Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Electronics & Communication Engineering

(Applicable from the academic session 2018-2019)

Semester-VII

HS-**HU701**	**Principles of Management**	**2L:0T:0P**	**2 credits**

Module-I

1. Basic concepts of management: Definition - Essence, Functions, Roles, Level.
2. Functions of Management: Planning - Concept, Nature, Types, Analysis, Management by objectives; Organisation Structure -Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organisational Effectiveness.

Module-II

3. Management and Society - Concept, External Environment, CSR, Corporate Governance, Ethical Standards.

4. People Management - Overview, Job design, Recruitment & Selection, Training & Development, Stress Management.
5. Managerial Competencies - Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship.

Module-III

6. Leadership: Concept, Nature, Styles.
7. Decision making: Concept, Nature, Process, Tools & techniques.
8. Economic, Financial & Quantitative Analysis - Production, Markets, National Income Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods - Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control.

Module-IV

9. Customer Management - Market Planning & Research, Marketing Mix, Advertising & Brand Management.
10. Operations & Technology Management - Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.

References:

1. Management: Principles, Processes & Practices - Bhat, A & Kumar, A (OUP).

2. Essentials for Management - Koontz, Revised edition, Tata McGraw Hill (TMH)
3. Management - Stoner, James A. F. (Pearson)
4.Management - Ghuman, Tata McGraw Hill(TMH)

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PE-EC701A	Microwave Theory and Technique	3L:0T:0P	3 credits

Introduction to Microwaves-History of Microwaves, Microwave Frequency bands;Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.

Mathematical Model of Microwave Transmission-Concept of Mode, Features ofTEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

Analysis of RF and Microwave Transmission Lines- Coaxial line, Rectangularwaveguide, Circular waveguide, Strip line, Micro strip line.

Microwave Network Analysis- Equivalent voltages and currents for non-TEMlines, Network parameters for microwave circuits, Scattering Parameters.

Passive and Active Microwave Devices- Microwave passive components:Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

Microwave Design Principles-Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.

Microwave Antennas-Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas.

Microwave Measurements- Power, Frequency and impedance measurement atmicrowave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters.

Microwave Systems- Radar, Terrestrial and Satellite Communication, Radio Aidsto 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, RFMEMS for microwave components, Microwave Imaging.

Text/Reference Books:

1. R.E. Collins, Microwave Circuits, McGraw Hill
2. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house

Course Outcomes:

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

1. Understand various microwave system components their properties.

2. Appreciate that during analysis/ synthesis of microwave systems, the different mathematical treatment is required compared to general circuit analysis.
3. Design microwave systems for different practical application.

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PE-EC701B	**Satellite Communication**	**3L:0T:0P**	**3 credits**

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.

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.

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.

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

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.

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.

Text /Reference Books:

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 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.

PE-EC701C	**Mobile Communication and Networks**	**3L:0T:0P**	**3 credits**

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

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.

Capacity of flat and frequency selective channels. Antennas-Antennas for mobileterminal-monopole antennas, PIFA, base station antennas and arrays.

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

Receiver structure- Diversity receivers- selection and MRC receivers, RAKEreceiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.

MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

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:

1. Understand the working principles of the mobile communication systems.
2. Understand the relation between the user features and underlying technology.
3. Analyze mobile communication systems for improved performance

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PE-EC702A	**Adaptive Signal Processing**	**3L:0T:0P**	**3 credits**

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complexvalued The LMS algorithm (real, complex), convergence analysis, weight errorcorrelation matrix, excess mean square error and mis-adjustment

Variants of the LMS algorithm: the sign LMS family, normalized LMSalgorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. Signal space concepts - introduction to finite dimensional vectorspace theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection,orthogonal decomposition of vector spaces.

Vector space of random variables, correlation as inner product, forward andbackward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Introduction to recursive least squares (RLS), vector space formulation of RLSestimation, pseudoinverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

Text/Reference Books:

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

Course Outcomes:

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

1. Understand the non-linear control and the need and significance of changing the control parameters w.r.t. real-time situation.
2. Mathematically represent the ‘adaptability requirement’.
3. Understand the mathematical treatment for the modeling and design of the signal processing systems.

Digital Image Fundamentals-Elements of visual perception, image sensing andacquisition, image sampling and quantization, basic relationships between pixels - neighborhood, adjacency, connectivity, distance measures.

PE-EC702B	**Digital Image and Video Processing**	**3L:0T:0P**	**3 credits**

Image Enhancements and Filtering-Gray level transformations, histogramequalization and specifications, pixel-domain smoothing filters - linear and order-statistics, pixel-domain sharpening filters - first and second derivative, two-dimensional DFT and its inverse, frequency domain filters -low-pass and high-pass.

Color Image Processing-Color models-RGB, YUV, HSI; Color transformations- formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Image Segmentation- Detection of discontinuities, edge linking and boundarydetection, thresholding - global and adaptive, region-based segmentation.

Wavelets and Multi-resolution image processing- Uncertainty principles of FourierTransform, Timefrequency localization, continuous wavelet transforms, wavelet bases and multiresolution analysis, wavelets and Subband filter banks, wavelet packets.

Image Compression-Redundancy-inter-pixel and psycho-visual; Losslesscompression - predictive, entropy; Lossy compression-predictive and transform coding; Discrete Cosine Transform; Still image compression standards-JPEG and JPEG-2000.

Fundamentals of Video Coding-Inter-frame redundancy, motion estimationtechniques - fullsearch, fast search strategies, forward and backward motion prediction, frame classification - I, P and B; Video sequence hierarchy-Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards - MPEG and H.26X.

Video Segmentation-Temporal segmentation-shot boundary detection, hard-cutsand soft-cuts; spatial segmentation-motion-based; Video object detection and tracking.

Text/Reference Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004
3. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015

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Course Outcomes:

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

1. Mathematically represent the various types of images and analyze them.
2. Process these images for the enhancement of certain properties or for optimized use of the resources.
3. Develop algorithms for image compression and coding

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PE-EC702C	Neural Network and Fuzzy Logic Control	3L:0T	3 credits

Neural Networks and Pattern Association:
Differences between biological and artificial neural networks – Typical architecture – Common activation functions– McCulloch – Pitts neuron – Simple neural nets for pattern classification – Linear separability – Hebb net –Perceptron – Adaline – Madaline – Architecture – Algorithm and simple applications – Training algorithms forpattern association – Hebb rule and delta rule – Hetero associative – Auto associative and iterative auto associativenet – Bidirectional associative memory – Architecture – Algorithm – Simple applications.

Neural Netwroks based on Competition:
Kohonen self organising maps – Learning vector quantization – Counter propagation – Architecture – Algorithm and applications

Adaptive Resonance and Backpropagation Neural Networks:
ART1 and ART2 – Basic operation and algorithm – Standard back propagation architecture – Derivation of learning rules – Boltzmann machine learning – Architecture – Algorithm and simple applications

Fuzzy sets and Membership Functions:
Properties and operations on classical and fuzzy sets – Crisp and fuzzy relations – Cardinality – properties and operations – Composition – Tolerance and equivalence relations – Simple problems –Features of membership function – Standard forms and boundaries – Fuzzification – Membership value assignments – Fuzzy to crisp conversions – Lambda cuts for fuzzy sets and relations –Defuzzification methods.

Applications of Neural networks and Fuzzy logic:
Applications of neural networks – Pattern recognition – Image compression – Communication – Control systems
Applications of fuzzy logic – Fuzzy pattern recognition – Fuzzy image compression – Fuzzy logic controllers

Text Book
1. Fundamentals of Neural Networks, LaureneFausett, 2004, Pearson Education.
2. Fuzzy Logic with Engineering Applications, Timothy Ross, 1998, McGraw-Hill.

Reference Book
1. Introduction to Neural Networks Using Matlab 6.0, Sivanandam, S.N., Sumathi, S. and Deepa, S.N, 2005,TMH.
2. Fundamentals of Artificial Neural Networks, Mohammad H. Hassoun, 1st edition,2010, PHI
3. Neural Networks and Fuzzy Systems, Bark Kosko, 1st edition, PHI

Course Outcome

1. analyze and classify neural networks and its implementation algorithms.

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2. apply suitable algorithms on different cases.
3. apply fuzzy logic and neural networks.
4. analyze the applications of Neural Network and Fuzzy logic in image processing.

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PE-EC703A	**Embedded System**	**3L:0T:0P**	**3 credits**

Overview of Embedded System: Embedded System, Embedded Processor in System, Components of Embedded
System, Brief introduction to Embedded software in system, Design Process in Embedded System.

Embedded Hardware:
Processor & Memory: Brief overview of 8051 Architecture and real world interfacing, Introduction to advanced
Processor Architectures-ARM, Processor and Memory organization, Parallelism in instruction level, Processor and memory selection.

I/O Types: Serial and Parallel communication Ports, Timer and Counting devices, Watchdog timers, real time clock, Serial bus Communication Protocols- I2C, CAN, and Parallel Communication ProtocolISA.

Interrupt Service Mechanism: Concept of ISR, different interrupt sources, Interrupt handling Mechanism,
Multiple Interrupts, Interrupt Latency and deadline.

Embedded Software Development-
Software Development: Programming concept in ALP (assembly language programming) and High level
language-C, Processor directives, functions and macros and other programming elements, Embedded C++ concept only.

RTOS(Real time operating System)- OS overview, Process, Interrupt and memory management, RTOS overview,
Basic Design rule using RTOS, Task scheduling using Priority based scheduling, cyclic scheduling and round robin scheduling.

Embedded system Design using PIC microcontroller: Introduction toMicrochip PIC16 family, PIC16F873

processor architecture- features, memory organization, on chip peripherals, Watchdog timer, ADC, Data EEPROM,
Asynchronous serial port, SPI mode, I2C mode, Interfacing with LCD, ADC, sensors, stepper motor, key board, DAC.

Case study of different types of Embedded System: Design of Automated Chocolate Vending Machine, Digital Camera.

Text Book

1. Microcontrollers Theory and Application, Ajay V. Deshmukh, TMH, 2011.
2. Embedded Systems: Architecture, Programming & Design, Raj Kamal, TMH, 2011 319

Reference Book

1. Embedded System Design: A unified Hardware/ Software Introduction, by Frank Vahid, Willey, 2011.
2. Design with PIC Microcontrollers , J. B. Peatman, Pearson India,2008

PE-EC703B	**Wireless Sensor Networks**	**3L:0T**	**3 credits**

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

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

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.

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

PE-EC703C	**Wavelet Transforms**	**3L:0T**	**3 credits**

Introduction:

- Origin of wavelets and its history
- Different communities of wavelet
- Classification: continuous and discrete wavelet transforms
- Developments in wavelet theory applications

Continuous Wavelet Transform:

- Introduction
- Continuous time wavelets
- Definition of CWT
- Constant Q factor filtering interpretation and Time Frequency Resolution
- CWT as an operator
- Inverse CWT

Introduction to the Discrete Wavelet Transform and orthogonal Wavelet decomposition:

- Approximations of vectors in nested linear vector subspaces
- Multi-resolution Analysis of $L^2(R)$
- Haar Scaling function
- Haar wavelet
- Haar wavelet decomposition.
- Haar wavelet packets and application.

MRA Ortho -normal wavelets and their relationships to filter banks:

- Construction of an ortho-normal MRA
- Wavelet basis for the MRA
- Digital filtering interpretation
- Examples of orthogonal basis generating wavelets
- Interpreting ortho-normal MRA for discrete time signals
- Generating scaling functions and wavelets from filter coefficients.

Bi-orthogonal Wavelets:

- Bi-orthogonal Wavelet bases
- Filtering relationship for Bi-orthogonal filters
- Bi-orthogonal scaling functions and wavelets
- Two dimensional wavelets
- Non separable Multi-dimensional wavelet
- Wavelet Packets.

Wavelength Transform and applications:

- Transform coding
- DTWT for image compression, audio compression
- Wavelet based audio coding, video coding and multi resolution Techniques
- Wavelet de-noising, Speckle removal, Edge detection and
- object isolation
- Image fusion, Object detection, discrete wavelet multi-tone
- modulation.

Beyond Wavelet:

- Ridge lets and curve lets:Ridge let transform and Digital Curve let transform Curve let construction
- Properties and applications.

Reference Books:

1.RaguveerM.Rao and AjitS.Bopardikar-Wavelet Transforms –
Introduction and applications- Pearson Education, 2008
2.K.P Soman, K.I.Ramachandran – Insight into Wavelets from Theory to practice, PHI2006

Course Outcome:

After successfully completion of this course, students should able to –
1.Classify various wavelet transform and explain importance of it.
2.Describe Continuous Wavelet Transform (CWT) and Discrete Wavelet Transform (DWT).
3.Explain the properties and application of wavelet transform.

4.Develop and realize computationally efficient wavelet based algorithms for signal and image processing.
5.Explain brief features and strengthof transform beyond wavelet.

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OE-EC704A	**Web Technology**	**3L:0T:0P**	**3 credits**

Web Development:

HTML, Structure, Tags, Lists, Table, Link and it's types ,Images, Form, Frame, Style sheets and it's type

Introduction to Java:

Java and Java applications, Java Virtual Machine(JVM), Java Runtime Environment(JRE)Java Development Kit(JDK,) Byte code, Java characteristics, Object oriented Programming, Simple java programs, Data types, Operators, Expressions, control statements, Selection statements, Iteration statements, Jump statements **Classes, Inheritance :** Classes in java, Declaring a class, Creating instances of class, Constructors, Argument Passing, use of static keyword, Innner class. Method overloading, Inheritance, use of super keyword ,Method overriding, Abstract class, Dynamic method dispatch, use of final keyword

Interface, Package:

Package, Acesss control mechanism, Interface, Dynamic Method look up

Exception Handling:

Java Exception Handling Mechanism, try, catch, throw, throws and finally, Exception types, Built in Exceptions: checked and unchecked exceptions, User defined Exceptions

String Handling:

String and String Buffer, Constructors, String operations : character extractions, String comparisons, searching, strings, modifying a string. To String() and valueOf() methods, String Buffer operations **Java I/O Stream:**

I/O basics, Byte stream, Character stream, Reading console input, Writing console output, Reading and writing files **Java Utility package:**

Collection overview, Collection interfaces, Collection classes: ArrayList, LinkedList, Accessing a collection using, iterator and for-Each statement **Applet:**

Applet class, Applet architecture, Applet Skeleton, Life cycle methods, setForeground() and set Bachground()methods, Using the status window,HTML Applet tag, Passing parameters to an applet, GetCodebase() and Get Documentbase() methods.

Event Handling and AWT:

Delegation Event Model, Event classes, Sources of Events, Event Listener interfaces,Event handling using adapter class, Inner and anonymous class, AWT classes: Label,Button,TextField etc.

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Text Book

1. Java-The Complete Reference,Herbert Schildt, 9th Edition, McGraw Hill Education 2014

Reference Book

1. HTML- Complete Reference,Powell, 3rd Edition, TMH 2007

2. Core Java-An Integrated Approach, Dr. R.Nageswara Rao, Dreamtech 2015

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

1. design good web pages using different tags, tables, forms, frames and style sheets supported by HTML.
2. implement, compile, test and run Java programs, comprising more than one class, to address a particular software problem.
3. demonstrate the ability to employ various types of selection statements and iteration statements in a Java program.
4. be able to leverage the object-oriented features of Java language using abstract class and interface.
5. be able to handle errors in the program using exception handling techniques of Java.
6. design applets as per the requirements with event handling facility.

OE-EC704B	**Optimization Technique**	**3L:0T:0P**	**3 credits**

Introduction: Optimal problem formulation, Design variables constraints, Objective function, Variablebounds,, Engineering optimization problems, Optimization algorithms.

Single-variable Optimization Algorithm: Optimality Criteria, Bracketing methods: Exhaustive search methods, Region-Elimination methods; Interval halving method, Fibonacci search method, Point estimationmethod; Successive quadratic estimation method.

Gradient-based Methods: Newton-Raphson method, Bisection method, Secant method, Computer programmes.

Multivariable Optimization Algorithm: Optimality criteria, unidirectional search, Direct search methods: Evolutionary optimization method, Simplex search method, Hooke-Jeeves pattern search method, Cauchy's (Steepest descent) method, Newton's method, multi-objective optimization, Pareto optimization.

Constrained Optimization Algorithm: Characteristics of a constrained problem. Direct methods: The complex method, Cuttingplane method, Indirect method: Transformation Technique, Basic approach in thepenalty function method, Interior penalty function method, Convex method.

Advanced Optimization Algorithms: Genetic Algorithm (GA), working principles, GAoperators, selection methods, advanced GAs, computerprogrammes, simulated annealing. Particle swarm optimization (PSO), differential evolution (DE) algorithm, bacterial foraging algorithm, ant colony optimization algorithm.

Text Book

1. Optimization for Engineering Design-Algorithms & Examples – K. Deb, PHI, 2nd Ed., 2012.

2. Multi-objective Optimization Using EvolutionaryAlgorithms-K. Deb, John Wiley & Sons, 1st Ed., 2001.

Reference Book

1. Optimization: Theory and Applications - S.S. Rao, Wiley Eastern Ltd, 2nd Ed., 1979.

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

1. formulate fitness functions and cost functions for engineering optimization problems and specify the constraints as required.
2. implement different single variable optimization algorithms including the gradient based methods.
3. analyze and implement different multi variable optimization algorithms and a multi objective optimization techniques based on Parento-Fronts.
4. implement Bio-inspired optimization algorithms for solving complex engineering problems.

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OE-EC704C	**Entrepreneurship**	**3L:0T:0P**	**3 credits**

UNIT-I :

New Industrial Policy of 1991,Meaning and Definition of Entrepreneurship, Incentives and benefits available to SSI Units and New Entrepreneurs. Dearth of entrepreneurial talent in India, Growth of SSI in India. Procedures to startSSIs.

UNIT-II :

Market survey and research pricing and techniques, Distribution Channel, Sales promotion activities. Raising Finance and enterprise launching.

UNIT-III :

Financial Management, Working Capital Management, Costing,Book Keeping, Break-EvenAnalysis. Taxation: Income Tax, Excise duty, Sales tax and VAT.

UNIT-IV :

Decision making – Types, Forecasting-Qualitative and Quantitative methods, Personal Management, Motivation and theories of motivation. Preliminary Project Report (PPR), Detailed Project Report (DPR) writing.

Text Book

1. Entrepreneurial Development.S.S.Khanka. S.Chand, 2007.

Reference Book

1. Industrial Organisation and Engg.Economics. Sharma & Banga.Khanna Publication, 2003.
2. Entrepreneurship New Venture Creation. David H.Holt.Prentice Hall .PHI, 2013.

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

1. know the contribution of an entrepreneur and role of SSI units in growth and development of socioeconomic condition of our country.
2. learn market survey, sales promotions and management of working capital through costing and book keeping.
3. know different decision making technique and benefit of personal management system as well asmotivational methods of an enterprise.
4. learn how to prepare a project report and knowledge about different tax system of an enterprise.

EC782	**Project Stage I**	**L:0T:8P**	**4 credits**

The object of Project Work 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.