ECE211G **Network Theory**

L	T	P	Credits	Class Work : 25 Marks
3	1	0	3	Theory : 75 Marks
				Total : 100 Marks
				Duration of Exam: 3 Hrs.

Course Objective: The objectives of this course are as under:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks
2 To solve the given circuit with various theorems and methods.
3 To analyze the various three phase circuits star and delta connections.
4 To distinguish between tie set and cut set methods for solving various circuits.
5 To design various types of filters.
6 To relate various two port parameters and transform them.

Unit I

Fundamentals of Network Analysis: Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality**.**

Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. circuits.

Unit 2

Fourier Series: Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values.

Fourier Transform& Laplace Transform: Fourier transform and continuous spectra, three phase unbalancedcircuit and power calculation.
Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis.

Unit 3

A.C Analysis: Analysis of RC, RL, and RLC networks with and without initial conditions with Laplacetransforms evaluation of initial conditions, Behaviors of series and parallel resonant circuits.

Transient behavior: concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations,
convolution theorem.

Unit 4

Two port network and interconnections: Characteristics and parameters of two port networks**,** Network Configurations**,** short-circuit Admittance parameters, open-circuit impedance parameters, Transmission parameters, hybrid parameters, condition for reciprocity & symmetry, Inter-relationships between parameters of two-port network sets, Inter-connection of two port networks.

Topology: Principles of network topology, graph matrices, network analysis using graph theory

Filter Analysis: Introduction to band pass, low pass, high pass and band reject filters, Analysis & design of prototype high-pass, prototype low-pass, prototype band-pass, and prototype band-reject filter.

Text Books:

1. Van, Valkenburg.; "Network Analysis", 3rd Edition, Pearson Education, 2015.
2. Sudhakar A. Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994
3. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education
4. S.K Bhattacharya & Manpreet Singh, Network Analysis and Synthesis, Pearson Education, 2015.

Reference Books:

1. Network Theory by U.A Bakshi, V.A Bakshi, Technical Publications
2. "Fundamentals of Electric Circuit" by C.K Alexander and Sadiku.
3. A.V. Oppenheim, A.S. Willsky, with S. Nawaab "Signals & Systems"2nd Edition, Pearson Education, 2015.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Apply Laplace Transform for steady state and transient analysis.
4. Determine different network functions.
5. Appreciate the frequency domain techniques.

Note:

Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

LC-ECE-212G **NETWORK THEORY LAB**

L	T	P	Credits- 1	Class Work marks : 25
0	0	2		Theory marks : 25
				Total marks : 50

Course Objective: The objectives of this course are as under:

1. To impart practical knowledge to the students about the basic theory concepts of network theory and familiarize them with various kits, filters and parameters used in the circuits.
2. To enable students to design and analyze various circuits using the network components (Resistor, capacitor and inductor).
3. To make students practically capable of designing various types of filters implement such filters for various high level applications and systems.

LIST OF EXPERIMENTS:

A: Simulation based

1. Introduction of circuit creation & simulation software like TINAPRO, P-Spice, Dr.-Spice/other relevant Software

2. Transient response of RC, RL circuit on any of above software.

3. To find the resonance frequency, Band width of RLC series circuit using any of above software.

4. To plot the frequency response of low pass filter and determine half-power frequency.

5. To plot the frequency response of high pass filter and determine the half-power frequency.

6. To plot the frequency response of band-pass filter and determine the band-width.

B: Hardware Based

7. To calculate and verify "Z" & “Y” parameters of a two port network.

8. To determine equivalent parameter of parallel connections of two port network and study loading effect.

9. To calculate and verify "ABCD" parameters of a two port network.

10. To synthesize a network of a given network function and verify its response.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Implement the basic network theory concepts practically and will be able to verify filter results derived in theory.
2. Design and analyze various network and filter circuits for various practical problems.
3. Understand all the concepts and parameters of network theory.

NOTE: Ten experiments are to be performed, out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & setup by the concerned institution as per the scope of the syllabus.

LC-ECE-213G **PCB & ELECTRONIC WORKSHOP LAB**

L	T	P	credits	Class Work marks : 25
0	0	2	1	Theory marks : 25
				Total marks : 50

Objective: To create interest in Hardware Technology.

1. Winding shop: Step down transformer winding of less than 5VA.

2. Soldering shop: Fabrication of DC regulated power supply

3. PCB Lab: (a) Artwork & printing of a simple PCB.

(b) Etching & drilling of PCB.

4. Wiring & fitting shop: Fitting of power supply along with a meter in cabinet.

5. Testing of regulated power supply fabricated.

Experiment to be performed

1. Introduction & Hands on experience to use circuit creation & simulation software like TINAPRO , PSPICE or ORCAD etc.

2. Design a full wave centre tapped rectifier & study the effect of capacitive filter & its output on a virtual oscilloscope.

3. Design a RLC resonance circuit & verify the transient & phase response for different values of R,L &C.

4. Design a circuit for a fixed power supply.

5. Design a half adder using discrete components & verify the timing diagrams.

6. Convert the power supply circuit into PCB & simulates its 2D & 3D view.

7. PCB printing using screen printing or any other technique.

8. Etching of the above PCB.

9. UV exposure & Drilling of PCB.

10. Coating of etched PCB to protect it from oxidation.

11. Fabrication & placing of components as per above power supply circuit.

12. Testing of above circuit.

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

1. Understand the characteristics of diodes and filter circuits.
2. Understand the operation and characteristics of different types of rectifiers.
3. Understand the operation and characteristics of power supply.

Course Name	**:**	**ECONOMICS FOR ENGINEERS**	
Course Code	**:**	**HSMC-01G**	**External marks: 75**
Credits	**:**	**2**	**Internal marks: 25**
L-T-P	**:**	**2-0-0**	**Total marks: 100**
Course Objectives:			

1. Acquaint the students to basic concepts of economics and their operational significance.

2. To stimulate the students to think systematically and objectively about contemporary economic problems

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

SYLLABUS

UNIT-1

Definition of Economics- Various definitions, types of economics- Micro and Macro Economics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development. **Demand-** Meaning of Demand, Law of Demand, **Elasticity of Demand**- meaning, factors effecting it, its practical application and importance.

UNIT-2

Production- Meaning of Production and factors of production, Law of variable proportions, Returns to scale, Internal and external economies and diseconomies of scale. **Various concepts of cost of production-** Fixed cost, Variable cost, Money cost, Real cost, Accounting cost, Marginal cost, Opportunity cost. Shape of Average cost, Marginal cost, Total cost etc. in short run and long run.

UNIT-3

Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features). **Supply-** Supply and law of supply, Role of demand & supply in price determination and effect of changes in demand and supply on prices.

UNIT 4

Indian Economy- Nature and characteristics of Indian economy as under developed,developing and mixed economy (brief and elementary introduction), **Privatization -** meaning, merits and demerits. **Globalization of Indian economy -** merits and demerits. **Banking-** Concept of a Bank, Commercial Bank- functions, Central Bank- functions, Difference between Commercial & Central Bank.

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

1. The students will able to understand the basic concept of economics.
2. The student will able to understand the concept of production and cost.
3. The student will able to understand the concept of market.
4. The student will able to understand the concept of privatization, globalization and banks.

Suggested Books:

1. Chopra P. N., Principle of Economics, Kalyani Publishers.
2. Dewett K. K., Modern economic theory, S. Chand.
3. H. L. Ahuja., Modern economic theory, S. Chand.
4. Dutt Rudar & Sundhram K. P. M., Indian Economy.
5. Mishra S. K., Modern Micro Economics, Pragati Publications.
6. Singh Jaswinder, Managerial Economics, dreamtech press.
7. A Text Book of Economic Theory Stonier and Hague (Longman's Landon).
8. Micro Economic Theory – M.L. Jhingan (S.Chand).
9. Micro Economic Theory - H.L. Ahuja (S.Chand).
10. Modern Micro Economics : S.K. Mishra (Pragati Publications).
11. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co).
12. Jain T.R., Economics for Engineers, VK Publication.

ENVIRONMENTAL SCIENCE
MC-106G

L	T	P	Credits	
3	0	1	-	Class Work : 25 Marks Theory : 75 Marks Duration of Exam: 3 Hrs.

Unit-1

The Multidisciplinary nature of environmental studies. Definition, scope and importance. (2 lecture)

Unit-2

Natural Resources:

Renewable and non-renewable resources :

Natural resources and associated problems.

a) Forest resources : Use and over-exploitation : deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Water logging, salinity, case studies.

e) Energy resources : Growing energy needs; renewable and non- renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

* Role of an individual in conservation of natural resources.

* Equitable use of resources for sustainable lifestyles.

(8 lectures)

Unit-3

Ecosystems :

* Producers, consumers and decomposers.
* Energy flow in the ecosystem.
* Ecological succession.
* Food chains, food webs and ecological pyramids.
* Introduction, types, characteristic features, structure and function of the following eco-system :

a. Forest ecosystem.
b. Grassland ecosystem.
c. Desert ecosystem.
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). (6 lectures)

Unit-4

Biodiversity and its conservation :

* Introduction - Definition : Genetic, Species and ecosystem diversity.
* Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
* Biodiversity at global, National and local levels.
* India as a mega-diversity nation.
* Hot-spots of biodiversity.
* Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
* Endangered and endemic species of India.
* Conservation of biodiversity : In-situ and ex-situ conservation of biodiversity.

(8 lectures)

Unit-5

Environmental pollution :

Definition, causes, effects and control measures of :

a) Air pollution.

b) Water pollution

c) Soil pollution

d) Marine pollution

e) Noise pollution

f) Thermal pollution

g) Nuclear hazards

* Solids waste management: causes, effects and control measures of urban and industrial wastes.
* Role of an individual in prevention of pollution.
* Pollution case studies.
* Disaster management : floods, earthquake, cyclone and landslides.

(8 lectures)

Unit-6

Social issues and the Environment:

* From unsustainable to sustainable development.
* Urban problems related to energy.
* Water conservation, rain water harvesting, watershed management.
* Resettlement and rehabilitation of people : its problems and concerns case studies.
* Environmental ethics : Issues and possible solutions.
* Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
* Wasteland reclamation.
* Consumerism and waste products.
* Environment Protection Act.
* Air (Prevention and Control of pollution) Act.
* Water (Prevention and Control of pollution) Act.
* Wildlife Protection Act.
* Forest Conservation Act.

* Issues involved in enforcement of environmental legislation.
* Public awareness.

(7 lectures)

Unit-7

Human population and the Environment :

Population growth, variation among nations. Population explosion- Family Welfare Programme. Environment and human health.
Human Rights. Value Education. HIV/AIDS.
Woman and Child Welfare

Role of Information Technology in Environment and human health.
Case Studies. (6 lectures)

Unit-8

Field Work :

* Visit to a local area to document environmental assets - river/forest/grassland/hill/mountain.
* Visit to a local polluted site-urban/Rural/ Industrial/ Agricultural.
* Study of common plants, insects, birds.
* Study of simple ecosystems- pond, river, hill slopes, etc.
(Field work equal to 10 lecture hours).

References

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Pub. Ltd., Bikaner.
2. Bharucha, Frach, The Biodiversity of India, MApin Publishing Pvt. Ltd. Ahmedabad-380013, India, E-mail : mapin@icenet.net (R).
3. Brunner R.C. 1989, Hazardous Waste Incineration, Mc. Graw Hill Inc. 480p.
4. Clark R.S., Marine pollution, Slanderson Press Oxford (TB).
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Pub. House, Mumbai 1196 p.
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R).
8. Gleick, H.P., 1993. Water in crisis, Pacific Institute for Studies in Dev. Environment &

Security Stockholm Env. Institute, Oxford Univ. Press, 473p.

9. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R).

10. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge Uni. Press 1140p.

11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.

12. Mackinney, M.L. & Schoch, RM 1996, Environmental Science systems & solutions, Web enhanced edition. 639p.

13. Mhaskar A.K., Mayyer Hazardous, Tekchno-S cience Publications (TB).

14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB).

15. Odum, E.P. 1971, Fundamentals of Ecology. W.B. Saunders Co. USA, 574p.

16. Rao M.N. & Datta, A.K. 1987 Waste Water Treatment. Oxford & TBH Publ. Co. Pvt. Ltd. 345p.

17. Sharma, B.K. 2001, Environmental Chemistry, Goal Publ. House, Meerut.

18. Survey of the Environment, The Hindu (M).

19. Townsend C., Harper J. and Michael Begon. Essentials of Ecology, Blackwell Science (TB).

20. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Comliances and Standards, Vol. I and II Enviro Media (R).

21. Tridevi R.K. and P.K. Goal, Introduction to air pollution, Techno Science Publications (TR).

22. Wagner K.D., 1998, Environmental Management, W.B. Saunders co. Philadelphia, USA 499p.

23. A text book environmental education G.V.S. Publishers by Dr. J.P. Yadav.

(M) Magazine (R) Reference (TB) Textbook

The scheme of the paper will be under :

The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded.

The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations.

Exam. Pattern : In case of awarding the marks, the paper will carry 100 marks. Theory : 75 marks, Practical/ Field visit : 25 marks.
The structure of the question paper will be :

Part- A : Short Answer Pattern	:	15 marks
Part- B : Essay Type with inbuilt choice	:	60 marks

Part-C : Field Work (Practical) : 25 marks

Instructions for Examiners :

Part- A : Question No. 1 is compulsory and will contain five short- answer type question of 3 marks each covering the entire syllabus.
Part-B : Eight essay type questions (with inbuilt choice) will be set from the entire syllabus and the candidate will be required to answer any four of them. Each essay type question will be of 15 marks.

The examination of the regular students will be conducted by the concerned college/Institute. Each student will be required to score minimum 40% marks separately in theory and practical/Field visit. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

PCC-ECE202G Communication System

L	T	P	Credits	Class Work : 25 Marks
3	0	0	3	Theory : 75 Marks Total : 100 Marks Duration of Exam: 3 Hrs.

Course Objective: The objectives of this course are as under:

- To introduce the students to the basics of different types of modulation techniques
- To aim at a comprehensive coverage of design of radio transmitter and receiver

Unit 1

Introduction To Communication System: Modulation, Demodulation, Radio Frequency Spectrum, Signals & their classification, Limitations & Advantages of a Communication System, Comparison of Analog & Digital Communication Systems, Historical Perspective, Modes & Medias of Communication.

Noise: Sources of Noise, External & Internal Noise, Noise Calculations, Noise Figure, Noise Figure Calculation, Noise Temperature, Noise in Communication Systems, Band Pass Noise Model, Cascaded States & its Noise Figure Calculation, Signal in presence of Noise, Pre-Emphasis & De-Emphasis, Noise Quieting Effect, Capture Effect, Noise in Modulation Systems.

Unit 2

Linear Modulation: (AM) Basic definition & derivation for Modulation & Modulation Index, Modulation & Demodulation of AM, Suppressed Carrier Modulation, Quadrature Amplitude Modulation, SSB-SC, DSB-SC, VSB Modulation & Demodulation, Comparison of various AM Systems, Generation of AM waves.

Angle Modulation:

Basic definition & derivation for Modulation & Modulation Index, Generation of FM waves, Comparison between PM & FM, Frequency Spectrum of FM, B.W. & required spectra, Types of FM, vector representation of FM, Universal Curve, Multiple FM, Demodulation of FM waves, Demodulation of PM waves, Comparison between AM & FM.

Unit 3

Transmitters & Receivers: Classification of Radio Transmitters, Basic Block Diagram of Radio Transmitter, Effect of Feedback on operation of Transmitter, Radio Telephone Transmitters, Privacy Device in Radio Telephony, FM Transmitter using Reactance Modulator, Armstrong FM Transmitter, Radio Receivers, Classification, TRF Receiver, Super Heterodyne Receiver, Image Rejection & Double Spotting, Choice of IF, Tracking & Alignment of Receivers, AGC.

Pulse Analog Modulation: Sampling theory, TDM, FDM, PAM, PWM, PPM, Modulation & Demodulation techniques of above all.

UNIT 4

Pulse Digital Modulation: Elements of Pulse Code Modulation, Noise in PCM Systems, Bandwidth of PCM Systems, Measure of Information, Channel Capacity, Channel Capacity of PCM System, Differential Pulse Code Modulation (DPCM). Delta Modulation (DM)

Digital Carrier Modulation And Demodulation Techniques: Digital Modulation Formats, Coherent Binary Modulation & Demodulation: ASK, BPSK, BFSK, Coherent Quadrature Modulation & Demodulation Techniques: QPSK, MSK.
Non Coherent BFSK, Differential PSK, M-Ary Modulation & Demodulation Techniques: M-Ary PSK, M-Ary QAM, M-Ary FSK, Synchronization: Carrier & Symbol Synchronization.

Reference Books:

1. Communication Systems — By Manoj Duhan – I. K. International
2. Electronic Communication Systems — By Kennedy – TMH
3. Communication Systems — By Singh & Sapre – TMH
4. Communication System Engineering — By John G. Proakis and Masoud Salehi, Pearson Education, 2015.
5. Analog Communication — By P. Chakarbarti – DR & Co.
6. Communication Systems — By Simon Haykins – Wiley

COURSE OUTCOMES:

- Student will be familiar with concept of modulation and various modulation techniques
- Ability to model noise in communication systems
- Familiarity with design of radio transmitter and receiver

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

LC-ECE204G Communication System Lab

L	T	P	Credits			
-	-	2	1	Class Work	:	25 Marks
				Theory	:	25Marks
				Total	:	50 Marks
				Duration of Exam.	:	3 Hrs.

COURSE OBJECTIVES:

- To provide the basic understanding about various modulation techniques.
- To analyze different characteristic parameters of these modulation techniques.

LIST OF EXPERIMENTS:

1. To study and waveform analysis of amplitude modulation and determine the modulation index of amplitude modulation.
2. To study and waveform analysis of amplitude demodulation by any method.
3. To study and waveform analysis of frequency modulation and determine the modulation index of frequency modulation.
4. To study and waveform analysis of frequency demodulation by any method.
5. To study Amplitude Shift Keying (ASK) modulation.
6. To study Frequency Shift Keying (FSK) modulation.
7. To study Phase Shift Keying (PSK) modulation.
8. To study and waveform analysis of phase modulation.
9. To study Phase demodulation.
10. To study Pulse code modulation.
11. To study Pulse amplitude modulation and demodulation.
12. To study Pulse width modulation.
13. To study Pulse position modulation.
14. To study delta modulation.
15. To deliver a seminar by each student on ADVANCE COMMUNICATION SYSTEM.

COURSE OUTCOMES:

- Students are able to analyze digital communication signals.

- Students understand the basics of PAM, QAM, PSK, FSK, and MSK.
- They can analyze noise and disturbance in modulated signals.

Note:-

1 Total ten experiments are to be performed in the semester

2 At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed and set by the concerned institution as per the scope of the syllabus.

PCC-ECE205G **Digital Electronics**

L	T	P	Credits			
3	1	-	3	Sessional Marks	:	25
				Theory Marks	:	75
				Duration of Exams	:	3 Hours

Course Objective: The objectives of this course are as under:

1. To provide a comprehensive introduction to digital logic design leading to the ability to understand binary codes, binary arithmetic and Boolean algebra and its relevance to digital logic design.
2. To design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder etc.
3. To design & analyze synchronous sequential logic circuits.
4. To familiarize students with basics of digital logic families.
5. To Analyze and design simple systems composed of PLDs.

Unit 1

Logic Simplification: Review of Boolean Algebra and DeMorgan's Theorem, SOP & POS forms, Canonical forms comlements of a numbers ,addition and subtractions of a comlements numbers, Realization Using Gates. Karnaugh maps up to 6 variables , Q M & VEM technique,

Unit 2

Combinational & Sequential Logic Design: Binary codes, error detection and correction code ,Code Conversion. Numericals

Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display,Half andFull Adders, Subtractors , Parallel Adders, Adder with Look Ahead Carry ,BCD Adder.

Unit 3

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, conversions of FF, Ripple and Synchronous counters, Ring and Johnson counter, UP & DOWN counter, Sequence Generator,Shift registers.

Unit 4

PLDs and Finite state machines: Concept of Programmable logic devices like PAL,PLA ,ROM ,CPLD and FPGA. Logic implementation using Programmable Devices

Introduction, Design of synchronous FSM :Serial Binary Adder Sequence detector ,Parity Bit Generator pulse train generator. Algorithmic State Machines charts :Introduction, Component of ASM chart, Introductory examples of ASM chart.

Text/Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009
2. A.Anand Kumar, "Switching Theory & Logic Design",PHI.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition ,2006.

4. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989.
5. Morris Mano, “Digital Design: With an Introduction to the Verilogn HDL 5th Edition, Pearson Education, 2013.
6. Morris Mano, “ Logic & Computer Fundamentals,4th Edition, Pearson Education.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Design digital logic circuits depicting their ability to understand binary codes, binary arithmetic and Boolean algebra, its axioms and theorems.
2. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder.
3. Design & analyze synchronous sequential logic circuits
4. Understand and design various digital circuits using different digital logic families.
5. Analyze and design simple systems composed of PLDs.

Note:

1. The paper setter will set two questions (with or without parts) from each of four units , & a ninth compulsory question comprising of 5 to 10 sub-parts , covering the entire syllabus . The examinee will attempt 5 questions in all, alongwith the compulsory question (with all its sub-parts), selecting one question from each unit.

The use of programmable devices such as programmable calculators, phones etc. and sharing of materials during the examination are not allowed

Note:

Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

LC-ECE207G **Digital Electronics Lab**

L	T	P	Credits			
-	-	2	1	Class Work	:	25 Marks
				Theory	:	25Marks
				Total	:	50 Marks
				Duration of Exam.	:	3 Hrs.

Course Objective: The objectives of this course are as under:

4. To impart practical knowledge to the students about the basic theory concepts of digital electronics and familiarize them with various kits and I.C's used for digitally designing the circuits.
5. To enable students to design and analyze various combinational and sequential circuits using logic gates as well as medium scale integrated (MSI) components.
6. To make students practically capable of designing various types of counters and implement such counters for various high level applications and systems.

LIST OF EXPERIMENTS:

1 To study & design basic gates.

2 To realize and minimize five & six variables using K-Map method .

3 To verify the operation of Multiplexer & De-multiplexer.

4 To perform Half adder and Full adder

5 To perform Half Substractor and Full substractor.

6 To verify the truth table of S-R,J-K,T & D Type flip flop .

7 To study FLIP- FLOP conversion.

8 To design & verify the operation of 3 bit synchronous counter.

9 To design & verify the operation of synchronous UP/DOWN decade counter using JK flip

10 To design & verify operation of Asynchronous counter.

11 To design and implement a ckt to detect a Count Sequence.

12 Conversion of state diagram to the state table and implement it using logical ckt.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

4. Implement the basic digital theory concepts practically and will be able to verify various results derived in theory.
5. Design and analyze various combinational and sequential circuits for various practical problems using basic gates and flip flops I.C's.
6. Implement LSI and MSI circuits using programmable logic devices (PLDs).

Note:-

1. Each laboratory class/section shall not be more than about 20 students.

To allow fair opportunity of practical hands on experience to each student,each experiment may either done by each student individually or in groupofnotmore than 3-4 students. Larger groups be strictly discouraged/disallowed.

PCC-ECE210G **Microcontrollers**

L	T	P	Credits	
3	0	-	03	Sessional Marks: 25 Theory Marks: 75 Total Marks: 100 Duration of Exams: 3 Hours

Course Objectives: The objectives of this course are as under:

1. To make the students understand the architecture of various microprocessor.
2. To acquaint the students with the exposure of assembly language programming of Microprocessors.
3. To acquaint the students with a first-hand exposure of interfacing various peripheral devices and develop applications based on these devices.

Unit 1

Overview of microcomputer systems and their building blocks, memory interfacing, concepts of interrupts and Direct Memory Access, Architecture & Instruction set of microprocessors (8086).

Unit 2

Concepts of virtual memory, Cache memory, Architecture & Instructions set of X86 family Microprocessors (80186, 80286, 80386, 80486).

Unit 3

Enhanced features of Pentium, Pentium Pro, Pentium-II, Pentium-III, Pentium-IV, Multi-core Technology, Mobile Processor.

Unit 4

Interfacing with peripherals - Serial I/O, parallel I/O, A/D & D/A converters, PPI chip, DMA controller, Programmable Interrupt Controller, Programmable interval timer chips. Introduction to RISC processors ; ARM microcontrollers design.

Text / Reference Books:

1. D. V. Hall, Microprocessors and interfacing, Tata McGraw-Hill, 2nd Edition, 2006.
2. Ray A. K. and Burchandi, Advanced Microprocessors and Peripherals Architectures, Programming and Interfacing, Tata McGraw Hill, 2002.
3. Brey, The Intel Microprocessors 8086- Pentium Processor, 8th Edition, Pearson Education.
4. M. A. Mazidi, J. P. Maizidi and Danny Causey, The X86 PC: Assembly Language, Design and interfacing, 5th Edition, Pearson Education, 2017.
5. Liu Yu-Chang and Gibson Glenn A., Microcomputer Systems: The 8086/8088 Family: Architecture, Programming and Design, 2nd Edition, Pearson Education, 2015.
6. L. B. Das, The X86 Microprocessor (Architecture, Programming and Interfacing), 2nd Edition, Pearson Education, 2014.

7. Daniel Tabak, Advanced Microprocessor", Tata McGraw-Hill, 2nd Edition, 2012.
8. B. Ram, Fundamentals of Microprocessor and Microcomputers, Dhanpat Rai Publications, 5th edition, 2008.

Course Outcomes: At the end of this course, the students will demonstrate the ability to:

1. Do assembly language programming
2. Do interfacing design of peripherals.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

LC-ECE-214G **Microcontrollers Lab**

L	T	P	Credits			
-	-	2	1	Class Work	:	25 Marks
				Theory	:	25Marks
				Total	:	50 Marks
				Duration of Exam.	:	3 Hrs.

Course Objectives: The objectives of this course are as under:

- To introduce the students with 8086 kit.
- To acquaint them to do assembly language programming of 8086.
- To acquaint them to do assembly language programming of 8086 for interfacing of peripherals.

LIST OF EXPERIMENTS:

1. To study the architecture of 8086 microprocessor and 8086 microprocessor kit.
2. Write a program to add the contents of the memory location to the content of other memory location and store the result in 3rd memory location.
3. Write a program to add 16 bit number using 8086 instruction set.
4. Write a multiplication of two 16 bit numbers using 8086 instruction set.
5. Write a program for division of two 16 bit numbers using 8086 instruction set.
6. Write a program factorial of a number.
7. Write a Program to transfer a block of data with & without overlap.
8. Write a program to find the average of two numbers.
9. Write a Program to check whether data byte is odd or even
10. Write a program to find maximum number in the array of 10 numbers.
11. Write a program to find the sum of the first 'n' integers.
12. Write a program to generate a square wave.
13. Write a program to generate a rectangular wave.
14. Write a program to generate a triangular wave.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Do assembly language programming of 8086.
2. Do assembly language programming of 8086 for interfacing of peripherals.

Note:

1 Total ten experiments are to be performed in the semester.

2 At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed and set by the concerned institution as per the scope of the syllabus.

Course code	**HSMC-02G**				
Course title	**ORGANIZATIONAL BEHAVIOUR**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**0**	0	**3**	
Branches (B. Tech.)	**CSE/ECE**				
Class work	25				
Exam	75				
Total	100 Marks				
Duration of Exam	03 Hours				

The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

SYLLABUS

UNIT - 1

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Difference between management and administration.

UNIT - 2

Introduction of organization:- Meaning and process of Organization, Management v/s Organization; **Fundamentals of Organizational Behavior:** Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB. **Individual Processes and Behavior**-**Personality**- Concept, determinants and applications; **Perception-** Concept, process and applications, **Learning**- Concept (Brief Introduction) ; **Motivation-** Concept, techniques and importance

UNIT - 3

Interpersonal Processes- **Teams and Groups**- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, **Conflict-** Concept, sources, types, management of conflict; **Leadership:** Concept, function, styles & qualities of leadership. **Communication –** Meaning, process, channels of communication, importance and barriers of communication.

UNIT 4

Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior; **Organizational culture -** Elements, types and factors affecting organizational culture. **Organizational change:** Concept, types & factors affecting organizational change, Resistance to Change.

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

1. Students will be able to apply the managerial concepts in practical life.
2. The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
3. Students will be able to understand the behavioral dynamics in organizations.
4. Students will be able to understand the organizational culture and change

Suggested Books:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi.
7. Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications-New Delhi.

Mathematics-III (Partial differential equations and Numerical methods)

BSC-MATH-202G

Course code	BSC-MATH-202G				
Category	Basic Science Course				
Course title	Mathematics-III (Partial differential equations and Numerical methods)				
Scheme and Credits	L	T	P	Credits	Semester-IV
	3	1		4	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Partial Differential Equations of first order: Definition of Partial Differential Equations, First order linear partial differential equations, Solutions of first order linear partial differential equations, Charpit's method for solving first order non-linear partial differential equations

Unit-II

Partial Differential Equations of higher order: Second-order linear partial differential equations and their classification, Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method, Initial and boundary conditions, D'Alembert's solution of the wave equation, Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates, One dimensional diffusion equation and its solution by separation of variables

Unit-III

Numerical Methods 1: Solution of polynomial and transcendental equations – Bisection method, Regula-Falsi method and Newton-Raphson method, Finite differences, Interpolation

using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae, Numerical differentiation, Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules

Unit-IV

Numerical Methods 2: Taylor's series, Euler and modified Euler's methods, Runge-Kutta method of fourth order for solving first and second order ordinary differential equations, Finite difference solution of two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers
3. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited
4. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications
5. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand and Company
6. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI

Course Outcomes

The Students will learn:

1. To solve field problems in engineering involving partial differential equations.
2. To find roots of polynomial and transcendental equations using numerical methods.
3. To conduct numerical differentiation and numerical integration.
4. To solve differential equations using numerical methods.

Data Structures

Course code	PCC-CSE-221G				
Category	Professional Core Course				
Course title	tructures				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

1. To impart the basic concepts of data structures and algorithms.
   To understand concepts about searching and sorting techniques
   To understand basic concepts about stacks, queues, lists, trees and graphs.
   To enable them to write algorithms for solving problems with the help of fundamental data structures

Unit 1:

Introduction: Basic Terminologies: Concept of Data Structure, Choice of right Data Structure, Algorithms , how to design and develop algorithm . Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, **Searching:** Linear Search and Binary Search Techniques.

Unit 2:

Stacks and Queues: Stack and its operations: Applications of Stacks: Expression Conversion and evaluation queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues.

Unit 3:

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree. Applications of Binary Trees.

Unit 4:

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Selection Sort Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods.

Suggested books:

"Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

Suggested reference books:

Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company

"How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.

Course outcomes

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Electronics & Communication Engineering)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Electronics & Communication Engineering) – 5th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Professional Core Course	PCC-ECE301G	Electromagnetic Waves	3	1	0	4	4	25	75		100	3
2	Professional Core Course	PCC-ECE303G	Computer Organization & Architecture	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-ECE305G	Communication Engineering	3	1	0	4	4	25	75		100	3
4	Professional Core Course	PCC-ECE307G	Digital Signal Processing	3	1	0	4	4	25	75		100	3
5	Program Elective Course	Refer to Annexure I	Program Elective –I	3	1	0	4	4	25	75		100	3
6	Open Elective Course	Refer to Annexure I	Open Elective-I	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-ECE323G	Electromagnetic Waves Lab	0	0	3	3	1.5	25		25	50	3
8	Professional Core Course	LC-ECE325G	Digital Signal Processing Lab	0	0	3	3	1.5	25		25	50	3
9	Training	PT-ECE327G	Practical Training – 1	-	-	-	-	-	-	-	* Refer Note 1		
		TOTAL CREDIT						**25**				**700**	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.
2. Choose any one from Elective-I
3. Choose any one from open Elective-I

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Annexure I

Elective –I

PEC-ECE309G	Power Electronics
PEC-ECE311G	Nano electronics
PEC-ECE313G	Linear IC Applications
PEC-ECE315G	Scientific computing

Open Elective-I

OEC-ECE317G	Object Oriented Programming with C++
OEC-ECE319G	Additive Manufacturing
OEC-ECE321G	Measurements and Instrumentation

Scheme of Studies and Examination
B.TECH (Electronics & Communication Engineering) – 6th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Professional Core Course	PCC-ECE302G	Control Systems	3	1	0	4	4	25	75		100	3
2	Professional Core Course	PCC-ECE304G	Computer Network	3	1	0	4	4	25	75		100	3
3	Humanities/ Basic Science	HUM-ECE-306G	Engineering Ethics	3	0	0	3	3	25	75		100	3
4	Professional Core Course	PCC-ECE308G	CMOS Design	3	1	0	4	4	25	75		100	3
5	Program Elective Course	Refer to Annexure II	Program Elective –II	3	1	0	4	4	25	75		100	3
6	Open Elective Course	Refer to Annexure II	Open Elective-II	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-ECE322G	Computer Network Lab	0	0	4	4	2	25		25	50	3
8	Professional Core Course	LC-ECE324G	Control System Lab	0	0	3	3	1.5	25		25	50	3
9	Professional Core Course	LC-ECE326G	Mini Project/Electronic Design workshop	0	0	4	4	2	25		25	50	3
		TOTAL CREDIT						**27.5**				**750**	

Note:

1. Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.
2. Choose any one from Elective-II
3. Choose any one from Open Elective-II

Annexure II

Elective –II

PEC-ECE310G	Bio-Medical Electronics
PEC-ECE312G	VHDL and Digital Design
PEC-ECE314G	Introduction to MEMS
PEC-ECE316G	Speech and Audio Processing

Open Elective-II

OEC-ECE318G	Python Programming
OEC-ECE320G	Probability and Stochastic Processes

PCC-ECE301G **ELECTROMAGNETIC WAVES**

L T P	Theory: 75 Marks
3 1 -	Class work : 25 Marks
	Total: 100 Marks
	Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant, characteristic impedance, reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Unit II

Maxwell's Equations - Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface. Uniform plane wave, Propagation of plane wave, Wave polarization, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection.

Unit III

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Unit IV

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna

References:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, latest edition
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, latest edition, Prentice Hall, latest edition
4. David Cheng, Electromagnetics, Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand characteristics and wave propagation on high frequency transmission lines
2. Carryout impedance transformation on TL
3. Characterize uniform plane wave
4 Calculate reflection and transmission of waves at media interface
5 Analyze wave propagation on metallic waveguides in modal form
6 Understand principle of radiation and radiation characteristics of an antenna

PCC-ECE303G **COMPUTER ORGANIZATION & ARCHITECTURE**

L T P
3 - -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Data representation: Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes, Error Detection Codes.

Register Transfer and Microoperations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

Unit II

Basic Computer Organization and Design : Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

Central Processing Unit : General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.

Unit III

Pipeline and Vector Processing: Introduction to Parallel Processors, Amdahl's Law, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors, SIMD Array Processors, Pipeline Hazards.

Unit IV

Input-output Organization: I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts.

Memory organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

References:

1) "Computer System Architecture", latest edition by M.Morris Mano, Pearson.
2) "Computer Organization and Design: The Hardware/Software Interface", latest edition by David A. Patterson and John L. Hennessy, Elsevier.
3) "Computer Organization and Embedded Systems", latest edition by CarlHamacher, McGraw Hill Higher Education.

4) “Computer Architecture and Organization”, latest edition by John P. Hayes, WCB/McGraw-Hill
5) “Computer Organization and Architecture: Designing for Performance”, latest edition by William Stallings, Pearson Education
6) “Computer System Design and Architecture”, latest edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1 Understand the basics structure of computers, operations and instruction
2 Design arithmetic and logic unit.
3 Understand pipelined execution and design control unit.
4 Understand parallel processing architectures.
5 Understand the various memory systems and I/O communication.

PCC-ECE305G COMMUNICATION ENGINEERING

L T P	Theory : 75 Marks
3 1 -	Class work : 25 Marks
	Total : 100 Marks
	Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Spectral Analysis:

Fourier series, Fourier transforms, Convolution Theorem, Correlation, Cross-Correlation and autocorrelation.

Unit -II

Information Theory:

Introduction to information and entropy, channel capacity for discrete and continuous channels, Shannon's Theorem, Shannon-Hartley Theorem, Noisy channels, coding theory : Shannon-Fano coding, minimum redundance coding, maximization of entropy of a continuous message transmission rate, effect of medium on the information, selection of channels ,effect of noise and its minimization.

Unit -III

Random Signal Theory:

Representation of random signals, concept of probability, probability of joint occurrence, conditional probability, discrete probability theory, continuous random variables, probability distribution function, probability density function, joint probability density functions.

Unit -IV

Random Signal Theory:

Statistical average and moments, Ergodic processes, correlation Function, power spectral density, central limit theory, response of linear system to random signals. Error function Covariance relation among the spectral densities of the two input-output random processes. Cross spectral densities, optimum filters. Introduction to Linear Block Code and cyclic Codes

References:

1. Principles of Communication Systems : Taub Schiling; TMH
2. Communication Systems : Singh and Sapre ; TMH
3. Communication Systems : A Bruce Carlson; TMH

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. To Study and Derive equations for entropy mutual information and channel capacity for all types of channels.

2. To acquire the knowledge about Fourier series and Fourier transform signal analysis tool.

3 Design a digital communication system by selecting an appropriate error correcting codes for a particular application.

4 To learn about Probability of Random signal theory and process.

5 Formulate the basic equations of linear block codes and a cyclic code.

6 Compare the performance of digital communication system by evaluating the probability of error for different error correcting codes

PCC-ECE307G DIGITAL SIGNAL PROCESSING

L T P	Theory: 75 Marks
3 1 -	Class work : 25 Marks
	Total: 100 Marks
	Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Discrete-Time Signals and Systems: Sequences; representation of signals on orthogonal basis; representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Z-Transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z- transforms, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

Unit II

Frequency Representation of Signal and Systems: Frequency Domain analysis concept, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Circular convolution, Linear Filtering using DFT, Fast Fourier Transform Algorithm, Decimation in time and Decimation in frequency algorithms, Computations Complexity Calculations, Parsevals Identity.

Unit III

Design of Digital Filter : Ideal Filter vs Practical Filters, General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Frequency sampling Method, Park-McClellan's method, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation.

Unit IV

Implementation of Discrete Time Systems: Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects, Parametric and non-parametric spectral estimation. Applications of Digital Signal Processing

Multirate Digital Signal Processing: Introduction to multirate digital signal processing, Multi rate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks

References :

1 John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles,

Algorithms And Applications, Prentice Hall, latest edition
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, latest edition
3. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
4. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya;TMH
5. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, latest edition
6. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, latest edition
7. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. To get an introduction of basics like Sampling, Interpolation, Aliasing and operations, Convolution and Correlation.
2. To Study the basics, mathematical analysis and applications of DFT and FFT
3. To study the design and implementation of Digital Filters.
4. To impart practical knowledge of signal processing operations in MATLAB.

LC-ECE323G ELECTROMAGNETIC WAVES LAB

L T P
- - 3

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hour

Hands-on experiments related to the course contents PCC-ECE301G

LC-ECE325G DIGITAL SIGNAL PROCESSING LAB

L T P
- - 3

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hour

List of Experiments

Experiments to be performed:

1. Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)
2. To develop program for Z-Transform
3. To develop program for Convolution of sequences
4. To develop program for Correlation of sequences
5. To develop program for DFT & IDFT of two sequences
6. To develop program for FFT of two Sequences
7. To develop program for Circular Convolution
8. To design analog filter (low-pass, high pass, band-pass, band-stop).
9. To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
10. To develop program for Interpolation and Decimation of sequences
11. To design FIR filters using windows technique.
12. Detection of Signals buried in Noise
13. Effect of noise on signals

PCC-ECE302G CONTROL SYSTEMS

L T P
3 1 -

Theory : 75 Marks
Class work : 25 Marks
Total : 100 Marks
Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Systems Components and Their Representation

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

Unit II

Time Response Analysis And Stability Concept

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control.

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus.

Unit III

Frequency Domain Analysis

Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

Unit IV

Control System Analysis Using State Variable Methods

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations.

References:

1. Gopal. M., " Control Systems: Principles and Design" , Tata McGraw-Hill, latest edition
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, latest edition
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, latest edition
4. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Characterize a system and find its steady state behaviour
2. Analyse the time domain specification and calculate steady state errors..
3. Investigate stability of a system using different tests
4. Illustrate the state space model of a physical system.

PCC-ECE304G **COMPUTER NETWORK**

L T P
3 1 -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction and Physical Layer

Networks – Network Types LAN –MAN – WAN – Protocol Layering – OSI Model - TCP/IP Protocol suite – Network Hardware, Internetworks – Network Software – Protocol hierarchies — Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT II

Data-Link Layer & Media Access

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – ALOHA protocols - Overview of IEEE standards – Media Access Control – Sliding Window protocols, Error Handling - Bridges - Switches – High Speed LANs - Gigabit Ethernet - Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices - Multiplexing.

UNIT III

Network Layer

Network Layer Services –Performance – IPV4 Addresses –Network Layer Protocols: IP, Internet Control Protocols – ICMP, ARP, RARP, BOOTP. Internet Multicasting – IGMP-ICMP v4 – IP Addressing – Classless and Classfull Addressing - Sub-netting - Congestion control– QoS.- Overview of IPv6

UNIT IV

Transport Layer and Application Layer

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol –Connectionless vs Connection-oriented transport - Remote Procedure Call.

WWW and HTTP – FTP –Telnet –SSH – DNS –Electronic mail, MIME, SNMP.

References:

1. J.F. Kurose and K. W. Ross, " Computer Networking – A top down approach featuring the Internet", Pearson Education, latest edition
2. L. Peterson and B. Davie, " Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, latest edition
3. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall
4. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, latest edition
5. Andrew Tanenbaum, "Computer networks", Prentice Hall
6. D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall

7. William Stallings, “Data and computer communications”, Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Visualise the different aspects of networks, protocols and network design models.
2. Examine various Data Link layer design issues and Data Link protocols.
3. Analyse and compare different LAN protocols.
4. Compare and select appropriate routing algorithms for a network.
5. Examine the important aspects and functions of network layer, transport layer and application layer in internetworking.

HUM-ECE306G ENGINEERING ETHICS

L T P
3 - -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Ethics and Professionalism: Ethics and Excellence in Engineering, Micro and Macro Issues, Dimensions of Engineering, Potential Moral Problems, What Is Engineering Ethics, Why Study Engineering Ethics? Responsible Professionals, Professions, and Corporations: Saving Citicorp Tower, Meanings of Responsibility, Engineering as a Profession, Ethical Corporations and Senses of Corporate Responsibility. Moral Reasoning and Codes of Ethics, Moral Choices and Ethical Dilemmas, Rights Ethics, Duty Ethics, Utilitarianism, Virtue Ethics, Self-Realization Ethics, Ethical Egoism, Which Ethical Theory Is Best?

UNIT II

Engineering as Social Experimentation: Engineering as Experimentation, Engineers as Responsible Experimenter, Commitment to Safety: The Concept of Safety, Risks, Acceptability of Risk, Assessing and Reducing Risk: Uncertainties in Design, Risk-Benefit Analyses, Personal Risk versus Public Risk, Examples of Improved Safety, Three Mile Island, Safe Exits.

UNIT III

Truth and Truthfulness: Whistle-Blowing, Moral Guidelines, Protecting Whistle-Blowers, Common Sense Procedures, Beyond Whistle-Blowing, Honesty and Research Integrity: Truthfulness, Trustworthiness, Academic Integrity: Students, Research Integrity, Bias and Self-Deception, Protecting Research Subjects, Giving and Claiming Credit.
Computer Ethics: The Internet and Free Speech, Power Relationships, Property, Privacy,Additional Issues.

UNIT IV

Environmental Ethics: Engineering, Ecology, and Economics, Environmental Moral Frameworks, Human-Centered Ethics, Sentient-Centered Ethics, Biocentric Ethics, Ecocentric Ethics, Religious Perspectives.
Global Justice: Multinational Corporations, Technology Transfer and Appropriate Technology, Bhopal, “When in Rome”, International Rights, Promoting Morally Just Measures, Weapons Development and Peace, Involvement in Weapons Work, Defense Industry Problems, Peace Engineering.

References:

1. Mike W. Martin and Roland Schinzinger, “Introduction to Engineering Ethics”, Second Edition, McGraw Hill, New Delhi, latest edition

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, latest edition
3. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, latest edition
4. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, latest edition
5. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, latest edition
6. Edmund G Seebauer and Robert L Barry, “Fundametals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, latest edition
7. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi latest edition
8. World Community Service Centre, " Value Education", Vethathiri publications, Erode, latest edition
9 Web sources:
i. www.onlineethics.org
ii. www.nspe.org
iii. www.globalethics.org
iv. www.ethics.org

Outcomes:

Upon completion of the course, the student should be able to

1. apply ethics in society
2. discuss the ethical issues related to engineering
3. realize the responsibilities and rights in the society
4. realize the importance of sustainable development

PCC-ECE308G **CMOS DESIGN**

L T P
3 1 -

Theory : 75 Marks
Class work : 25 Marks
Total : 100 Marks
Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction of MOS Transistor

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V characteristics, C-V characteristics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II

Combinational Circuit Design

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.

Power: Dynamic Power, Static Power, Low Power Architecture.

Interconnect: Interconnect Modelling and Impact

UNIT III

Sequential Circuit Design

Static latches and Registers Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

Timing Issues: Timing Classification of Digital System, Synchronous Design

UNIT IV

Design of Arithmetic Building Blocks and Subsystem

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry

References:

1. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4thEdition, Pearson Education India, latest edition
2. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, latest edition
3. C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, latest edition
4. P. Douglas, VHDL: programming by example, McGraw Hill, latest edition
5. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Examine the CMOS circuit's behaviour and its characteristics.
2. Design and realization of combinational & sequential digital circuits.
3. Interpret different Architectures and performance tradeoffs involved in designing and realizing the circuits in CMOS technology.
4. Design the Arithmetic blocks and Memory structures

LC-ECE322G **COMPUTER NETWORK LAB**

L T P
- - 4

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hours

List of Experiments

1. Running and using services/commands like ping, trace route, NSLOOKUP, ARP, TELNET, FTP, etc.
2. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc.
3. Network Topology – Star, Bus, Ring
4. Simulate the transmission of ping messaged over a network topology and find the number of packets dropped due to congestion.
5. Understanding IP Addressing using the simulation tool.
6. Study of various application protocols using the simulation like FTP, HTTP
7. Understand IP forwarding within a LAN and across a router
8. Understand the working of "Connection Establishment" in TCP using Network simulation using tools
9. Study how the Data Rate of a Wireless LAN (IEEE 802.11b) network varies as the distance between the Access Point and the wireless nodes is varied
10. Study the working and routing table formation of Interior routing protocols, i.e. Routing Information Protocol (RIP) and Open Shortest Path First (OSPF)
11. To determine the optimum persistence of a CSMA / CD network
12. Implementation of distance vector routing algorithm
13. Implementation of Link state routing algorithm
14. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
15. Encryption and decryption.

LC-ECE324G **CONTROL SYSTEM LAB**

L T P
- - 3

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hour

Hands-on experiments related to the course contents PCC-ECE307G

LC-ECE326G **MINI PROJECT/ELECTRONIC DESIGN WORKSHOP**

L T P
- - 4

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hours

Guidelines:

1. The mini- project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within two week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. Design, implement and test the prototype/algorithm in order to solve the conceived problem.
3. Write comprehensive report on mini project work.

PROGRAM ELECTIVE COURSES

PEC-ECE309G **POWER ELECTRONICS**

L T P
3 1 -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Role of Power electronics, SCR- Construction, working principles of SCR, V-I characteristics of SCR, Two transistor analogy of SCR, Protection of SCR, Different methods of SCR triggering, Different commutation circuits for SCR, Construction & working principle of DIAC, TRIAC, IGBT, GTO, MOSFET, UJT and their V-I characteristics. Basic idea about the selection of Heat sink for thyristors.

Unit -II

Controlled Rectifiers: Single phase half wave-controlled rectifier with R, R-L Load & concept of freewheeling diode, Single phase half controlled full wave rectifier (Half Bridge and Full Bridge with R, R-L Load), Single phase full wave centre tapped rectifier, Three phase full wave half-controlled and fully controlled bridge rectifier (R Load)

Inverters: Principle of operation of basic inverter circuits, concepts of duty cycle, series & parallel, inverters & their applications.

Unit -III

Choppers: Introduction, types of choppers (Class A, Class B, Class C and Class D). Step up and step-down choppers.

Cyclo-converters: Dual Converters and cyclo- converters: Introduction, types & basic working principle of dual converters and cyclo- converters & their applications.

Unit -IV

Thyristorised Control of Electric drives

DC drive control: Half wave drives, Full wave drives, Chopper drives (Speed control of DC motor using choppers)

AC drive control: Phase control, Constant V/F operation, Cyclo-converter /Inverter drives, Slip control AC drives

Applications of power devices:

light intensity control, speed control of universal motors, fan regulator, battery charger. Uninterrupted power supplies (UPS online, off line), SMPS Application of Power Electronics in Electrical vehicles controls. UJT as relaxation oscillator.

References:

1. Muhammad H. Rashid, "Power electronics" Prentice Hall of India.
2. Ned Mohan, Robbins, "Power electronics", edition III, John Wiley and sons.

3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V.R.Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International Publishers. SCR manual from GE, USA.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.

PEC-ECE311G **NANO ELECTRONICS**

L T P Theory: 75 Marks

3 1 - Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Introduction to nanotechnology, applications of nano electronics. Basics of Quantum Mechanics: Wave nature of particles and wave-particle duality, Pauli Exclusion Principle, wave functions and Schrodinger's equations, Density of States, Band Theory of Solids, Particle in a box Concepts

Unit -II

Shrink-down approaches: CMOS scaling: advantages and limitations. Nanoscale MOSFETs, FINFETs, Vertical MOSFETs, system integration limits (interconnect issues etc.)

Unit -III

Nanostructure materials, classifications of nanostructure materials, zero dimensional, one dimensional, two dimensional and three dimensional, properties and applications Characterization techniques for nanostructured materials: SEM, TEM and AFM

Unit -IV

Nano electronis devices : Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

References:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, latest edition
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, latest edition
3. K.E. Drexler, Nanosystems, Wiley, latest edition
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, latest edition
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.

PEC-ECE313G **LINEAR IC APPLICATIONS**

L T P — Theory: 75 Marks

3 1 - — Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Differential and cascade amplifiers: Balanced, unbalanced output differential amplifiers, FET differential amplifier, current mirrors, level Translators, cascade configuration of amplifiers, operational amplifiers, Introduction to ideal OP-AMP, characteristic parameters, Practical OP-AMP, its equivalent circuit and op-amp circuit configurations.

Unit-II

Op-amp with negative feedback and frequency response: Block diagram representation of feedback amplifier, voltage series feedback, voltage shunt feedback differential amplifiers, frequency response compensating network, frequency response of internally compensative op-amp and non compensating op-amp. High frequency op- amp equivalent circuit, open loop gain V/s frequency, closed loop frequency response, circuit stability, slew rate.

Unit-III

Op-amp application: DC, AC amplifiers, peaking amplifier, summing, scaling, averaging and instrumentation amplifier, differential input output amplifier, voltage to current converter, current to voltage converter, very high input impedance circuit, integration and differential circuit, wave shaping circuit, active filters, oscillators.

Unit-IV

Specialized liner IC applications: 555 timer IC (monostable & astable operation) & its applications, Universal active filter, PLL, power amplifier, 8038 IC.

References:

1. R.A. Gayakwaed , OP-amps and Linear Integrated circuits .
2. K.R.Botkar , Integrated circuit

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Design linear and non-linear applications of op-amps.
2. Design the applications using Timer and PLL.
3. Design the applications using Voltage regulator and Function generator ICs

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PEC-ECE315G **SCIENTIFIC COMPUTING**

L T P
3 1 -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy

Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

Unit-II

System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination,Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems

Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

Eigenvalues and singular values:Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Unit-III

Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares

Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation

Unit-1V

Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigen value Problems Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

References:

1. Heath Michael T., "Scientific Computing: An Introductory Survey", McGraw-Hill, latest edition

2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, latest edition
3. Xin-she Yang (Ed.)., "Introduction To Computational Mathematics", World Scientific Publishing Co., latest edition
4. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, latest edition
5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, " Scientific Computing With MATLAB And Octave", Springer, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the significance of computing methods, their strengths and application areas.
2. Perform the computations on various data using appropriate computation tools.
3. Analyse the various system using Linear and Non Linear methods.
4. Understand application of these methods in various areas.

PEC-ECE310G **BIO-MEDICAL ELECTRONICS**

L T P — Theory: 75 Marks

3 1 - — Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Physiology and Transducers

Brief introduction to human physiology: Cell and its structure; Resting and Action Potential; Nervous system: Functional organisation of the nervous system ; Structure of nervous system, neurons; synapse; transmitters and neural communication; Cardiovascular system; respiratory system; Basic components of a biomedical system. Biomedical transducers: Transducers selection criteria; Piezoelectric; ultrasonic; displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases; Temperature measurements; Fibre optic temperature sensors;

UNIT II

Electro – Physiological Measurements

Bio-electrodes and Biopotential amplifiers for ECG, EMG, EEG, etc.: Limb electrodes; floating electrodes; pregelled disposable electrodes ;Micro, needle and surface electrodes; Preamplifiers, differential amplifiers, chopper amplifiers ;Isolation amplifier. ECG; EEG; EMG; ERG; Lead systems and recording methods

UNIT III

Non-Electrical Parameter Measurements

Measurement of blood temperature, pressure and flow; ; Cardiac output ; Heart rate ; Heart sound ;Pulmonary function measurements ; spirometer ; Impedance plethysmography; Photo Plethysmography, Body Plethysmography

UNIT IV

Medical Imaging

Ultrasonic, X-ray and nuclear imaging: Radio graphic and fluoroscopic techniques; Computer tomography; MRI; Ultrasonography

UNIT V

Assisting And Therapeutic Equipments

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped; Safety aspects: safety parameters of biomedical equipments

References:

1. W.F. Ganong, Review of Medical Physiology, latest edition, Medical Publishers
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, latest edition
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, latest edition
4. R.S.Khander, Handbook of Biomedical Instrumentation‖, TATA Mc Graw-Hill, New Delhi, latest edition
5. Leslie Cromwell, ―Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, latest edition

Course outcomes:

At the end of the course, students will demonstrate the ability to:

1. Apply the concept of electronic systems design in Bio- medical applications.
2. Examine the practical limitations on the electronic components while handling bio- substances.
3 Evaluate and analyze the biological processes like other electronic processes.
4 Familiar the various Bio Medical Measuring Instruments and therapeutic equipments.
5 Aware of electrical safety of medical equipments

PEC-ECE312G **VHDL AND DIGITAL DESIGN**

L T P — Theory: 75 Marks

3 1 - — Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to 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.

Unit-II

VHDL Statements: 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

Combinational & Sequential Circuit Design: VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders , code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

Unit-IV

Design of Microcomputer & Programmable Device: Basic components of a computer, specifications, architecture of a simple microcomputer system, implementation of a simple microcomputer system using VHDL Programmable logic devices: ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

References:

1. Ashenden - Digital design,Elsevier
2. IEEE Standard VHDL Language Reference Manual latest edition
3. Digital Design and Modelling with VHDL and Synthesis : KC Chang; IEEE Computer Society Press.
4. "A VHDL Primmer" : Bhasker; Prentice Hall latest edition
5. "Digital System Design using VHDL" : Charles. H.Roth ; PWS latest edition
6. "VHDL-Analysis & Modelling of Digital Systems" : Navabi Z; McGraw Hill.
7. VHDL-IV Edition: Perry; TMH latest edition
8. "Introduction to Digital Systems" : Ercegovac. Lang & Moreno; John Wiley latest edition
9. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH latest edition
10. Modern Digital Electronics- III Edition: R.P Jain; TMH latest edition
11. Grout - Digital system Design using FPGA & CPLD 'S,Elsevier

Course Outcome

At the end of the course, students will demonstrate the ability to:

1. Understand the need & application of hardware description language.
2. Modelling & simulations of various basic & advanced digital systems using VHDL.
3. Implementation of various basic & advanced digital systems using FPGAs.
4. Apply knowledge to design & implement combinational circuits & sequential circuits related to research & industry applications.

PEC-ECE314G **INTRODUCTION TO MEMS**

L T P — Theory: 75 Marks
3 1 - — Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Overview of MEMS and Microsystems: Introduction Microsystems vs. MEMS, Microsystems and Microelectronics, the Multidisciplinary Nature of Microsystems design and manufacture, Application of MEMS in various industries. MEMS and Miniaturization: Scaling laws in miniaturization: Introduction to Scaling, Scaling in Geometry, Rigid Body dynamics, Electrostatic forces, Electromagnetic forces, Electricity, Fluid Mechanics, Heat Transfer, Overview of Micro/Nano Sensors, Actuators and Systems.

Unit -II

Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.

Unit -III

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods

Unit -IV

Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems: electrostatics, coupled electro mechanics.

References:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, latest edition
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano- and Microengineering (Vol. 8). CRC press, latest edition
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, latest edition
4. M. Madou, Fundamentals of Microfabrication, CRC Press, latest edition
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, latest edition
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Interpret the basics of micro/nano electromechanical systems including their applications and advantages
2. Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
3. Analyze the key performance aspects of electromechanical transducers including sensors and actuators
4. Comprehend the theoretical foundations of quantum mechanics and Nano systems

PEC-ECE316G **SPEECH AND AUDIO PROCESSING**

L T P
3 1 -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.

Unit-II

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

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.

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

Unit-III

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.

Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.

Unit-IV

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero- state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

References:

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students *Edition)* latest edition
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C.Chu, WileyInter science, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Mathematically model the speech signal
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.

OPEN ELECTIVE COURSE

OEC-ECE317G **OBJECT ORIENTED PROGRAMMING WITH C++**

L T P
3 - -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit – I

Object-Oriented Programming Concepts: Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, data abstraction, encapsulation, inheritance, polymorphism.

Basic Concepts of C++: Structure of C++ Program, Basic Data Types, Expressions and Control Structures, Functions in C++: Call by Value, Call by Reference, Recursion, Function Overloading.

Unit - II

Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifiers, static data members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes.

Constructors and Destructors: Need for constructors and destructors, copy constructor, dynamic constructors, destructors.

Unit - III

Inheritance: Introduction, defining derived classes, forms of inheritance, virtual base classes.

Operator Overloading and Type Conversion: Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.

Unit - IV

Virtual functions & Polymorphism: Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes, virtual destructors.

Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.

References:

1. E. Balagurusamy,"Object Oriented Programming with C++", 7th edition, Mc Graw Hill Education(2018)
2. Bjrane Stroustrup, "C++ Programming language",3rd edition, Pearson education Asia(1997)
3. Lafore R."Object oriented Programming in C++",4th Ed. Techmedia,New Delhi(2002).
4. Yashwant Kenetkar,"Let us C++",1stEd.,Oxford University Press(2006)
5. B.A. Forouzan and R.F. Gilberg,CompilerScience,"A structured approach using C++" Cengage Learning, New Delhi.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Students will able to understand and implement real-world entities like inheritance, data hiding, polymorphism, etc in programming.
2. Students will aware about C++ Programming concepts.
3. Students will implement the function overloading and operator overloading concepts.
4. Students will understand the concept of Exception handling.

OEC-ECE319G ADDITIVE MANUFACTURING

L T P	Theory: 75 Marks
3 - -	Class work : 25 Marks
	Total: 100 Marks
	Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction and basic principles: Definition , Generic Additive Manufacturing (AM) Process, Terms related to AM, Benefits of AM, Distinction between AM and CNC machining, Additive manufacturing process chain: Variation between different AM machines, Metal systems, Maintenance of Equipment, Material Handling Issues.

Unit-II

Introduction to rapid prototyping (RP), Need of RP in context of batch production, Basic principles of RP, Steps in RP, Process chain in RP in integrated CAD- CAM environment, Advantages of RP, Medical applications.

Unit-III

Classification of different RP techniques – based on raw materials, layering technique (2-D or 3-D) and energy sources: Process technology, Stereo-lithography (SL), photo polymerization, liquid thermal polymerization, Solid foil polymerization

Unit-IV

Selective laser sintering, Selective powder binding, ballistic particle manufacturing – both 2- D and 3-D, Fused deposition modeling, Shape melting, Laminated object manufacturing, Solid ground curing, 3 D printing

Unit-V

Introduction to reverse engineering Meaning, Use, RE-The generic process, Phase of RE– scanning, Contact Scanners, Noncontact Scanners, Point Processing, Application Geometric Model, Development. Learning Resources

References:

1. Ian Gibson, David W. Rosen, Brent Stucker , “Additive Manufacturing Technologies” ,Springer, latest edition

2. Chua C. K., Leong K. F., and Lim C. S., “Rapid Prototyping: Principles and Applications”, Second Edition, World Scientific Publishers latest edition

3. Patri K. Venuvinod, Weiyin Ma “Rapid Prototyping: Laser-Based and Other Technologies” Springer , latest edition

4. Peter D. Hilton, Hilton/Jacobs, Paul F. Jacobs, “Rapid Tooling: Technologies and Industrial Applications”, CRC Press, latest edition

5. Burns. M, “Automated fabrication”, Prentice-Hall, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Apply the knowledge of Additive Manufacturing and Rapid Prototyping technologies.
2. Understand the applications in various fields, reverse engineering techniques.
3. Understand about mechanical properties and geometric issues relating to specific rapid prototyping applications.

OEC-ECE321G MEASUREMENTS AND INSTRUMENTATION

L T P — Theory: 75 Marks
3 1 - — Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Science of Measurement

Measurement System – Instrumentation – Characteristics of measurement systems – Static and Dynamic – Errors in Measurements – Calibration and Standards

Transducers

Classification of Transducers – Variable Resistive transducers – Strain gauges , Thermistor, RTD-Variable Inductive transducers- LVDT, RVDT,- Variable Capacitive Transducers – Capacitor microphone- Photo electric transducers – Piezo electric transducers – Thermocouple – IC sensors - Fibre optic sensors – Smart/intelligent sensors.

Unit-II

Signal Conditioning and Signal Analyzers

DC and AC bridges – Wheatstone, Kelvin, Maxwell, Hay and Schering. Pre- amplifier – Isolation amplifier – Filters – Data acquisition systems. Spectrum Analyzers – Wave analyzers – Logic analyzers

Unit-III

Digital Instruments

Digital Voltmeters – Millimeters – automation in Voltmeter – Accuracy and Resolution in DVM - Guarding techniques – Frequency counter- Data Loggers – Introduction to IEEE 488/GPIB Buses.

Unit-IV

Data Display Recording and Systems

Dual trace CRO – Digital storage and Analog storage oscilloscope. Analog and Digital Recorders and printers. Virtual Instrumentation - Block diagram and architecture – Applications in various fields. Measurement systems applied to Micro and Nanotechnology

References:

1. Albert D.Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, latest edition
2. Ernest o Doebelin and Dhanesh N Manik, "Measurement Systems", McGraw-Hill, latest edition
3. A course in Electrical & Electronics Measurements & Instrumentation : A.K.Sawhney; Dhanpat Rai & Sons.
4 Albert D.Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Discuss about the principles of various measurement techniques.
2. Analyze the transducers and its impact.
3. Explain about the signal conditioning system and signal analyzers.
4. Illustrate the digital measurement equipments.
5. Emphasize the need for data acquisition, recording and display systems.

OEC-ECE318G **PYTHON PROGRAMMING**

L T P	Theory: 75 Marks
3 - -	Class work : 25 Marks
	Total: 100 Marks
	Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT I

Introduction: Fundamental ideas in computer science; modern computer systems, installing Python; basic syntax, interactive shell, editing, saving, and running a script; The concept of data types; variables, assignments; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages; Control statements: if-else, loops (for, while)

UNIT II

Strings, text files: String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).

UNIT III

Lists, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding, and removing keys, accessing and replacing values; traversing dictionaries, arguments and return values. Recursive functions.

UNIT IV

Object Oriented concepts: Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, Inheritance, polymorphism, operator overloading; abstract classes.

References:

1. “Fundamentals of Python: First Programs” Kenneth Lambert, Course Technology, Cengage Learning, latest edition

2. “Introduction to Computer Science Using Python: A Computational Problem-Solving Focus”, By Charles Dierbach, John Wiley & Sons, latest edition

Course outcomes:

At the end of the course, students will demonstrate the ability to:

1. For a given conceptual problem student will able to analyze the problem and write a program in python with basic concepts.

2. For a given problem of Strings and texts, student will able to analyze the problem and write a program in python with basic concepts involving strings and texts.
3. The knowledge of list and dictionary will enable student to implement in python language and analyze the same.
4. Student will able to write a program using functions to implement the basic concepts of object oriented programming language

OEC-ECE320G PROBABILITY AND STOCHASTIC PROCESSES

L T P
3 - -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT I

Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models. Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions;

UNIT II

Joint distributions, functions of one and two random variables, moments of randomvariables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds;

UNIT III

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.

UNIT IV

Random process. Stationary processes. Mean and covariance functions. Ergodicity. Transmission of random process through LTI. Power spectral density.

References:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education
2. A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
6. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand representation of random signals
2. Investigate characteristics of random processes

3. Make use of theorems related to random signals
4. To understand propagation of random signals in LTI systems.

Maharshi Dayanand University, Rohtak

(A State University established under Haryana Act No. XXV of 1975)
(NAAC Accredited 'A+' Grade)

Scheme of Studies and Examination

B.Tech (Electronics and Communication Engineering)

Common with (Electronics and Telecommunication Engineering)

Semester 7th and 8th

Scheme effective from 2021-22

Course code and definitions:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
PR	Practical

General Notes:

1. Mandatory courses are non-credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.

3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.TECH (Electronics and Communication Engineering)

Common with (Electronics and Telecommunication Engineering)

SEMESTER –7th w.e.f. 2021-22

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	Theory	Practical	Total	
1	Professional Elective Course	Refer to Annexure-I	Professional Elective-III	3	3	0	6	3	25	75	-	100	3
2	Professional Core Course	PCC-ECE-401G	Fiber Optic Communication	3	3	0	6	3	25	75	-	100	3
3	Professional Core Course	PCC-ECE-402-G	Antenna and Wave Propagation	3	3	0	6	3	25	75	-	100	3
4	Professional Elective Course	Refer to Annexure-I	Professional Elective-IV	3	3	0	6	3	25	75	-	100	3
5	Professional Elective Course	Refer to Annexure-I	Professional Elective-V	3	3	0	6	3	25	75	-	100	3
7	Mandatory Course	MC-317-G	Constitution of India	2	0	0	2	Refer Note:1 (Grading)					
8	LAB	LC-ECE-405-G	Data Communication Networking Lab	0	0	2	2	1.5	25	-	25	50	3
9	Project	PROJ-ECE-407-G	Project Stage-I			4	4	5	50	-	100	150	3
TOTAL CREDIT								**21.5**	**200**	**375**	**125**	**700**	

Note:

1. The students will be awarded grades A, B, C & F in Evaluation of Constitution of India. A student who is awarded 'F' grade is required to repeat.

Excellent: A; Good: B; Satisfactory: C; Not Satisfactory: F.

2. Choose any one subject from Elective-III.
3. Choose any one subject from Elective-IV.
4. Choose any one subject from Elective-V.

Annexure I

Professional Elective-III

S. No.	Course Code	Course Title
1	PEC-ECE-409-G	Wireless Communication
2	PEC-ECE-410-G	Mobile Communication and Networks

Professional Elective-IV

S. No.	Course Code	Course Title
1	PEC-ECE-411-G	Data Communication Networking & Security
2	PEC-ECE-412-G	Error Correcting Codes

Professional Elective-V

S. No.	Course Code	Course Title
1	PEC-ECE-413-G	Wireless Sensor Networks
2	PEC-ECE-414-G	Radar and Sonar Engineering
3	PEC-ETE-401-G	Telecommunication and Switching Networks

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS
B.TECH (Electronics and Communication Engineering)
Common with (Electronics and Telecommunication Engineering)
SEMESTER –8th w.e.f. 2021-22

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	Theory	Practical	Total	
1	Professional Elective Course	Refer to Annexure-II	Professional Elective-VI	3	3	0	6	3	25	75	-	100	3
2	Professional Core Course	PCC-ECE-403-G	Satellite Communication	3	3	0	6	3	25	75	-	100	3
3	Professional Core Course	PCC-ECE-404-G	Microwave theory and techniques	3	3	0	6	3	25	75	-	100	3
5	Professional Core Course	LC-ECE-406-G	Wireless & Satellite Communication Lab	0	0	2	2	1.5	25	-	25	50	3
6	Open Elective Course	Refer to Annexure-III	Open Elective	3	0	0	6	3	25	75	-	100	3
7	Project	PROJ-ECE-408-G	Project Work II/ Dissertation	-	-	8	8	6	100	-	150	250	3
		TOTAL CREDIT						**19.5**	**225**	**300**	**175**	**700**	

Note:

1. Choose any one subject from Elective-VI.
2. Choose any one subject from Open Elective

Annexure-II

Professional Elective-VI

S. No.	Course Code	Course Title
1	PEC-ECE-415-G	Embedded System
2	PEC-ECE-416-G	High speed Electronics
3	PEC-ECE-421-G	Mixed Signal Design

Annexure-III

Open Elective Courses-I

S. No.	Course Code	Course Title
1	OEC-ECE-417-G	Renewable Energy Resources
2	OEC-ME-455-G	Composite Materials
3	OEC-BME-419-G	Biosensors
4.	OEC-CE-417-G	Disaster Management
5.	OEC-CE-402-G	Solid & Hazardous waste management
6.	OEC-ME-410-G	Quality Engineering
7.	OEC –ME-402G	Operations Research
8.	OEC –EE-412G	Electrical Power Generation

Course code	**PEC-ECE-409-G**				
Category	**Professional Elective Course**				
Course title	**Wireless Communication System**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	03	**03**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

During the duration of the course, students will be made to learn to:

1. Identify and discuss the fundamental operational and design problems of wireless communication systems.
2. Apply basic techniques to design radio links and basic communication systems.
3. Discuss basic technical standards related to 2G/3G/4G wireless systems
4. Discuss basic technical standards related to WiFi.

UNIT I

Review of Digital Communications - Components of a Wireless Transmitter and Receiver – Bandwidth, Duplexing, Licensed and Unlicensed Bands - Power, Rate and SNR - Shannon's Capacity, Bandwidth and Power Limited Regimes - Radio Propagation and Propagation Path-Loss Model: Free-Space Attenuation, Multipath Channel Characteristics,

Introduction to wireless communication systems: Evaluation of mobile radio communications, examples of wireless communication systems, paging systems, cordless telephone systems, compression of various wireless systems.

UNIT II

Types of Multiplexing: Fixed Assignment vs. Statistical Multiplexing - Aloha, Slotted Aloha - CSMA with Collision Avoidance and Collision Detection - WIFI: History and Motivation, Architecture, Wireless Personal Area Networks (PANS): Bluetooth 802.15.1, Zigbee 802.15.4.

UNIT III

Multiple access techniques in wireless communication: contention-free multiple access schemes (FDMA TDMA, CDMA, SDMA and Hybrid)

Mobile wireless communication systems: second generation cellular networks, third generation wireless networks, fourth generation wireless networks. Recent wireless technologies: multicarrier modulation, OFDM, MIMO system.

UNIT IV

Diversity Techniques- Polarization Diversity, Frequency Diversity, Time Diversity, Practical

Space Diversity Consideration-Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, spatial multiplexing, MIMO and space time signal processing.

Text Books/Reference Books

1. Vijay K Garg, "Wireless Communications and Networks", Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian reprint)
2. D. P. Agrawal and Q.-A. Zeng, Introduction to Wireless and Mobile Systems, Third Edition, Cengage Learning, 2010
3. W. Stallings, Wireless Communications & Networks, Second Edition, Prentice Hall, 2004.
4. T. S. Rappaport, Wireless Communications, Second Edition, Prentice Hall, 2002
5. J. Schiller, Mobile Communications, Second Edition, Addison Wesley, 2003

Course Outcomes:

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

1. Demonstrate their understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards
2. Learn to model radio signal propagation issues and its impact on communication system performance.
3. Explain the architecture, functioning, protocols, capabilities and application of various wireless communication networks

Course code	**PCC-ECE-401-G**				
Category	**Professional Core Course**				
Course title	**Fiber Optical Communication**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	03	**03**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

During the duration of the course, students will be made to learn to:

1. Understand the working principles of the Optical communication systems.
2. Understand the optical networks and characteristics of elements used for communication.
3. Understand modulation schemes and their utility for different networks.
4. Analyze planning/budgeting of optical communication systems.

Unit – I

Introduction: Elements of Optical communication system. Principle of working, Ray Theory and electromagnetic mode theory for optical propagation. Type of optical fibers, step index and graded index and their characteristics. Optical losses: Attenuation, Absorption, Scattering, dispersion, polarization and fiber bend losses. Fabrication techniques of fiber.

Unit – II

Optical Sources: Basic concepts of light source: LED and Lasers. Working principle, Shape geometry, efficiency, Fabry Perot laser, quantum well lasers, and MQM and Quantum dot lasers. Characteristics of both LED and Lasers. Optical Detectors: Working principle, PN, PIN diodes, APD. Efficiency and effect of noise.

Unit – III

Link Budget: Link design, path loss calculations, safely margin and budgeting. Optical termination and distribution system. Optical Amplifiers and Modulation: EDFA, SOA and Raman amplifiers. Intensity modulation, concept of WDM and DWDM systems and networks.

Unit – IV

System Effects: Nonlinear effects in fiber optic links. Concept of self phase modulation, four wave mixing, Kerr effect. Soliton based communication system

TEXT BOOK:

Optical Fiber Communications: John M Senior; Pearson.

REFERENCE BOOKS:

1. Optical Communication Systems: John Gowar; PHI.
2. Optical Fiber Communications: Gerd Keiser; TMH

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. To explain the theory of optical communication.
2. To explain the various elements used and development in the field.
3. Various losses accrued by the fiber cable and link budgeting.
4. Working of amplifiers and there utilities.

Course code	**PCC-ECE-402-G**				
Category	**Professional Core Course**				
Course title	**Antenna and Wave Propagation**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	03	**03**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

During the course, students will be made to learn to:

1. Understand the working principles of the Antenna.
2. Understand the types of Antenna and their propagation.
3. Understand limitations and application for different networks.

Unit – I

Fundamental Concepts- Physical concept of radiation, Radiation pattern, near and far-field regions, reciprocity, directivity, gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.
Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

Unit – II

Aperture and Reflector Antennas, Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Unit – III

Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.
Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

Unit – IV

Antenna Arrays- Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method. Concept and benefits of smart antennas.

Text/Reference Books:

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw ill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the properties and various types of antennas.
2. Analyze the properties of different types of antennas and their design.
3. Operate antenna design software tools and come up with the design of the antenna of required specifications

Course code	**PEC-ECE-413-G**				
Category	**Professional Elective Course**				
Course title	**Wireless Sensor Networks**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	03	**03**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

During the duration of the course, students will be made to learn to:

1. Understand the working principles of the Sensors.
2. Understand the protocols used in sensor networks.
3. Understand engineering sensor networks.

Unit – I

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks, Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.

Unit – II

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee.

Unit – III

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols. Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

Unit – IV

Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Text/Reference Books:

1. Waltenegus Dargie , Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science
5. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press 2009

Course Outcomes:

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

1. Design wireless sensor networks for a given application.
2. Understand emerging research areas in the field of sensor networks.
3. Understand MAC protocols used for different communication standards used in WSN.
4. Explore new protocols for WSN.

Course code	**PEC-ECE-410-G**				
Category	**Professional Elective Course**				
Course title	**Mobile Communication and Networks**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**03**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

During the course, students will be made to learn to:

1. Understand the Cellular concepts.
2. Understand the digital modulation techniques.
3. Understand the mobility in Cellular Systems.

UNIT I

Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

UNIT II

Large scale signal propagation. Fading channels-Multipath and small scale fading- Doppler shift, doppler spread, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.

Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model.

UNIT III

Multiple access schemes-FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM and OFDMA.

UNIT IV

Mobility in Cellular Systems: The Gateway Concept, Measurement Reports, Mobility Procedures - Mobile IP: Basic Components, Tunneling

GSM: Architecture, – UMTS: Architecture, Basics of CDMA, - Introduction to LTE: History, Architecture - OFDM – Uplink and Downlink Communication in LTE

Text/Reference Books:

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
5. VK Garg & JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

5. Understand the working principles of the mobile communication systems.
6. Understand the relation between the user features and underlying technology.
7. Analyze mobile communication systems for improved performance

Course code	**PEC-ECE-412-G**				
Category	**Professional Elective Course**				
Course title	**Error Correcting Codes**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**3**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

During the course, students will be made to learn to:

1. Understand the encoding and decoding concept of the various codes.
2. Understand that using coding techniques how we improve the efficiency of communication system.
3. Understand various properties of different codes and how implements on different application.

UNIT I

Concept of information and entropy, Shannon theorem, Relation among Different entropies, Mutual information and self-information, channel capacity of different channels ,Basic conception of coding , Advantage of coding ,Source encoding and channel coding.

UNIT II

Linear block codes: introduction to linear block code. Syndrome and error detection Minimum distance of block code, Error detecting and error correcting capabilities of a block code, Hamming codes. Application of block codes for error control in data storage system.

UNIT III

Cyclic Codes: Description, Generator and parity check matrices, encoding, Syndrome computation and error detection, decoding, cyclic hamming codes, Shortened cyclic codes, error trapping decoding for cyclic codes. BCH codes, Decoding of BCH codes. Idempotent and Mattson-Solomon polynomials; Reed-Solomon codes, MDS codes,

UNIT IV

Convolution codes ; Encoding of convolutional codes, state diagrams, Trellis Diagram, structural and distance properties, Maximum likelihood decoding, sequential decoding algorithm,

Application of convolutional codes in ARQ system. Introduction to Space time codes, Diversity, orthogonal space –time block codes.

Text/Reference Books:

1. F.J. McWilliams and N.J.A. Slone, The theory of error correcting codes, 1977.
2. R.E. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the error sources.
2. Understand error control coding applied in digital communication.

Course code	**PEC-ECE-414-G**				
Category	**Professional Elective Course**				
Course title	**Radar & Sonar Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**3**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

During the course, students will be made to learn to:

1. Understand the working principles of the Radar and Sonar.
2. Understand the types of Radars and their applications.
3. Understand limitations and latest development in Radar technology.

Unit – I

Introduction: Radar basic block diagram, operation, working principle, frequency used. Evolution of Radar technology and its application in various fields with historical prospective

Unit – II

Radar Equation: Simple form of Radar equation, prediction of range, performance, minimum detectable signal, Receiver Noise, Signal to Noise Ration. Transmitter power, Pulse repetition frequency, range ambiguity, system losses and propagation effects. CW and Frequency Modulated Radars: Basic block diagram of CW and FMCW radar. Working principle, application and limitations.

Unit – III

MTI and Pulse Doppler Radar: Introduction, Delay Line Cancellors, Multiple or staggered, Pulse repetition frequencies, range-Gated Doppler Filters, Digital Signal Processing, Other MTI delay line, Limitation of MTI performance, Non-coherent MTI, Pulse Doppler Radar, MTI from a moving platform. Tracking in Radar: Tracking with Radar, Sequential Lobbing, Conical Scan, Monopulse Tracking Radar, Tracking in range, Acquisition.

Unit – IV

Receivers, Display & Duplexers: Radar Receivers, Noise Figure, Mixer, Low-noise Front ends, Displays, Duplexer, Receiver protectors. Introduction to SONAR: Working principle, propagation, transmission and reception of signals. Signal to Noise Ration, types of Sonar and their applications

TEXT BOOK:

1. Introduction to Radar Systems: Merrill I. Skolnik, ; MGH

REFERENCE BOOK:

1. Electronic Communication Systems : Kennedy; TMH

Course Outcome:

At the end of the course, students will demonstrate the ability to:

1. Explain working principles of the Radar and Sonar.
2. Explain availability of various types of Radars and their applications.
3. Explain optimum utilization of Radar and Sonar technology.

Course code	**PEC-ETE-401-G**				
Category	**Professional Elective Course**				
Course title	**Telecommunication and Switching Networks**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**3**	**0**	**3**	
Class work	25				
Exam	75				
Total	100				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE OBJECTIVES

1. Different components of telecommunication are explained.
2. Telecommunication traffic is measured by considering the mathematical model for network traffic.
3. Different signaling systems are explained.

Unit: I

Introduction: Evolution of Telecommunication, Switching System, Classification of Switching, Types of Telephone Switching Systems, Elements of Telecommunication, Telecommunication Standard. Telephone System: PSTN, Modern Telecom System, Telephone Network, Telephone Set, Telephone Network organization, Principles and examples of step by step, Cross bar and reed relay systems, Telephone numbering plan, Central Battery System, Transmission impairments, Two-four-wire transmission, Subscriber Loop Design.

Unit: II

Telecommunication traffic: Telecommunication traffic, Traffic considerations, Erlang, Grade of Service, Traffic Measurement, Mathematical model for telecommunication traffic. Switching System: Resource sharing and need for switching, Need for Networks, Switching, Types of Switching, Circuit Switching, Message Packet Switching, Store & Forward Switching, Function of Switching System, Electronic Switching System, Multiplexing, IDM (E1/E2. TI), FDM, Implementation of Switching System, Blocking and Non-blocking Switches, Single & Multi stage Switches, Space Switching, Time Switching, Hybrid Switching, Path finding, Complexity, Blocking Probability of Switch.

Unit: III

Telephone Exchange: Stored Program Controlled Exchange, Electronic Exchange, Electronic Switching & Stored Program Control Systems, Digital Switching Time, Space & Hybrid Switches, Example of Digital Exchanges, Example of Modern Exchanges (C-DOI exchange), Availability of Parallel Exchange.

Unit: IV

Signaling Systems: Signaling, Types of Signaling information, Forms of Signaling, Channel Associated Signaling (CAS), Common Channel Signaling, CCITT No-7 System, SS7 Signaling, Architecture Computer & Data Networks, ARPANET, ALOHA-Toke Protocols Network Topology, Multiple Access Schemes, Layered Architectures, Networks Protocols, Local Area Network, Evolution towards ISDN.

Text Books:

1. J. E. Flood, *Telecommunication and Switching Traffic & Networks*, Pearson Education , 2001
2. Thiagarajan Viswanathan, *Telecommunication Switching Systems & Networks*, PHI , 2006

Reference Books:

1. John G. van Bose and Fabrizio u devetak, *Signaling in Telecommunication Networks*, Wiley interscience. 2nd edition , 2007
2. Roger L. Freeman, *Telecommunication System Engineering: Analog and Digital Network Design*, John Wiley & Sons.

Course code	**PEC-ECE-411-G**				
Category	**Professional Elective Course**				
Course title	**Data Communication Networking & Security**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**3**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

During the course, students will be made to learn to:

1. Understand the working principles of Data Communication.
2. Understand the Data link layer.
3. Understand the network security.

UNIT-I

Overview of Data Communication and Networking: Data communications, Uses of computer Networks, The Internet, Protocols and standards, Layered tasks, OSI model, TCP/IP model.

Data and Signals, Analog and Digital, Periodic Analog Signals, Digital Signals, Transmission impairment, Data Rate Limits, Performance, Digital Transmission, Digital-to-Digital Conversion, Analog-to-Digital Conversion, Analog Transmission, Digital-to-analog Conversion, Analog-to-analog Conversion

UNIT II

Physical layer: Bandwidth utilization: Multiplexing, FDM, WDM, TDM, Transmission Media, Guided Media, Unguided Media: Wireless, Switching, Circuit-Switched Networks, Datagram Networks. Modulation of digital data, Telephone Network,

Data Link Layer: Data link layer design issues, Error Detection and Correction, Data Link Control and Protocols, Types of errors, Detection, Error correction, Flow and error control.

UNIT III

Network Layer: Internetworks, Addressing: IP Address Classes, Subnet, CIDR, Routing, ARP, IP, ICMP, IPV6, Unicast routing, Unicast routing protocol, Multicast routing, Multicast routing protocols.

Transport layer: Process to process delivery, Elements of transport protocols, User datagram protocol (UDP), Transmission control protocol (TCP), Data traffic, Congestion, Congestion

control, Quality of service, Techniques to improve QOS, Integrated services, Differentiated services, QOS in switched networks.

UNIT IV

Application layer: DNS-Domain Name System, Electronic mail, File transfer, HTTP, World wide web (WWW), Digitizing audio and video, Audio and video compression, Voice over IP.

Network Security: Cryptography, Symmetric key Algorithms (DES, AES), Public key Algorithms-RSA, Digital Signatures, Firewall

Text Books/Reference Books:

1. Data Communication and Networking by Behrouz A. Forouzan (Fourth Edition), Tata McGraw Hill
2. Computer Networks by Andrew S. Tanenbaum (Fifth Edition), Pearson Education
3. Introduction to Data communications and Networking ,W.Tomasi, Pearson education
4. Stallings William, Data and Computer Communication, Pearson Education (2000) 7th ed.

Course Outcomes:

1. Describe the technical aspects of data communications on the Internet
2. Analyze error detection/correction and flow control of data in the data network
3. Configure the network component and assign IP address.

Course code	**LC-ECE-405-G**				
Category	**Laboratory Course**				
Course title	**Data Communication Networking Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	0	**0**	**2**	**1.5**	
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

List of Experiments (Perform any 10 experiments)

1. Overview of Boson Simulator or Cisco Packet Tracer or Netsim and Matlab
2. To study various network topologies
3. To study network components and categories of networks
4. Experiment for various keying techniques like ASK, FSK, PSK and QAM
5. Describe various techniques for Encoding, decoding and Digital data communication.
6. Experiment with various error detection and flow control techniques
7. To study the connections of hubs, switchers and routers.
8. To establish connections of LAN, MAN and WAN
9. To learn and observe the usage of different networking commands e.g. PING, TRACEROUTE. Learning remote login using telnet session. Measuring typical average delays between different locations of the network.
10. Observe the need for router configuration. To compare the working of 1750, 2620 and 2621 series of routers on the basis of bandwidth
11. Understand the subnet mask.
12. Understand the need of a routing mechanism in a router.
13. Learn how to configure a router with the static routing.
14. To observe the working of IP protocol. Exploring the routing tables for different routers.
15. Observe how the TCP/IP applications (e.g., DNS, Telent, FTP) exchange the control information and data.
16. Experiment with various application layer protocols

Course Outcome

1. Student will have the basic knowledge of computer network
2. The student will be having the basic knowledge of data sharing, transmission media and their protocol

Course code	**PROJ-ECE-407-G**				
Category	**Project**				
Course title	**Project Stage-I**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	0	**0**	4	**5**	
Class work	50 Marks				
Exam	100 Marks				
Total	150 Marks				
Duration of Exam	3 Hours				

The object of Project Stage I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work.

The assignment to normally include:
1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental committee.

Course code	**MC-317G**				
Category	Mandatory Course				
Course title	**Constitution of India**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	2	0	0	0	

MC-317G is mandatory non-credit course in which the students will be awarded grades.

Note: 1 The students will be awarded grades A, B, C & F in Evaluation of Constitution of India. A student who is awarded 'F' grade is required to repeat .

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Course Objectives: Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT-I

Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

UNIT-II

Federal structure and distribution of legislative and financial powers between the Union and the States

UNIT-III

Organs of Governance: President – Qualification and Powers of the President, GovernorQualification and Powers of Governor, Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

UNIT-IV

Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Right to equality , Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

Course Outcomes: Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956. The examination of the regular students will be conducted by the concerned college/Institute internally.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

Course code	**PCC-ECE-403-G**				
Category	**Professional Core Course**				
Course title	**SATELLITE COMMUNICATION**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	3	**03**	**0**	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objective:

1. Study the Satellite Communication Procedure.
2. Understand the analog and digital satellite communication.
3. Study the satellite link design.
4. Study the satellite orbits.

UNIT-I

PRINCIPLES OF SATELLITE COMMUNICATION: Evolution & growth of communication satellite, Synchronous satellite, Satellite frequency allocation & Band spectrum, Advantages of satellite communication, Active & Passive satellite, Applications of satellite communication, Block diagram of transponder and Earth Station, Satellite communication with respect to Fiber Optic Communication.

COMMUNICATION SATELLITE LINK DESIGN: Introduction, General link design equations, System noise temperature, C/N & G/T ratio, Atmospheric & Ionospheric effects on link design, Complete link design.

UNIT-II

ANALOG SATELLITE COMMUNICATION: Introduction, Baseband analog(Voice) signal, FDM techniques, S/N & C/N ratio in frequency modulation in satellite link, S/N ratio in FM with multiplexed telephone signal in satellite link, Single channel per carrier(SCPC) systems, Analog FM/FDM TV satellite link, Energy disposal in FM/FDM systems.

DIGITAL SATELLITE COMMUNICATION: Advantages of digital communication, Elements of digital satellite communication systems, Digital baseband signals, Digital modulation techniques like MSK, QAM, QPSK.

UNIT-III

MULTIPLE ACCESS TECHNIQUES: Introduction, TDMA, TDMA-Frame structure, TDMA-Burst structure, TDMA-Frame efficiency, TDMA- Superframe, TDMA Frame acquisition & Synchronization, TDMA compared to FDMA, TDMA Burst Time Plan. FDMA- FDM/FM/FDMA, Preassigned FDMA, Demand assigned FDMA, Spade System, Limitations of FDM/FM/FDMA, Comparison of TDMA and FDMA.

SATELLITE ORBITS: Introduction, Kepler's laws, Synchronous orbit, Orbital parameters, Satellite location with respect to earth, Look angles, Earth coverage & slant range, Eclipse effect.

UNIT-IV

SPECIAL PURPOSE COMMUNICATION SATELLITES: BDS, INMARSAT, INTELSAT, VSAT(data broadband satellite), MSAT(Mobile Satellite Communication technique), Sarsat (Search & Rescue satellite) & LEOs (Lower earth orbit satellite), LANDSAT, Defence satellite.

LASER SATELLITE COMMUNICATION: Introduction, Link analysis, Optical satellite link transmitter, Optical satellite link receiver, Satellite Beam Acquisition, Tracking & Positioning.

TEXT BOOK/ REFERENCE BOOK:

1. Satellite Communication: D.C. Aggarwal; Khanna.
2. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002
3. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
4. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Visualize the architecture of satellite systems as a means of high speed, high range communication system.
2. State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
3. Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

Course code	**PCC-ECE-404-G**				
Category	**Professional Core Course**				
Course title	**Microwave Theory and Techniques**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 7th**
	3	**3**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objective:

1. An understanding of microwave waveguides, passive & active devices, tubes and network analysis.
2. An ability to perform microwave measurements.

UNIT: I

WAVEGUIDES:

Introduction to Microwaves-History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI, EMC, comparison with transmission lines, propagation in TE & TM mode, rectangular wave guide, TEM mode in rectangular wave guide, characteristic impedance, introduction to circular waveguides and planar transmission lines.

UNIT: II

MICROWAVE COMPONENTS:

Directional couplers, tees, hybrid ring, S-parameters, attenuators, cavity resonators, mixers& detectors, matched Load, phase shifter, wave meter, and Ferrite devices, Isolators, circulators.

MICROWAVE TUBES:

Limitation of conventional tubes, Construction, operation and properties of Klystron amplifier, reflex Klystron, magnetron, TWT, BWO, crossed field amplifiers.

UNIT: III

MICROWAVE SOLID STATE DEVICES:

Varactor diode, Tunnel diode, Schottky diode, GUNN diode, IMPATT, TRAPATT and PIN diodes, MASER, parametric amplifiers.

MICROWAVE MEASUREMENTS:

Power measurement using calorimeter & bolometers, measurement of SWR, frequency wavelength and impedance, Microwave bridges.

UNIT: IV

MICROWAVE SYSTEMS:

Microwave Systems- Radar, Terrestrial and Satellite Communication, Radio Aids to Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic

Compatibility (EMI & EMC), Monolithic Microwave ICs, RF MEMS for microwave components, Microwave Imaging.

TEXT BOOKS:s

1. Samuel Liao, Microwave devices and circuits, PHI
2. M .Kulkarni, Microwave devices & Radar Engg, Umesh
3. R.E. Collins, Microwave Circuits, McGraw Hill
4. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house

REFERENCE BOOK:

1. Microwaves and Radar : A.K. Maini; Khanna

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain different types of waveguides and their respective modes of propagation.
2. Analyze typical microwave networks using impedance, admittance, transmission and scattering matrix representations.
3. Explain working of microwave passive circuits such as isolator, circulator, Directional couplers, attenuators etc.
4. Describe and explain working of microwave tubes and solid state devices.

Course code	**LC-ECE-406-G**				
Category	**Laboratory Course**				
Course title	**WIRELESS & SATELLITE COMMUNICATION LAB**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	0	**0**	**2**	**1.5**	
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	3 Hours				

LIST OF EXPERIMENTS:

1. To set up a satellite communication link & study of change in uplink & downlink frequency.

2. To Study Transmission of Audio & Video Signals & Data communication over satellite link.

3. To Study Transmission of telemetry data like temperature & light intensity over satellite link

4. To measure the propagation delay of signal in a Satellite communication Link.

5. To study different GPS data like longitude, latitude & different types of dilute of precision using GPS receiver..

6. To study selection of various PN codes like Gold, Barker & MLS in CDMA technology .

7. To study generation (spreading) & demodulation (Despreading) of of DSSS modulated signal

8. To study Voice communication over DSSS.

9. To study Minimum shift keying modulation & de modulation.

10. To study radiation pattern & calculate beam width for Yagi uda & Folded dipole antenna.

11. To study radiation pattern & calculate beam width for Circular & Triangular Patch Antenna.

12. to study FHSS Modulation & demodulation & transfer of numeric data.

NOTE:

At least ten experiments are to be performed.

Course code	**PROJ-ECE-408-G**				
Category	**Project**				
Course title	**Project Work II/ Dissertation**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	0	**0**	**8**	**6**	
Class work	100				
Exam	150				
Total	250				
Duration of Exam	03 Hours				

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership.

The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under PROJ-ECE-407-G;

2. Review and finalization of the Approach to the Problem relating to the assigned topic;

3. Preparing an Action Plan for conducting the investigation, including team work;

4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;

5. Final development of product/process, testing, results, conclusions and future directions;

6. Preparing a paper for Conference presentation/Publication in Journals, if possible;

7. Preparing a Dissertation in the standard format for being evaluated by the Department.

8. Final Seminar Presentation before a Departmental Committee.

Course code	**PEC-ECE-415-G**				
Category	**Professional Elective Course**				
Course title	**Embedded System**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	3	**3**	0	**3**	
Class work	25				
Exam	75				
Total	100				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objective:

1. To introduce students to the microcontroller and embedded system and applications. .
2. To make understand the architecture of PIC and 8051 microcontrollers in detail.
3. To provide knowledge about the embedded system and interfacing.

UNIT I

INTRODUCTION OF MICROCONTROLLER: Different types of microcontrollers: Embedded microcontrollers, External memory microcontrollers; Processor Architectures: Harvard V/S Princeton , CISC V/S RISC; microcontrollers memory types; microcontrollers features : clocking, i/o pins, interrupts, timers, peripherals.

UNIT II

MICROCONTROLLER ARCHITECTURE: Introduction to PIC microcontrollers, Architecture and pipelining, program memory considerations, Addressing modes, CPU registers, Instruction set, simple operations.

UNIT III

Microcontrollers - Microcontroller 8051- Architecture, Pin Diagram, I/O Ports, Internal RAM and Registers, Interrupts, Addressing Modes, Memory Organization and External Addressing, Instruction Set, Assembly Language Programming, Real Time Applications of Microcontroller- Interfacing with LCD, ADC, DAC, Stepper Motor, Key Board and Sensors.

UNIT IV

Embedded Systems-Introduction, Classification, Processors, Hardware Units, Software Embedded into System, Applications and Products of Embedded Systems, Structural Units in Processor, Memory Devices, I/O Devices, Buses, Interfacing of Processor Memory and I/O Devices, Case Study of an Embedded System for a Smart Card.

TEXT BOOKS :

1.B. B. Brey: The Intel Microprocessors, Architecture, Programming and Interfacing, Pearson Education.
2.Design with PIC Microcontrollers by John B. Peatman , Pearson.
3.Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New

Delhi.
4.V. Udayashankara and M. S. Mallik arjunaswamy: 8051 Microcontroller, TMH, New Delhi

REFERENCE BOOKS:

1.Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education.
2.A. V. Deshmukh: Microcontroller (Theory and Application), TMH.
3.D. V. Hall: Microprocessors and Interfacing, TMH
4.Programming and Customizing the 8051 Microcontroller : Predko ; TMH.
5.Programming Embedded Systems in C and C++ : Michael Barr; SHROFF PUB. & DISTR

COURSE OUTCOMES: After the completion of the course the student will be able to:

1. To gain the knowledge about Microcontroller and its need.
2. To learn and understand the basic architecture of different Microcontroller 8051.
3. Foster ability to write the programming using 8051 microcontrollers.
4. To learn and understand the internal architecture and interfacing of different peripheral devices with 8051 Microcontrollers.
5. Ability to understand the role of Embedded systems in the industry.
6. To understand the design concept of Embedded systems.

Course code	**PEC-ECE-416-G**				
Category	**Professional Elective Course**				
Course title	**High Speed Electronics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	3	**3**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objective:

1. Study the high speed electronics system.
2. Understand Radio frequency amplifiers and mixers.
3. Learn the fabrication process.

UNIT: I

Transmission line theory (basics) crosstalk and nonideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery, methodologies for design of high speed buses; radiated emissions and minimizing system noise.

UNIT: II

Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Inter-modulation, Cross-modulation, Dynamic range.

Devices: Passive and active, Lumped passive devices (models), Active (models, low vs High frequency)

UNIT: III

RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF power output stages.

Mixers –Up conversion Down conversion, Conversion gain and spurious response. Oscillators Principles. PLL Transceiver architectures.

UNIT:IV

Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

Text/Reference Books:

1. Stephen H. Hall, Garrett W. Hall, James A. McCall “High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices”, August 2000, Wiley-IEEE Press.
2. Thomas H. Lee, “The Design of CMOS Radio-Frequency Integrated Circuits”, CambridgeUniversity Press, 2004, ISBN 0521835399.
3. Behzad Razavi, “RF Microelectronics”, Prentice-Hall 1998, ISBN 0-13-887571-5.
4. Guillermo Gonzalez, “Microwave Transistor Amplifiers”, 2nd Edition, Prentice Hall.
5. Kai Chang, “RF and Microwave Wireless systems”, Wiley.
6. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand significance and the areas of application of high-speed electronics circuits.
2. Understand the properties of various components used in high speed electronics.
3. Design High-speed electronic system using appropriate components.

Course code	**PEC-ECE-421-G**				
Category	**Professional Elective Course**				
Course title	**MIXED SIGNAL DESIGN**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	3	**3**	**0**	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objective:

1. Study the mixed signal of submicron CMOS circuits.
2. Understand the various integrated based filters and topologies.
3. Learn the data converters architecture, modeling and signal to noise ratio.
4. Study the integrated circuit of oscillators and PLLs.

UNIT I

Submicron CMOS Circuit Design:

Submicron CMOS: Overview and Models, CMOS process flow, Capacitors and Resistors. Digital circuit design: The MOSFET Switch, Delay Elements, An Adder. Analog Circuit Design: Biasing, Op-Amp Design, Circuit Noise.

UNIT II

Integrator Based CMOS Filters:

Integrator Building Blocks- low pass filter, Active RC integrators, MOSFET-C Integrators, g_m- C integrators, Discrete time integrators. Filtering Topologies: The Bilinear transfer function, The Biquadratic transfer function, Filters using Noise shaping.

UNIT III

Data Converter Architectures:

DAC Architectures- Resistor string, R-2R ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, and Pipeline DAC. ADC Architectures- Flash, Two-step flash ADC, Pipeline ADC, Integrating ADC's, Successive Approximation ADC.

Data Converter Modeling and SNR:

Sampling and Aliasing: A modeling approach, Impulse sampling, The sample and Hold, Quantization noise. Data converter SNR: An overview, Clock Jitter, Improving SNR using Averaging, Decimating filter for ADCs, Interpolating filter for DACs, Band pass and High passsinc filters - Using feedback to improve SNR.

UNIT IV

Oscillators and PLL:

LC oscillators, Voltage Controlled Oscillators. Simple PLL, Charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops.

Text/References:

1. CMOS Mixed Signal Circuit Design by R.Jacob Baker, Wiley India, IEEE Press, reprint 2008.
2. CMOS Circuit Design, Layout and Simulation by R.Jacob Baker, Wiley India, IEEE Press, Second Edition, reprint 2009.
3. Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill, 33 Reprint, 2016.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Apply the concepts for mixed signal MOS circuit.
2. Analyze the characteristics of IC based CMOS filters.
3. Design of various data converter architecture circuits.
4. Analyze the signal to noise ratio and modeling of mixed signals.
5. Design of oscillators and phase lock loop circuit.

Course code	**OEC-ECE-417-G**				
Category	**Open Elective course**				
Course title	**Renewable Energy Resources**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	3	**0**	0	**3**	
Class work	25				
Exam	75				
Total	100				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objective:

1. Study the various Renewable Energy Resources.
2. Understand the working principles of generation of electricity by Renewable Energy.

UNIT-I

Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

UNIT-II

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.
Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations.

UNIT-III

Geothermal Energy: Resources of geothermal energy, thermodynamics of geothermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT-IV

Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics, performance and limitations of energy conversion systems.
Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations.

Text/Reference Books:

1. Raja etal, “Introduction to Non-Conventional Energy Resources” Scitech Publications.

2. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.
3. M.V.R. Koteswara Rao, “Energy Resources: Conventional & Non-Conventional” BSP Publications,2006.
4. D.S. Chauhan,”Non-conventional Energy Resources” New Age International.
5. C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI Learning.
6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.
7. Godfrey Boyle,“ Renewable Energy Power For A Sustainable Future”, Oxford University Press.

Course Outcomes:

After completion of course the students will be able to understand the use of Renewable Energy Resources and their advantages.

Course code	**OEC-ME-455-G**				
Category	**Open Elective Course**				
Course title	**Composite Materials**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives: to develop an understanding of the design, processing, and behavior of composite materials.

Unit-1 Introduction: Classifications of Engineering Materials, Concept of composite materials, Matrix materials, Functions of a Matrix, Desired Properties of a Matrix, Polymer Matrix (Thermosets and Thermoplastics), Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc. Types of Reinforcements/Fibers: Role and Selection or reinforcement materials, Types of fibres, Glass fibers, Carbon fibers, Aramid fibers , Metal fibers, Alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multiphase fibers, Whiskers, Flakes etc., Mechanical properties of fibres. Material properties that can be improved by forming a composite material and its engineering potential

Unit-2 Matrix composites: Classification based on Matrix Material: Organic Matrix composites, Polymer matrix composites (PMC), Carbon matrix Composites or Carbon-Carbon Composites, Metal matrix composites (MMC), Ceramic matrix composites (CMC);

Unit-3 Reinforced Composites: Classification based on reinforcements: Fiber Reinforced Composites, Fiber Reinforced Polymer (FRP) Composites, Laminar Composites, Particulate Composites, Comparison with Metals, Advantages & limitations of Composites

Unit-4 Testing of Composites: Mechanical testing of composites, tensile testing, Compressive testing, Intra-laminar shear testing, Inter-laminar shear testing, Fracture testing etc.

TEXT/ REFERENCE BOOKS:

1. Materials characterization, Vol. 10, ASM hand book
2. Mechanical Metallurgy by G. Dieter Mc-Graw Hill
3. Thermal Analysis of Materials by R.F. Speyer, Marcel Decker
4. Engineering Materials: Polymers, Ceramics and Composites A.K Bhargava Prentice Hall India

Course code	**OEC-BME-419-G**				
Category	**Open Elective Course**				
Course title	**BIOSENSORS**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

1. To understand the basic principles and classification of sensors and measurands.
2. To know the hardware and software of DAQ system and Electronic Interface systems.
3. To understand how to measure various parameters and helps to design simple biomedical sensors.
4. To study about the sensor measurements for biological applications.

UNIT:I

Overview of biosensors and their electrochemistry: Molecular reorganization: Enzymes, Antibodies and DNA, Modification of bio recognition molecules for Selectivity and sensitivity, Fundamentals of surfaces and interfaces

UNIT:II

Bioinstrumentation and bioelectronics devices: Principles of potentiometry and potentiometric biosensors, Principles of amperometry and amperometric biosensors, Optical Biosensors based on Fiber optics, Introduction to Chemometrics, Biosensor arrays; Electronic nose and electronic tongue.

UNIT:III

Iron-Selective Field-Effect Transistor (ISFET), Immunologically Sensitive Field Effect Transistor (IMFET). Fabrication and miniaturization techniques.

UNIT:IV

Sensor-to-Frequency Conversion Data-Acquisition Systems: Hardware and Software of Data Acquisition System (DAS), Electronic Interface, Integrated Sensors, Wireless integration. Smart sensor, Nano sensor.

Text Books: 1. Gardner, J.W., Microsensors, Principles and Applications, John Wiley and Sons (1994). 2. Kovacs, G.T.A., Micromachined Transducer Sourcebook, McGraw−Hill (2001).
3. Turner, A.P.F., Karube,I., and Wilson G.S., Biosensors−Fundamentals and Applications, Oxford University Press (2008)
4. Jon Cooper, *Biosensors A Practical Approach*, Bellwether Books
5. Manoj Kumar Ram, Venkat R, Bhethanabolta, *Sensors for chemical and biological applications*, CRC Press

Course Outcomes: After the successful completion of the course the students will be able to:
1. Explain the concept of molecular reorganization, fundamentals of surfaces and interfaces
2. Elucidate the principles of different types of biosensors

Disaster Management		
Course Code	**OEC-CE-417G**	**External Marks: 75**
Credits	**3**	**Internal Marks: 25**
L-T-P	**3-0-0**	**Total Marks: 100**
		Duration of Examination: 3hrs

COURSE OBJECTIVES:

1. To provide basic conceptual understanding of disasters and its relationships with development.
2. Provide an understanding of the social nature of natural hazards and disasters
3. Increase awareness of hazards and disasters around the world and the unequal social consequences stemming from disaster events.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction

Definition of Disaster, hazard, Global and Indian scenario, role of engineer, importance of study in human life, long term effects of disaster. Geological Mass Movement and land disasters, Atmospheric disasters, Disaster Mitigation

Unit-II

Module 2: Natural Disaster

Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion

Module 3: Man-made Disasters

Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

Unit -III

Module 4: Case Studies

Damage profile analysis- Uttarkashi/Bhuj/Latur earthquakes. Forest Related disasters, Mining disasters, Atmospheric disasters.

Unit IV

Module 5: Disaster Management

Importance of public awareness, Preparation and execution of emergency management programme. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India. Use of Internet and software for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard.

COURSE OUTCOMES:

After completing this course, students should be able:

1. To know natural as well as manmade disaster and their extent and possible effects on the economy.
2. To Plan national importance structures based upon the previous history.
3. To acquaint with government policies, acts and various organizational structures associated with an emergency.
4. To know the simple dos and don’ts in such extreme events and act accordingly.

Reference Books

- Singhal J.P. Disaster Management, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
- Tushar Bhattacharya, Disaster Science and Management, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
- Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011

Solid & Hazardous waste management		
Course Code	**OEC –CE-402G**	**External Marks: 75**
Credits	**3**	**Internal Marks:25**
L-T-P	**3-0-0**	**Total Marks: 100**
		Duration of Examination: 3h

COURSE OBJECTIVES:

1. To understand the sources of solid and hazardous wastes.
2. To understand methods of solid and hazardous waste disposal.
3. To gain knowledge of E-Waste management.

Note: Examiner will set 9 questions in total, with two questions from each section and one question covering all the section which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carries equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section

Unit I

Module:1 Sources and Composition of Municipal Solid Waste

Introduction, Sources and Types of solid waste, Composition of Solid Waste and its Determination, Properties of Municipal Solid Waste

Module:2 Solid Waste Generation and Collection

Quantities of Solid Waste, Measurements and methods to measure solid waste quantities, Solid waste generation and collection, Factors affecting solid waste generation rate, Quantities of materials recovered from MSW.

Unit II

Module:3 Handling, Separation and Processing of Solid Waste

Handling and separation of solid waste at site- Material separation by pick in, screens, float and separator magnets and electromechanical separator and other latest devices; Waste handling and separation at Commercial and industrial facilities, Processing of solid waste at residence, Commercial and industrial site - Storage, conveying, compacting, Shredding, pulping, granulating etc.

Module:4 Disposal of Municipal Solid Waste

Landfill: Classification, planning, sitting, permitting, landfill processes, landfill design, landfill operation, use of old landfill; Combustion and energy recovery of municipal solid waste, effects of combustion, undesirable effects of Combustion

Unit III

Module:5 Hazardous Waste Management

Definition, identification and classification of hazardous solid waste. The magnitude of the problem; Hazardous waste: Risk assessment, Environmental legislation, Characterization and site assessment.

Module:6 Biological Treatment of Solid and Hazardous Waste

Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation.

Unit IV

Module:7 Radioactive Waste Management

Fundamentals Sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options.

Module:8 Electronic waste management

E waste- Definition, composition; environmental and human health issues, recovery of metals from E waste, E waste management,

COURSE OUTCOMES:

After completing this course, students should be able:

1. To realize the significance of solid and hazardous waste management in today life
2. To understand the processes involved in solid and hazardous waste management
3. To comprehend the techniques for various waste management
4. To appreciate the role of common/integrated waste management plants

Suggested Books:

1. Basics of Solid and Hazardous Waste Mgmt. Tech. by Kanti L.Shah 1999, Prentice Hall.

2. Solid And Hazardous Waste Management 2007 by S.C.Bhatia Atlantic Publishers & Dist.

3. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.

Course code	OEC –ME-402-G				
Category	Open Elective Courses (OEC) (Semester-VIII) List-III				
Course title	**OPERATIONS RESEARCH**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The aims of operation research include: solving operational questions, solving questions related to resources' operations, and solving decision-making questions. Operational research has a relation with different areas of study and it has several applications. Operation research is considered as a tool of productivity. In comparison to traditional approaches, operation research provides more extensive, quantitative, and detailed information about different issues and managers can implement their decisions based on quantitative analyses. Operation research will be a good assistance for managers in different areas.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction: Definition, role of operations research in decision-making, applications in industry. Concept on O.R. model building –Types & methods.

Linear Programming (LP): Programming definition, formulation, solution- graphical, simplex GaussJordan reduction process in simplex methods, BIG-M methods computational, problems.

UNIT-II

Deterministic Model: Transportation model-balanced & unbalanced, north west rule, Vogel's Method, least cost or matrix minimal, Stepperg stone method, MODI methods, degeneracy, assignment, traveling salesman, problems.

Advanced Topic Of LP: Duality, PRIMAL-DUAL relations-its solution, shadow price, economic interpretation, dual-simplex, post-optimality & sensitivity analysis, problems.

UNIT-III

Waiting Line Models: Introduction, queue parameters, M/M/1 queue, performance of queuing systems, applications in industries, problems.
Project Line Models: Network diagram, event, activity, defects in network, PERT & CPM, float in network, variance and probability of completion time, project cost- direct, indirect, total, optimal project cost by crashing of network, resources leveling in project, problems.

UNIT-IV

Simulation: Introduction, design of simulation, models & experiments, model validation, process generation, time flow mechanism, Monte Carlo methods- its applications in industries, problems.
Decision Theory: Decision process, SIMON model types of decision making environment-certainty, risk, uncertainty, decision making with utilities, problems.

Course Outcomes (COs): At the end of the course, the student shall be able to:
CO 1- Discuss the role of operations research in decision-making, and its applications in industry and should be able to formulate and design real-world problems through models & experiments.
CO 2- Knowledge of various types of deterministic models like linear programming, transportation model etc.
CO 3- Explore various types of stochastic models like waiting line model, project line model, simulation etc.
CO 4- Deduce the relationship between a linear program and its dual and perform sensitivity analysis.
CO 5- Describe different decision making environments and apply decision making process in the real world situations

Text Books:

1) Operation Research – TAHA, PHI, New Delhi.
2) Principle of Operations Research – Ackoff, Churchaman, arnoff, Oxford IBH, Delhi.

Reference Books :

1) Operation Research- Gupta & Sharma, National Publishers, New Delhi.
2) Quantitative Techniques- Vohra, TMH, New Delhi 8. Principles of operation Research (with Applications to Managerial Decisions) by H.M.Wagher, Prentice Hall of India, New Delhi.
3) Operation Research – Sharma, Gupta, Wiley Eastern, New Delhi.
4) Operation Research – Philips, Revindran, Solgeberg, Wiley ISE.

Course code	OEC-ME-410G				
Category	Open Elective Courses (OEC) (Semester-VIII) List-III				
Course title	**QUALITY ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To understand the concept of Quality Engineering which emphasizes growth, creativity, and analytical thinking.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section A

Basic Concepts of Quality: Definitions of Quality and its importance in industry, Quality function, Quality Characteristics, Quality process, Quality Traits, Applications of Quality Concept, Introduction to quality control, Computer aided quality control, Total quality control(TQC) and its implementation, Elements of TQC, Quality Circle, Objectives of quality circle, Role of management in quality circle, Quality in service organizations, characteristics of a service organization, Important service dimensions, Design of service quality.

Section B

Basic Statistical Concepts: The Concept of variation, Distinction between variables and attributes data, The frequency distribution, graphical representation of frequency distribution, Quantitative description of distribution, the normal curve, concept of probability, laws of probability, probability distributions, hyper geometric distribution, binomial distribution, The Poisson distribution.

Section C

Quality systems: Quality systems, Need for quality System, Need for standardization, History of ISO:9000 series standards and its features, steps to registration, India and ISO:9000, Automated inspection systems technologies, Different forms of Inspection, Industrial inspection,

Section D

Total Quality Management: Introduction o TQM, Concepts, Characteristics of TQM, Relevance of TQM, Approaches to TQM Implementation, TQM philosophies, Taguchi Philosphy, JIT, Kaizen, Six Sigma approach, 5-S approach

Course Outcomes: Upon completion of this course the student will be able to:

CO1 - Attain the basic techniques of quality improvement, fundamental knowledge of statistics and probability
CO2 - Use control charts to analyze for improving the process quality.
CO3 - Describe different sampling plans
CO4 - Acquire basic knowledge of total quality management
CO5 - Understand the modern quality management techniques

Text Books:

1. Quality planning and Analysis, Juran and Gryna, TMH, New Delhi
2. Quality Management, Kanishka Bed, Oxford University Press, New Delhi
3. Introduction to SQC, Montgomery DC, 3e, Wiley, New Delhi
4. Fundamentals of quality control and improvement, A Mitra, Mcmillan pub. Company, NY

Reference Books:

1. Fundamentals of Applied Statistics, Gupta and Kapoor, Sultan Chand and Sons, New Delhi.

Course code	OEC –EE-412G				
Category	Open Elective Courses (OEC) (Semester-VIII) List-I				
Course title	**ELECTRICAL POWER GENERATION**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The aims of Electrical power generation include: The aim of subject is to get knowledge about power generation and its related issues.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

INTRODUCTION: Energy sources, their availability, recent trends in Power Generation, Interconnected Generation of Power Plants.

Section-B

POWER GENERATION PLANNING: Load forecasting, load curves, load duration curve, Base load and Peak load Power Plants, connected Load, maximum demand, demand factor, Group diversity factor, load factor, significance of load factor, plant factor, capacity factor, selection of unit size, No. of Units, reserves, cost of power generation, Depreciation, tariff.

Section-C

CONVENTIONAL ENERGY SOURCES: Selection of site, capacity calculations, classification, Schematic diagram and working of Thermal Power Stations, Hydro Electric Plant, Nuclear Power Plant and Diesel Power Stations.

Section-D

ELECTRIC ENERGY CONSERVATION & MANAGEMENT: Energy management, Energy Audit, Energy Efficient Motors, Co-generation.

TEXT BOOKS:

1. Electric Power Generation, B.R.Gupta
2. Power Generation, Operation and Control, Wood and Wollenberg, John Wiley & Sons,1984.

REF. BOOKS:

1. A Course in Electric Power System, Soni, Gupta, Bhatnagar, Dhanpat Rai & Sons
2. Power System Engineering, Nagrath & Kothari, Tata Mc-Graw Hill, New Delhi
3. Power Plant Engg: G.D. Rai
4. Electric Power: S.L. Uppal (Khanna Publishing)