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)