Curriculum for Undergraduate Degree (B.Tech.) in Electronics and Communication Engineering (w.e.f. AY: 2020-21)

Part III: Detailed Curriculum

Eighth Semester

Course Name:	**Antennas and Propagation**		
Course Code:	PE-EC801A	**Category:**	Professional Elective
Semester:	Eighth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Knowledge of Electromagnetic Waves
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To apply the knowledge of Maxwell's equation in solving the radiation fields of antenna.
2	To understand all the characterizing parameters of antenna.
3	To Analyze the fields of antenna array.
4	To relate the basic principles and design considerations of Aperture and Microstrip antennas.
5	To understand the principles and mechanism of various Radio wave Propagation methods.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	Review of Maxwell's Equation; Physical concept of Radiation and introducing Antenna; Vector Potential and Retarded Vector Potential; Radiation fields of a Hertzian dipole(electric); Duality Principle, Radiation fields due to short magnetic dipole. Radiation fields and Characteristics of λ/2 dipole; discussion on λ/4 monopole antenna; Current distribution and Radiation patterns of center-fed dipoles of length λ, 3λ/2 and 2 λ. Horizontal and Vertical antennas over a plane ground.	2 4
2	**Antenna Characteristics**: Radiation Pattern, Beam Width; Radiation Resistance, Directivity and Gain; Aperture, Efficiency, Impedance, VSWR, Polarization; Effective height, Noise Temperature of Antenna. Friis transmission equation.	5

3	**Antenna Arrays**: Electric Field due to 2 element arrays, N element Arrays; Pattern Multiplication; Uniform Linear Array: End fire and Broad side array; Analysis of uniformly spaced array with uniform and non-uniform excitation of currents, synthesis of antenna array. Yagi array.	7
4	**Aperture and Reflector Antennas** Huygen's principle, radiation from rectangular aperture, Design considerations, Babinet's principle, Radiation from Sectoral and pyramidal horn, design concept, prime focus parabolic reflector and cassegrain feed reflector antenna. **Broadband Antennas** Log-periodic, Frequency independent antenna.	6
5	**Microstrip Antenna** Basic characteristics, Radiation mechanism, Feeding Mechanism, Design of Rectangular Microstrip antenna, Bandwidth Enhancement Techniques.	5
6	**Methods of Propagation**: Ground Wave Propagation, Components of ground wave, Field strength dependence on physical factors. Sky wave Propagation; Ionospheric Layers; Virtual Height, Critical Frequency, MUF, Skip distance, Space wave propagation: Tropospheric Scatter, Ducting, Super refraction, absorption, refraction , multipath propagation and fading.	7
Total		**36**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Apply the knowledge of Maxwell's equation in solving the radiation fields of antenna.
2	Define all the characterizing parameters of antenna.
3	Analyze the fields of antenna array.
4	Relate the basic principles and design considerations of Aperture and Microstrip antennas.
5	Define the principles and mechanism of various Radio wave Propagation methods.

Learning Resources:	
1	Antennas,J.D. Kraus, McGraw Hill.
2	Antenna Theory- Analysis and Design, C.A Balanis, John Wiley.
3	Micro Strip Antennas, I.J. Bahl and P. Bhartia, Artech House.
4	Antenna and Wave Propagation, K.D.Prasad, Satya Prakashan, New Delhi.

Course Name:	**Fiber Optic Communication**		
Course Code:	PE-EC801B	**Category:**	Professional Elective
Semester:	Eighth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Basic Knowledge of Electromagnetic Fields and waves, Semiconductor materials
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To learn the basic elements of optical fiber transmission link, advantages, applications of Fiber optic communication
2	To understand the different kind of fibers, losses, signal distortion, fabrication optical fibers etc.
3	To learn the various optical sources, materials and their constructions
4	To learn the optical receivers and noise performance of photo detector.
5	To learn different optical fiber components such as switches, amplifiers
6	To learn link budget, WDM network.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**Introduction:** Introduction to optical communication, principles, components, advantages of fiber optic communication, Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod.	2
2	**Optical fiber waveguides:** Different types of optical fibers, structures, Single and Multi-mode fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation, modal dispersion, material dispersion, waveguide dispersion, dispersion-shifted fiber, dispersion flattened fiber, Fabrication of optical fibers and measurement techniques like OTDR.	8
3	**Optical sources** - Desired Features of Optical Sources for Optical Communication and Material Choices, LED Structure and Operating Principle, power and efficiency, coupling to fibres. Laser diodes; principle, double heterostructure, gain and index guiding, distributed lasers. Quantum Well Lasers; Modes and narrow line width lasers. Modulation; Bandwidth for modulation, Optical transmitters: components	8
4	**Optical Detectors:** Device types, optical detection principles, efficiency, responsivity, bandwidth, noise	4

	sources, p-n Photodiodes, p-i-n Photodiodes, APDs, signal to noise ratio.	
5	**Optical link design** – Point-to-point optical link, System Block Diagram, Power budgeting, Rise time budgeting, BER calculation, power penalties	4
6	**Optical Components:** Optical switches - Coupled mode analysis of directional couplers, electro-optics switches, MEMS optical switches. Optical amplifiers - EDFA, SOA, Raman amplifier etc.	6
7	**Wavelength division multiplexing:** WDM and DWDM systems. Principles of WDM networks.	4
Total		**36**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Describe the principles of fiber-optic communication, the components and bandwidth advantages
2	Discuss the properties of the optical fibers and optical components.
3	Realize operation of lasers, LEDs, and detectors
4	Analyze system performance of optical communication systems.
5	Plan a point-to-point optical fiber communication link based on power budgeting and rise-time budgeting.

Learning Resources:	
1.	Gerd Keiser, "Optical Fiber Communications", Tata McGraw-Hill Education
2.	John M. Senior, "Optical Fiber Communications: Principles and Practice", Pearson
3.	J. Gowar, "Optical Communication Sytems" Prentice Hall India, 1987
4.	Govind P. Agrawal, " Fiber-Optic Communications Systems", John Wiley & Sons, Inc
5.	Ajoy Ghatak, K. Thyagarajan, "An Introduction to Fiber Optics", Cambridge University Press

Course Name:	**Satellite Communication**		
Course Code:	PE-EC801C	**Category:**	Professional Elective
Semester:	Eighth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Microwave devices and communication, Antenna and wave Propagation
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To impart basic concept of Satellite communication.
2	To impart knowledge about the orbital mechanics related to satellites.
3	To understand the different subsystems of satellite related to its communication.
4	To understand the basic concepts of perturb forces suffered by satellite.
5	To develop an insight into the design of satellite links and related noise influences.
6.	To explain the different multiple access schemes used in satellite communication.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication. Concepts of modern Satellite Systems Ex: INTELSAT, INMARSAT, GPS.	4
2	Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.	6
3	Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.	6
4	Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. Satellite link budget	6
5	Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.	8
6	Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.Brief Introduction to Error Control Coding	8
Total		**36**

Course Outcomes:	
After completion of the course, students will be able 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.

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

Course Name:	**Mixed Signal Design**		
Course Code:	PE-EC802A	**Category:**	Professional Elective
Semester:	Eighth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Analog & Digital Electronics circuits & CMOS VLSI Design.
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To Study concepts of Data Converters, PLLs & CMOS Switched capacitors Circuits.
2	To Design and to implement the product level design blocks for VLSI applications.
3	To acquire knowledge on various integrated based Filters in mixed signal mode.
4	Learn the modeling of data converter architecture, modulator and Signal to Noise Ratio.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**Sample and Hold circuits & Switched Capacitor circuits:** Introduction to MOS, CMOS & Bi-CMOS Sample-and-Hold basics. Basic operation and analysis of switched capacitor circuits. Resistor equivalence of a switched capacitor, parasitic-sensitive integrator, parasitic-insensitive integrators, signal-flow-graph analysis, Noise in switched-capacitor circuits.	10
2	**Switched Capacitor Circuits & Filters:** Introduction to Switched Capacitor circuits, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor first order filters Bi-quad filters, Introduction to Gm-C Filters, Bi CMOS Tran conductors and MOSFET-C Filters.	8

3	**Data Converter Modeling**: Introduction to Integrating Converters, Nyquist rate A/D Converters and applications. Interpolating A/D converters, DAC-based successive approximation Converters and Algorithmic (or cyclic) A/D converter. Quantization noise, Deterministic approach, Stochastic approach. Noise shaping modulators.	10
4	**Oscillators & PLL**: LC oscillators, Voltage Controlled Oscillators (VCO). Basic PLL topology, Dynamics of simple PLL, Charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops.	8
Total		**36**

Course Outcomes:	
1	Understand the concepts of Switched capacitor and Data Converter circuits.
2	Apply the concepts for mixed signal MOS circuit.
3	Analyze the signal to noise ratio and modeling of mixed signals.
4	Design and analysis of engineering problems in the area of mixed-signal Design.

Learning Resources:	
1	CMOS Mixed Signal Circuit Design by R. Jacob Baker, Wiley India, IEEE Press.
2	Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill
3	Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edition
4	Gregorian, Temes, "Analog MOS Integrated Circuit for signal processing", John Wiley & Sons.
5	Roubik Gregorian and Gabor C. Temes, Analog MOS Integrated Circuit for Signal Processing, John Wiley and Sons

Course Name:	**Mobile Communication and Network**		
Course Code:	PE-EC802B	**Category:**	Professional Elective
Semester:	Eighth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Analog & Digital Communication
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To impart basic concept of cellular communication.
2	To impart basic knowledge signal propagation mechanism, such as fading, reflection, refraction etc.
3	To acquire knowledge about the frequency selective channels and antennas.
4	To acquire knowledge about the basic principle of multiple access and modulation schemes.
5	To impart the basic knowledge of diversity receivers.
6.	To acquire knowledge about space time signal processing and performance:

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**Cellular Concepts**: Cell Structure, Frequency Reuse, Cell Splitting, channel assignment, Hand off, Interference, capacity, Power control, Overview of 2G and 3G cellular standards.	8
2	**Signal propagation:** Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, 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.	8
3	**Frequency Selective Channels and Antenna:** Capacity of flat and frequency selective channels. Antennas-Antennas for mobile terminal monopole antennas, PIFA, base station antennas and arrays.	4
4	**Multiple access schemes:** FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.	8
5	**Receiver structure:** Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.	4
6	**Space time signal processing and Performance:** MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing trade off. Outrage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA	4
Total		**36**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Explain the basic cellular structure and frequency reuse concept.
2	Explain fading effect and different atmospheric effects on mobile communication.
3	Understand basic concept of frequency selective channel and different antenna requirements regarding mobile communication.
4	Explain TDMA, FDMA, CDMA and digital modulation scheme like BPSK, QPSK etc.
5	Understand basic operation principle of RAKE receiver, MRC receiver etc.
6	Understand basic of GSM, EDGE, GPRS etc.

Learning Resources:	
1	WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill.
2	VK Garg & JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall.
3	WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall.
4	AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley.
5	Raymond Steele, Mobile Radio Communications, IEEE Press, New York
6	Theodore S. Rappaport, Wireless Communications Principles and Practice , Prentice Hall

Course Name:	**VLSI Design Automation**		
Course Code:	PE-EC802C	**Category:**	Professional Elective
Semester:	Eighth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Microelectronics and Integrated Circuit Fabrication
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	Describe the concepts of VLSI design and methodology.
2	To impart the knowledge of the circuits for partitioning and placement.
3	Illustrate the concept of floor-planning and routing for VLSI Circuits
4	To develop an insight about the VLSI Simulation and synthesis of circuits.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	Introduction to VLSI Design methodologies: Review of Data structures and algorithms - Review of VLSI Design automation tools - Introduction to VLSI Design methodologies: Algorithmic Graph Theory and Computational Complexity - Tractable and Intractable problems - general purpose methods for combinatorial optimization	8
2	Layout Compaction, Placement & Partitioning :Layout Compaction: Design rules - problem formulation - algorithms for constraint graph compaction Layout Compaction, Placement & Partitioning :Placement & Partitioning: Circuit representation - Placement algorithms -partitioning	8
3	Floor planning & Routing :Floor planning concepts: Terminologies, floorplan representation, shape functions and floorplan sizing Floor planning & Routing : Routing: Types of local routing problems - Area routing - channel routing -global routing - algorithms for global routing.	8
4	VLSI Simulation :Gate-level modeling and simulation - Switch-level modeling and simulation – Combinational Logic Synthesis - VLSI Simulation :Binary Decision Diagrams - Two Level Logic Synthesis- High level Synthesis	8
5	High Level Synthesis Hardware models - Internal representation - Allocation assignment and scheduling – High Level Synthesis Simple scheduling algorithm - Assignment problem – High level transformations	8
Total		**40**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Discuss the concepts of VLSI design and methodology.
2	Analyze the circuits for partitioning and placement.
3	Apply the concept of floor-planning and routing for VLSI Circuits
4	Illustrate and analyze VLSI Simulation and synthesis of circuits.

Learning Resources:	
1	S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.
2	N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwar Academic Publishers, 2002

Course Name:	**Internet of Things**		
Course Code:	OE-IT801C	**Category:**	Open Elective
Semester:	Eighth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Programming for problem solving and basic knowledge of Computer Network.
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To understand the terminology, technology and its applications
2	To understand the concept of M2M (machine to machine) with necessary protocols
3	To learn the Python Scripting Language and the Raspberry PI platform, used in many IoT devices and applications.
4	To understand the implementation of web based services on IoT devices.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**Introduction to Internet of Things:** Definition and characteristics of IoT, **Physical design of IoT**- Things in IoT ,IoT Protocols, **Logical Design of IoT**- IoT communication models, Iot Communication APIs , **IoT enabled technologies**-Wireless sensor networks, Cloud computing, Big data analytics, Communication protocols, Embedded systems, IoT levels and deployment templates	10
2	**IoT and M2M Introduction**, M2M-Difference between IoT and M2M, SDN and NFV for IoT Software Defined Networking, Network Function Virtualization. Difference between SDN and NFV for IoT. Basics of IoT System Management with NETCOZF.	6
3.	**Introduction to Python:** Language features of Python, Data types, Data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling. Different Python packages.	6
4	**IoT Physical Devices and Endpoints:** Introduction to Raspberry PI- Interfaces (serial, SPI, I2C). Programming-- Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins..	6
5	**IoT Physical Servers and Cloud Offerings:** Introduction to Cloud Storage models and communication APIs. Webserver – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API	8
Total		**36**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Explain the definition and usage of the term "Internet of Things" in different contexts
2	Explain the key components that make up an IoT system.
3	Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack
4	Build and test a IoT system involving prototyping, programming and data analysis

Learning Resources:	
1	Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
2	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, Pearson Education, 2017.
3	Internet of Things, K.G. Srinivasa , G.M. Siddesh, R.R. Hanumantha, CENGAGE Leaning India, 2018
4	Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2016.
5	Internet of Things (A Hands-on-Approach), Arshdeep Bahga and Vijay Madisetti, VPT, 2014.
6	Internet of Things: Architecture and Design Principles, Raj Kamal , McGraw Hill Education,2017

Course Name:	**Artificial Intelligence**		
Course Code:	OE-CS801B	**Category:**	Open Elective
Semester:	Eighth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Discrete Mathematics, Algorithm
Full Marks:	70		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 5

Course Objectives:	
1	This subject will help in acquiring knowledge on Basic Techniques of AI and Intelligent agents**.**
2	The subject will help to acquire knowledge on reasoning with and without uncertainty.
3	The subject will help in having elementary knowledge on expert system, Learning and NLP.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	Introduction [2] Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents [3] Agents & environment, nature of environment, structure of agents, goal based agents, utility-based agents, learning agents. Problem Solving [3] Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	8
2	Search techniques [6] Solving problems by searching: problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies [6] Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. Adversarial search [3] Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.	15
3	Using predicate logic [2] Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Probabilistic reasoning [4] Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	6
4	Natural Language processing [3] Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. Learning [2] Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.	7

	Expert Systems [2] Representing and using domain knowledge, expert system shells, knowledge acquisition.	
Total		**36**

Course Outcomes:	
After completion of the course, students will be able to:	
1.	Evaluate the basic concepts of AI
2.	Explain between heuristic and non-heuristic search techniques.
3.	Interpret Resolution and Probability based inference.
4.	Explain NLP, Learning and Expert System Architecture.

Learning Resources:	
1.	Artificial Intelligence, Ritch & Knight, TMH
2.	Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3.	Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4.	Poole, Computational Intelligence, OUP
5.	Expert Systems, Giarranto, VIKAS
6.	M.C. Trivedi, Artificial Intelligence, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)

Course Name:	**Organizational Behaviour**		
Course Code:	OE-HU801H	**Category:**	Open Elective
Semester:	Eighth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	To know the existence of organization as a place for human livelihood
Full Marks:	70		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 5

Course Objectives:	
1	To help the students to develop cognizance of the importance of human behavior and how to align it with basic organizational theories
2	To enable students to describe how people behave under different conditions and understand why people behave as they do
3	To provide the students to analyze specific strategic human resources demands for future action
4	To enable students to synthesize related information and evaluate options for the most logical and optimal solution such that they would be able to predict and control human behaviour and improve results

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**Introduction of Organizational Behavior** : Introduction, definition, historical development, An OB model;contributing disciplines, challenges and opportunities	3
2	**Foundations of Individual Behavior**: Individual behavior; Intellectual abilities, Physical ability, the role of disabilities. Personality: Meaning, formation, determinants, traits of personality, big five and MBTI, personality attributes influencing OB. Attitude: Formation, components of attitudes, relation between attitude and behavior;Learning; Perception: Process of perception, factors influencing perception, link between perception and individual decision-making; Transactional Analysis: An Introduction to Transactional Analysis;Johari window.	6
3	**Group Dynamics and Team Development**: Group dynamics -definition and importance, types of groups, group formation, group development, group composition, group performance factors; Principle-centered-approach to team development.	5
4	**Motivation**: Meaning, theories of motivation-needs theory, two factor theory, Theory X and Y, application of motivational theories. Job satisfaction. Case Study analysis. **Leadership**: Meaning, styles of leadership, leadership theories, trait theory, behavioral theories, managerial grid, situational theories.	8
5	**Power and Authority** :Definition of Power –Types of Power; Power and Politics in Organization; Organizational Stress ; Conflict: Nature of Conflict & Conflict Resolution; Case Study Analysis.	4
6	**Organizational Change and Development**: Planned Change & OB Techniques; Organizational Development; Organizational Culture: Meaning & Definition, Contemporary Models of Culture and Organizational Effectiveness; Cross Cultural Management.	4
Total		**30**

Course Outcomes:	
After completion of the course, students will be able to:	
1	emonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization
2	Demonstrate the applicability of analyzing the complexities associated with management of individual behavior in the organization.
3	Analyze the complexities associated with management of the group behavior in the organization
4	Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.

Learning Resources:	
1	Robbins, S.P. Judge, T.A. &Sanghi, S.: Organizational Behaviour, Pearson
2	Luthans, Fred: Organizational Behaviour, McGraw Hill
3	Newstrom J.W. &Devis K.: Organizational Behavior, McGraw Hill
4	Aswathappa ,K : OrganisationalBehaviour ,Himalaya Publishing House
5	Shukla, Madhukar : Understanding Organizations – Organizational Theory & Practice in India, Prentice Hall
6	Sekharan, Uma: OrganisationalBehaviour , The McGraw –Hill Companies

Course Name:	**Operations Research and Optimizing Technique**		
Course Code:	OE-M801A	**Category:**	Open Elective
Semester:	Eighth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	School mathematics,BS-M101,BS-M201
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To impart knowledge in concepts and tools of Operations Research
2	To understand mathematical models used in Operations Research
3	To apply these techniques constructively to make effective business decisions

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**Solving Linear Programming Problems :** Formulation, Solving LPP : Using Simultaneous Equations and Graphical Method ; Simplex,Duality, Big-M method, Transpotation &Assignment,Travelling Salesman problem	11
2	**Game Theory** : Introduction ; 2- person Zero – sum Game; Saddle Point ; Mini-Max and Maxi-Min Theorems (statement only); Games without saddle point ; Graphical Method ; Principle of Dominance	7
3	**Queuing Theory :** Introduction ; Basic Definitions and Notations ; Axiomatic Derivation of the 7L Arrival & Departure (Poisson Queue). Pure Birth and Death Models; Poisson Queue Models : M/M/1 : ∞/FIFO and M/M/1: N/ FIFO.	6
4	. **Network Analysis :** Shortest Path : Floyd Algorithm ; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded).	6
5	**Non-Linear Programming:** Integer Programming, Dynamic Programming.	6
Total		**36**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained.
2	Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods, Finding initial basic feasible and optimal solution of the Transportation problems
3	Optimize the allocation of resources to Demand points in the best possible way using

	various techniques and minimize the cost or time of completion of number of jobs by number of persons
4	Analyse competitive real-world phenomena using concepts from game theory. Analyse pure and mixed strategy games
5	Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems

Learning Resources:	
1	H. A. Taha, "Operations Research", Pearson
2	P. M. Karak – "Linear Programming and Theory of Games", ABS Publishing House
3	Ghosh and Chakraborty, "Linear Programming and Theory of Games", Central Book Agency
4	Ravindran, Philips and Solberg - "Operations Research", WILEY INDIA
5	Kanti Swaroop — "Operations Research", Sultan Chand & Sons
6	Rathindra P. Sen—"Operations Research: Algorithms and Applications", PHI
7	R. Panneerselvam - "Operations Research", PHI
8	A.M. Natarajan, P. Balasubramani and A. Tamilarasi - "Operations Research", Pearson
9	M. V. Durga Prasad – "Operations Research", CENGAGE Learning
10	J. K. Sharma - "Operations Research", Macmillan Publishing Company

Course Name:	**Project-II**		
Course Code:	PW-EC881	**Category:**	Sessional
Semester:	Eighth	**Credit:**	7
L-T-P:	0-0-14	**Pre-Requisites:**	Knowledge on domain of project work and associated tools
Full Marks:	100		
Examination Scheme:	Semester Examination: 100	Continuous Assessment: 00	Attendance: 00

Course Objectives:	
1	To impart concepts of literature survey .
2	To impart knowledge about handling a topic independently to develop an approach for solution.
3	To impart knowledge about preliminary Modelling/Simulation/Experiment/Design related to the topic
4	To impart knowledge about writing a project report and preparing presentation on the topic.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
	The objective of Project Work II is to enable the student to extend further the investigative study taken up under PROJECT I, 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 PROJECT I. 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.	30

Course Outcomes:	
After completion of the course, students will be able to:	
1	Describe their project objective and state different research-oriented topics reviewed, related to their project work
2	Formulate mathematical expressions/ design electronic circuits relevant to their project objective.
3	Practically implement the designed circuits, apply different scientific software tools and techniques for design, simulation, analysis and interpretation.
4	Report and present their work and function in collaboration with the team members.

Learning Resources:	
1	Associated Books, Journals, Magazines and resources from Internet.

Course Name:	**Comprehensive Viva Voce**		
Course Code:	PW-EC882	**Category:**	Sessional
Semester:	Eighth	**Credit:**	1
L-T-P:	0-0-0	**Pre-Requisites:**	Comprehensive Knowledge of all courses under ECE
Full Marks:	100		
Examination Scheme:	Semester Examination: 100	Continuous Assessment: 00	Attendance: 00

Course Objectives:	
1	To develop the technique of self study and recapitulation of any subject in order to prepare oneself for answering in front of an examination panel.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
	The Comprehensive Viva Voce will enable the student to take up exhaustive study and recapitulation in the broad field of Electronics & Communication Engineering, and associated areas in order to be able to answer a panel of experts during any kind of examination or interview.	

Course Outcomes:	
After completion of the course, students will be able to:	
1	Express themselves effectively.
2	Apply knowledge to tackle unknown questions.
3	Review literature to independently study unknown modern topic.

Learning Resources:	
1	Relevant Books and Technical Magazines.