

IE-8101 INSTRUMENTATION SYSTEM DESIGN

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Credits:4

Unit I

Introduction: Concept of generalized measurement system, functional elements, generalized input-output configuration, static sensitivity, drifts, linearity, hysteresis, threshold, resolution, static stiffness and input-output impedance.

(12 Hrs)

Unit II

Transducers (Part-1): Operating principle, construction and design of variable resistive transducers, variable inductive transducers, variable capacitive transducers, piezoelectric transducers, magnetostrictive transducers, Hall effect, eddy current, ionization, optical transducers, digital transducers, single shaft encoders, photo voltaic cell, photo conductive, photo emissive, fiber optic sensors, concept of smart and intelligent sensor, bio-sensors

(12 Hrs)

Unit III

Transducers (Part-2): Construction and performance of industrially important transducer for measuring displacement, speed, vibrations, temperature, electrical power, strain, torque force, Design of intelligent instrumentation system

(12 Hrs)

Unit IV

Signal Conditioning & Recording: Quarter, half and full bridge circuit, active filters, differential instrumentation amplifiers, carrier amplifiers, design of display elements, LED, bar graph displays, LCDs , nixie tube and their interfacing

(12 Hrs)

RECOMMENDED BOOKS:

Title	Author	Publisher
Text Books		
Measurement Systems Application and Design	E.O. Doblin	McGraw Hill
Hand Book of transducer	Nortan	PHI
Reference Books		
Process and industrial instrumentation	Conside	Mc Graw Hill
Principles of Measurement Systems	Bentley	Pearson Education

IE-8102 MICROCONTROLLERS AND EMBEDDED SYSTEMS

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Credits:4

Unit I

Introduction: Microprocessor, Micro-controllers and their comparison.

(06 Hrs)

The 8051 Architecture: Introduction, 8051 micro-controller hardware, input/ output, pins, ports and circuits, external memory, counters and timers, serial data input/ output, interrupts

(06 Hrs)

Unit II

8051 Assembly Language Programming: The mechanics of programming, assembly language programming process, programming tools and techniques, instruction set (data moving, logical operations, arithmetic operations, jump and call instructions)

(12 Hrs)

Unit III

8051 Microcontroller Design: Micro-controller specification, external memory and memory space decoding, reset and clock circuits, expanding I/O, memory mapped I/O, memory address decoding, memory access times, testing the design, timing subroutines, lookup tables for the 8051, serial data transmission

(12 Hrs)

Unit IV

Microcontroller Applications: Interfacing keyboards, displays, D/A and A/D, multiple interrupts, serial data communications, introduction to the use of assemblers and simulators

(06 Hrs)

Embedded Systems: Introduction to PLDs and FPGA- architecture, technology and design issues, implementation of 8051 core

(06 Hrs)

RECOMMENDED BOOKS:

Title

Author

Publisher

Text Books

The 8051 Micro Controller- Architecture, Programming and Application

Kenneth J Ayola

Penram International
Publication

Design with Micro Controller

John B Peatman.

MC Graw Hill

Reference books

Advanced Microprocessors & Peripherals; Architecture, Programming & Interfacing

A K Ray & K M Bhurchandi,

TMH

The 8051 Micro-controller & Embedded System

M A Mazidi and J G Mazidi,

Pearson Education

IE-8103 NON LINEAR AND ADAPTIVE CONTROL

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3 1 0

Credits:4

Unit I

State Variable Analysis and Design: Review of state space representation for linear continuous system, solution of linear time invariant state equations, controllability and observability.

(12 Hrs)

Unit II

Non-Linear Control System: Introduction to non-linear feedback control system, Common physical non-linearities, special features of non-linear system, limit cycle, jump response, sub harmonics etc, stability of non-linear systems

(06 Hrs)

Describing Functions: Definition, describing function for common physical non-linearities, describing function method for stability analysis, limit cycle and limitations of describing functions

(06 Hrs)

Unit III

Phase plane analysis: Basic concepts of phase plane analysis, Phase portraits and their construction. Singular points & system analysis using phase plane technique.

(06 Hrs)

Liapunov's Stability Analysis: Concept of local, globe, asymptotic & total stability of non-linear system, Stability theorems of Liapunov for non-linear system. Liapunov's Direct method of stability, Generation of Liapunov's function by Krovoskii's & Variable gradient method. Popov; stability theorem for N.L. system

(06 Hrs)

Unit IV

Adaptive and Learning Control Systems: Basic principles of Adaptive and Learning Control Systems, Model reference adaptive control, types of learning-supervised and un-supervised leaning control systems, On-line and off-line learning control systems

(12 Hrs)

RECOMMENDED BOOKS:

Title	Author	Publisher
Text Books		
Modern Control Engineering	Ogata	PHI
Control System Engineering	Nagrath & Gopal	Wiley Eastern
Reference Books		
Control System Engineering	Norman S Nise	Wiley
Modern Control System	R C Drof, R H Bishop	Addision Wesley

IE-8104 DIGITAL SIGNAL PROCESSING

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Credits:4

Unit I

Introduction: Signals, Systems and Signal processing, Classification of Signals, Concept of frequency in continuous time and discrete time signals.

(06 Hrs)

Discrete Time Signals & Systems: Discrete time signals, Discrete time systems, Analysis of discrete time linear time-invariant systems, Discrete time systems described by difference equations, Implementation of discrete system, Correlation of discrete time signals.

(06 Hrs)

Unit II

Z-Transform: The Z-transformation, properties of Z-transformation, Rational Z-transformation, Inversion of Z-transform, Analysis of linear time invariant systems in Z-domain.

(06 Hrs)

Frequency Analysis Of Signals & Systems: Frequency analysis of continuous time signals, Frequency analysis of discrete time signals, Properties of Fourier Transform for discrete time signals, Frequency domain characteristics of linear time invariant systems, linear invariant systems as frequency selective filters, Inverse systems and de-convolution.

(06 Hrs)

Unit III

The Discrete Fourier Transform: Frequency domain sampling, Properties of DFT, Linear filtering methods based on DFT, Frequency analysis of signals using the DFT.

(12 Hrs)

Unit IV

Design Of Digital Filters: General considerations, Design of FIR filters, Design of IIR filters from analog filters, Frequency transformations, Design of digital filters based on least-square method, CAD design of IIR digital filters, CAD for FIR digital filters, CAD design using windows, Comparison of IIR & FIR filters.

(12 Hrs)

RECOMMENDED BOOKS:

Title	Author	Publisher
Text books		
Digital Signal Processing	Oppenheim & Schafer	PHI
Digital Signal Processing	Kuo	McGraw Hill
Reference Books		
Fundamentals of DSP	Proakais	PHI
Understanding Digital Signal Processing	Richard G Lyons	Pearson Education Publications

IE-8105A OPTO ELECTRONICS

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Credits:4

Unit I

Introduction: Optical fiber transmission link, Basic optical laws and definitions, various types of polarization

(06 Hrs)

Optical Sources: Review of semiconductor physics, LEDs- structures, materials, internal quantum efficiency, modulation capability, transient response & power bandwidth product

(06 Hrs)

Unit II

Laser Diodes: Types of lasers, theory of laser action in semiconductors, laser diode structures radiation pattern, modes, and single mode lasers, modulation of laser diodes & temperature effects, light source linearity, noises in laser diodes

(06 Hrs)

Power Launching and Coupling: Source to fiber power launching, source output pattern, power coupling calculation, equilibrium N.A., lensing schemes for coupling improvement optical fibre connectors

(06 Hrs)

Unit III

Photo Detectors: Physical principles of photodiodes, pin photo detectors and avalanche photo diodes, photo detector noise, detector response time, avalanche multiplication theory and noise, ADD bandwidth

(12 Hrs)

Unit IV

Optical Fiber: Fiber types, propagation of light through fiber, Ray & mode theory, Fiber materials and fiber optic cables, signal attenuation and signal distortion in optical waveguides, optimal design of single mode fibers, Step index fiber structure, Ray optics representation, wave representation, Maxwell's equation's, wave guides equations, wave equations for step index fibers, Modal equation, Modes in step index fibers, SMFs- Mode Field Dia & progal modes, Graded index fiber structure, N.A. modes in graded index fiber.

(08 Hrs)

Holography: Principle of holography, theory, requirements and applications

(04 Hrs)

RECOMMENDED BOOKS:

Title	Author	Publisher
Text Books		
Optical fibre communication systems	William B. Jones Jr.	Holt , Rinehart and Winston,
Optical electronics	A.K.Ghatak, K. Thyrgarajan	Manas Saikia foundation books
Reference Books		
Optical communication systems	John Gowar	PHI
Optical fibre communications	Gerd Keiser	Mc Graw Hill

IE-8105B INSTRUMENTATION FOR ENVIRONMENTAL ENGINEERING

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Credits:4

Unit I

Introduction: Source and classification of Air Pollution, Effect of Air Pollution in Human Health, Effect of Air Pollution on Animals, Effect of Air Pollution on Plants

(12 Hrs)

Unit II

Economic Effect and Control of Pollution: Economics Effects of Air Pollution, Control of Air Pollution by Equipment, Control of Air Pollution by Process Changes, Air Pollution from Major Industrial Operations, Air Pollution legislation and regulation, Environment Protection Act, Air Pollution in Indian cities, Water & Noise Pollution. & its control, Green House effects & its control

(12 Hrs)

Unit III

Pollution Control For Specific Pollutants: Industrial Pollution Emission and Indian Standards, Analysis of Pollutants, Control of BOD, Removal of Chromium, Removal of Mercury, Removal of Ammonia / urea, Treatment of Phenolic Effects, Removal of particular matter, Removal of Sulphur Dioxide, Removal of Oxides of Nitrogen, Removal of Vapour from Efficient case, Control of CO₂ and CO

(12 Hrs)

Unit IV

Pollution Control In Selected Process Industries: General considerations of Pollution Control in Chemical Industries, Pollution Control aspects of fertilizer industries, Pollution Control in Petroleum & Petrochemical Units, Pollution Control in Pulp & Paper Industries, Tanning Industries, Sugar Industries, Alcohol Industries, Electroplating & Metal Finishing Industries, Radioactive Wastes, Pollution Control methods used in Power Plants

(12 Hrs)

RECOMMENDED BOOKS:

Title	Author	Publisher
Text Books		
Environmental Air Pollution & its control	G.R. Chhatwal & Others	Anmol Publication
Pollution Control in Process Industries	S P Mahayar	McGraw Hill
Reference Books		
Environmental Water Pollution & its control	G R Chhatwal, M.C. Mehra	Anmol Publication
Air Pollution	H V Rao	McGraw Hill

Unit I

Introduction: Basics of physical methods of chemical analysis, Spectral method of analysis, basic techniques, terminology, units, interaction of emf radiation with matter, emission, absorption and scattering, various light sources, design consideration of analytic laboratory (12 Hrs)

Unit II

Spectrophotometers: Visible, UV and IR type of spectrophotometer, Atomic Absorption, Mass spectrometer, NMR and X-ray and related instrumentation, comparison of various spectral analysis techniques, data processing techniques and various detectors for these instruments (12 Hrs)

Unit III

Chromatography: Basics of Chromatography, various types of chromatography and their related instrumentation, liquid chromatography & HPLC (12 Hrs)

Unit IV

Electron Microscopy: Introduction to electron microscopy- SEM and TEM type of electron microscope, Difference between light microscopy, SEM and TEM (06 Hrs)

Data Presentation & Analysis: Analytical data presentation, Error analysis (06 Hrs)

RECOMMENDED BOOKS**Title****Author****Publisher****Text Books**

Handbook of analytical instruments
Instrumental methods of analysis

R.S. Khandpur
H.H.Willaird, Lynnel
Merrikt Jr., John A.
Dean, F.A. Settle Jr

Tata McGraw Hill
Wadsworth
Publishing Company

Reference Books

Introduction to instrumental analysis
Instrumental method of chemical
analysis

Robert D. Brawn
Galen W. E.wing,

McGraw Hill Co
McGraw Hill

Unit I

Introduction: Resources and development of power in India, various types of power plants, present energy scenarios in India

(06 Hrs)

Hydro-Power Plant: Hydrology, site selection of site for hydroelectric power plant, essential features/elements of hydroelectric power plant, classification, hydro turbines, governing of hydroelectric turbines

(06 Hrs)

Unit II

Steam power plant: Classification, fuel handling, combustion equipments for steam boilers, classification of boilers and their accessories, ash handling, steam turbines, classification, advantages, steam turbine governing and control, feed water treatment for steam power plant

(12 Hrs)

Unit III

Nuclear Power Plant: Element and layout of Nuclear power plant, Generation of Nuclear energy by fission, Nuclear reactor, Types and the applications, Nuclear waste and its disposal

(12 Hrs)

Unit IV

Plant Instrumentation: Significance of measurement and Instrumentation in Electric power plant, Measurement of water purity, Gas Analysis, Oxygen and Carbon dioxide Measurement of Smoke and Dust, Nuclear Measurements

(12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Power Plant Engineering	Varma	Metroplitan Publication
Power Plant Engineering	R.K Rajput	Laxmi Publishers
Reference Books		
Nuclear Power	Loftness D Van Nostrand	McGraw Hill
Nuclear power plant System and Equipment	Lish	Industrial press

Unit I

Introduction: Various Sources of Energy, Conventional and non- Conventional energy, Concept and Classification of Renewable energy, Concept of Energy Conservation and Energy Management, Present Energy Scenario in India (Conventional and non-Conventional energy)

(12 Hrs)

Unit II

Renewable Energy Sources: Potential and Utilization status of Renewable Energy in India, Solar Energy: Solar Water Heater Systems, Solar Air dryer Systems, Solar Photo-voltaic Systems, Solar Cookers and Solar ponds, Wind Energy: Selection Criteria for Wind farms, Wind Mills, Bio Gas Plants-Construction and Operation, Bio Mass Gasification, Bio Mass Briquetting; Mini and Micro Hydel Power Plants, Geo-Thermal Energy, Ocean Energy

(12 Hrs)

Unit III

Energy Conservation and Management (Unit-I): Actual energy requirement assessment techniques of any industry and energy consumption status, possibility of reduction of energy consumption by using various energy conservation techniques or equipments e.g. variable speed drives, constant voltage transformers, electronic chokes, CFLs etc.

(12 Hrs)

Unit IV

Energy Conservation and Management (Unit-II): Importance of instrumentation and control techniques in the energy conservation and management, SCADA systems, Instruments required to carry out energy audit exercise, optimal mixing of renewable energy sources and load rationalization for reducing load on conventional energy sources

(12 Hrs)

RECOMMENDED BOOKS:

Title	Author	Publisher
Text Books		
Solar Energy & Energy Conservation	Sawhney & Maheshwari	PHI
Energy Technology	S Rao & B. B. Parulkar	Khanna Publishers
Reference Books		
Solar Energy	S. P. Sukhatme	TMH
Hand Book of Industrial Energy Conservation	S David	Van Nostrand Reinhold Publishing Company

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Credits:4

Unit I

Introduction: Basic Concepts of analog and digital signals, data transmission concepts, Analog and digital transmission, transmission impairments

(06 Hrs)

Transmission Media: Guided and Un-guided media, Performance, Shannon Capacity, Media Computerization

(06 Hrs)

Unit II

Encoding and Modulating: Digital –to-Digital conversion, Analog and digital conversion, Digital to Analog conversion, Analog to Analog conversion

(06 Hrs)

Digital Data Communication: Digital data transmission, DTE-DCE Interface, EIA-449, EIA-530, X.21, Modems, Cable Modems

(06 Hrs)

Unit III

Multiplexing And Switching: FDM, WDM, TD, Multiplexing application- telephone systems, DSL, Par Circuit switching , Packet Switching & Message switching virtual circuits

(06 Hrs)

Spread Spectrum: Concept, Frequency hoping spread spectrum, direct sequence spread spectrum, code division Multiple Access

(06 Hrs)

Unit IV

Error Detection and Correction: Types of Errors, Detection, VRC, LRC, CRC, Checksum, Error Correction

(06 Hrs)

Protocol Architecture: Protocols, Standards, OSI, TCP/IP Protocol Architecture

(06 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Data Communication and Distributed Networks	Ulylers D Balck	PHI
Computer Networks	Andrew S. Teanebaum	PHI
Reference Books		
Data and Computer Communication	William Stallings	Pearson Education
Data Communications and Networking	Behrouz A Ferouzan-	TMH

IE-8105G COMPUTERS IN BIOMEDICAL ENGINEERING

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Credits:4

Unit I

Computer In Data Collection: Introduction, Basic Building Blocks of Data Acquisition Systems, Use of Computers in Physiological Data Acquisition, Off –Line Data Collection, Data Collection Techniques, Patient Data Base, computerized Medical Records (12 Hrs)

Unit II

Hospital Data Management: Hospital Information System, Functional capabilities of Computerized Hospital Information System, Efficiency, Security and Cost Effectiveness of Computer Records, Computerized Patient Data Management (12 Hrs)

Unit III

Bio-Signal Analysis: Computerized Electrocardiography, Holter Electro-cardiography, Electromyography, Electroencephalography and Echocardiography, Computer Analysis of Non-Electrical Signals, Computer Aided Medical Decision Making (06 Hrs)

Medical Imaging: Introduction to Medical Imaging, Computers in Medical Imaging, Computerized Ultrasonography, X-Rays, Computerized Tomography, Computerized Emission Tomography (06 Hrs)

Unit IV

Aids for Handicapped: Computer aids for blind and visually handicapped and deaf (06 Hrs)

Medical Research: Computers in simulation, modeling and analysis of bio-systems, On-line Interactive systems with patients for analysis and research, introduction to expert system (06 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Handbook of Biomedical Instrumentation	R S Khandpur	TMH
Biomedical Engineering Handbook	Joseph P Bronzino	CRC Press
Reference Books		
Design Engineering of Biomaterials for Medical Devices	David Hill	Wiley International
Biomedical Signal Processing	Metin Akay	Academic Press

IE-8201 OPTIMAL AND ROBUST CONTROL SYSTEM

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Credits:4

Unit I

Introduction and Parametric Optimization: Introduction to optimal control problems, Classification of optimal control problems, performance indices for optimal control and their selection, Dynamic optimization using.

(06 Hrs)

Calculus of variations: Lagrange multiplier, Euler Lagrange's equation for different conditions, Transversality conditions, Dynamic optimization with equality and inequality constraints

(06 Hrs)

Unit II

Pontryegans Max/min Principle: Optimization using Pontryegans maximum (minimum) principles with special emphasis on Bang-Bang type system

(06 Hrs)

Dynamic Programming in Continuous Time: Developments of Hamilton Jacobi equation, Matrix Riccati equation, Optimal control based on quadratic performance indices, Linear regulator and servomechanism problem

(06 Hrs)

Unit III

Dynamic programming in Discrete System: Dynamic programming multi stage decision processes in continuous time. Principle of causality, Invariant inbedding & optimality

(06 Hrs)

Iterative Method of Optimization: Optimization using gradient methods and interactive techniques (steepest descent), Newton Raphson and Fletcher Powell. Introduction to multivariable system and decoupling, Introduction to Optimal Filters (Kalman Filter)

(06 Hrs)

Unit IV

Robust Control System: Introduction, Robust Control System and System sensitivity, Analysis of Robustness, system with uncertain parameters, the design of robust control system, PID controllers, the design of robust PID controlled systems, design examples

(12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Modern Control System Theory	M Gopal	Wiley Eastern
Modern Control Systems 8 th Ed	Richard C Drof & R H Bishop	Addision Wesley
Reference Books		
Optimum Systems COntrol	Andrew P Sage & C C White-III	PHI
Optimum System Control	B D O Anderson & B Moree	PHI

IE-8202 TELEMETRY AND REMOTE CONTROL

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Credits:4

Unit I

Introduction: Introduction, classification and importance of telemetry, remote control, remote signaling, messages & signals, signal formation, conversion & transmission (12 Hrs)

Unit II

Signal Transmission Techniques: Analog, pulse, digital modulation, amplitude modulation, AM transmitters and receivers, frequency modulation, FM transmitters & receivers, phase modulation, pulse modulation techniques, digital transmission techniques, error detecting & correcting codes (12 Hrs)

Unit III

Signal Transmission Media: Wires & cables, power line carrier communication, terrestrial & satellite radio links, optical fiber communication, multiplexing- TDM, FDM & WDM (06 Hrs)

Remote Control & Remote Signaling: Principle of independent messages and combinational principle, multi-wire, FDM & TDM scheme (06 Hrs)

Unit IV

Supervisory Control & Data Acquisition: Layout, functions & operation of SCADA system, remote terminal unit details, control center details, communication between control centers, communication between control center & remote terminal units, introduction to internet based telemetry (12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text books		
Telemetry Principle	D Patronabis	TMH
Handbook of telemetry & Remote Control	Elliot L Gruenberg	McGraw Hill
Reference books		
Fundamentals of automation & remote control	Ginzberg, Lekhtman & Malov	Mir Publishers
Power System Control Technology	Tersen Legrell	PHI

IE-8203 INDUSTRIAL PROCESS CONTROL

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3 1 0

Credits:4

Unit I

Description And Modeling Of Various Industrial Processes: Model Classification, Mathematical Models, Physical Models, Analog Models, Estimation of Model Parameters, System Identification, Experimental Nature of Simulation, Steps Involved in Simulation Studies, Validation of Simulation Models, Computer Simulation of Continuous and Discrete Systems, Examples

(12 Hrs)

Unit II

Process Control: Types and Description of Processes, Blending, batch processes, compressor & chiller controls, distillation control, steam turbine & water treatment controls, boiler controls, reactor controls

(12 Hrs)

Unit III

Conventional Controllers: On-off Controllers, Cascade and Feed forward Controllers, Split Range Controllers, ratio controls, Single loop, multi loop & self tuning controllers, set point control (SPC), discrete digital control (DDC)

(12 Hrs)

Unit IV

Intelligent Controllers: Fuzzy logic control, programmable logic controllers, PC based system, conventional and widows NT based DCS systems, artificial intelligence & neural networks, smart & intelligent transmitters

(12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Industrial Process Instrumentation and control	Padmanabhan	Springer Publishing
Applied Instrumentation in the Process Industries	W.G. Andrew & Williams	H.B. Gulf Publishing, Houston
Reference books		
Instrumentation Reference Book	B.E. Nolting	Elsevier India Pvt ,New Delhi
Instrument Engineer's Handbook (Process Control)	B.G. Liptak	Elsevier India Pvt ,New Delhi

IE-8204 BIOMEDICAL INSTRUMENTATION AND TELEMEDICINE

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Credits:4

Unit I

Human Body Subsystems: Brief description of neuronal, muscular, cardiovascular and respiratory systems, their electrical, mechanical and chemical activities (04 Hrs)

Biomedical Sensors: Principles and classification of transducers for biomedical applications, electrode theory, different types of electrodes, selection criteria for transducer and electrodes (04 Hrs)

Electrical Activity of Heart: Cardiac system, bipolar and unipolar lead system, Einthoven triangle, electrodes, electrocardiogram-normal and abnormal, exercise ECG lead positioning, electrode positioning for Holter ECG recording, vector cardiography, inverse cardiography, signal conditioning and processing (04 Hrs)

Unit II

Electrical Activity Of Neuromuscular System: Muscular system, electrical signals of motor unit and gross muscle, human motor coordination system, electrodes, correlation of force and work, EMG integrators, signal conditioning and processing (06 Hrs)

Electrical Activity of Brain: Sources of brain potentials, generation of signals, component waves, EEG recording electrodes, 10-20 electrode system, EEG under normal, grand mal and Petit mal seizures, signals conditioning and processing (06 Hrs)

Unit III

Electrical Signals From Visual System: Sources of electrical signals in eye, generation of signals, electro-retinogram, electro-oculogram (06 Hrs)

Noise And Interference In Bioelectrical Signals: Sources on noise in bioelectrical signals recordings, filtering techniques-active and passive filters, digital filtering, grounding and shielding (06 Hrs)

Unit IV

Introduction to Telemedicine: Telemedicine System's classification, input and output peripherals, Characteristic of available transmission media, introduction to communication system for telemedicine. Medical image format standards, introduction to DICOM and PACs technologies various image compression techniques, loss less and lossy image compression for biomedical application. Telemedicine and law, confidentiality of telemedicine records, security in medical methods (12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Design of microprocessor based medical instrumentation	W. T. Webster, J. G. Tompkins	Englewood Cliffs
Handbook of Biomedical Instrumentation	R. S Khandpur	TMH
Reference Books		
Biomedical Transducers and Instruments	Tatsuo, Togato & Toshiya	CRC Press
The Biomedical Engineering Hand Book	Joseph P Bronzino	CRC Press

IE-8205A INDUSTRIAL ELECTRONICS

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Credits:4

Unit I

Introduction: Review of semiconductor power devices (Power diodes, Power Transistors, MOSFETS, IGBT, SCR, GTO, MCT, DIAC, TRIAC, PUT, SUS, SCS), Review of choppers, converters, inverters, cyclo-converters

(12 Hrs)

Unit II

Closed Loop Control Of Dc Drives: Single Quadrant variable speed drives; Four Quadrant variable speed drives, Armature voltage control at constant field, field weakening, details of various blocks of closed loop drives; drive employing armature reversal by a contactor, drive employing a dual converter with non- simultaneous and simultaneous control

(12 Hrs)

Unit III

Frequency Controlled Induction Motor Drives: Control of IM by VSI-3 phase VSI, six step inverter voltage control, PWM inverter, braking and multiquadrant control, VSI variable frequency drives; control of IM by CSI- 3 phase CSI, current sources, Braking, PWM in a thyristor CSI, PWM GTO CSI, CSI variable frequency drives

(12 Hrs)

Unit IV

Self -Controlled Synchronous Motor Drives: Self control, brushless & commutator-less, DC & AC motors synchronous motor control-operation of a wound field and permanent magnet synchronous motor from a variable frequency current source; source, permanent magnet, operation of a permanent magnet motor at the maximum torque to armature current ratio and at the maximum torque to flux ratio; operation of self controlled synchronous motor drives- CSI drives, VSI drives, cyclo-converters drives, brush-less and commutator-less AC & DC motor drives and their applications

(12 Hrs)

RECOMMENDED BOOKS

Title

Author

Publisher

Text Books

Power semiconductor drives
Industrial Electronics

G.K.Dubey
Morris

Prentice Hall Inc
McGraw-Hill

Reference Books

Industrial Electronics
Power Electronics

Frank D. Petruzella
P C Sen

Mc Graw- Hill
TMH

Unit I

Introduction: Basic concepts, Robot anatomy, Robot configurations, Basic Robot motions, Types of drives, manipulator end effectors, controller, power unit

(06 Hrs)

Transformations and Kinematics: Vector operations, Translational transformations and Rotational transformations, Properties of transformation matrices, Homogeneous transformations and Manipulator, Forward solution, Inverse solution

(06 Hrs)

Unit II

Sensory Devices: Non optical and optical position sensors, Range, Proximity, touch, slip, Machine vision, Image components, Representation, Hardware, picture coding, object recognition and categorization, soft ware consideration

(12 Hrs)

Unit III

Controls and End Effectors: Control system concepts, Analysis, control of joints, adaptive and optimal control, End effectors, classification, Mechanical, Magnetic, Vacuum, Adhesive, Drive systems, Force analysis and gripper design

(12 Hrs)

Unit IV

Robot Programming: Methods, Languages, types of programming, Robotic programming languages

(06 Hrs)

Robot Applications: Applications of robotics in material handling, machine loading and unloading, processing applications, welding and painting assembly and inspection, future robotic applications and related technologies developments

(06 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Robot engineering an integrated approach	R D Klafter T A Cmielewski and M Negin	Prentice hall of India
Robotics for Engineering	Yorem Korem	Mc Graw Hill
Reference Books		
Industrial Robotics	Groover,W Nagel & Odrey	Mc Graw Hill
Introduction to robotics mechanics & control	J Craigj	Addison Wesley

IE-8205C COMPUTATIONAL ELECTROMAGNETICS

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Credits:4

Unit I

Introduction: Conventional design methodology, Computer aided design aspects – Advantages

(04 Hrs)

Electromagnetic and Electrostatics: Basic field equations, calculation of field distribution, flux linkage, Voltage induced, inductance, capacitance, and force/torque. Electric and magnetic potentials, boundary conditions, Maxwell's equations, diffusion equation

(08 Hrs)

Unit II

CAD packages: Recent developments, processing, modeling, material characteristics, problem formulation, solution, post processing, commercial packages

(06 Hrs)

Finite Difference Analysis-FDM: Finite Difference Method (FDM): Finite Difference schemes, treatment of irregular boundaries, accuracy and stability of FD solutions, Finite-Difference Time-Domain (FDTD) method

(06 Hrs)

Unit III

Finite Element Analysis-FEM: Finite Element Method (FEM): overview of FEM, Variational and Galerkin Methods, shape functions, lower and higher order elements, vector elements, 2D and 3D finite elements, efficient finite element computations

(12 Hrs)

Unit IV

Special Topics: hybrid methods, coupled circuit - field computations, electromagnetic - thermal and electromagnetic - structural coupled computations, solution of equations

(06 Hrs)

Applications: Applications: low frequency electrical devices, static / time-harmonic / transient problems in transformers, rotating machines, actuators

(06 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
The Finite Element method in electromagnetics	J. Jin	John Wiley & sons
Finite Elements in Electric and Magnetic field Problems	M.V.K. Chari, P.P. Silvester	John Wiley
Reference Books		
Computer Aided Design in Magnetics Springer	D.A. Lowther & P.P. Silvester	Verlog New York
Finite Element for Electrical Engineers	P.P. Silvester & Ferrari	Cambridge University Press

IE-8205D OPTIMIZATION TECHNIQUES

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Credits:4

Unit I

Optimization Problem: Definition, types, optimality criteria, single-variable optimization, exhaustive search, region elimination, fibonacci search and golden section search, cubic interpolation method, Newton-Raphson bisection and secant method

(12 Hrs)

Unit II

Multivariable Optimization Algorithms: Direct search methods-evolutionary simplex, Hooke-Jeeves pattern search, Gradient Based Method- Steepest method, Newton conjugate gradient method

(12 Hrs)

Unit III

Constrained Optimization: Kuhn Tucker condition, transformation methods, penalty function, method of multipliers, sensitivity analysis, interior point optimization

(12 Hrs)

Unit IV

Non-Traditional Optimization: Genetic Algorithms for constrained optimization, simulated annealing, Multi Objectives Optimization Problems, weighting method, ϵ -constrained method, decision-making, min-max problem

(12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Optimization for Engineering Design Algorithms and Examples	Kalyanmoy Deb	PHI
Multi Objective Optimization using Evolutionary Algorithms	Kalyanmoy Deb, Chichester, UK,	Wiley
Reference Books		
Emerging Optimization Techniques in Production Planning & Control	Godfrey G Onubolu	Imperial College Press
Modern Optimization Techniques in Power Systems	Yong Hua Song, Kluwer	Academic Publishers

IE-8205E CONTROL SYSTEM DESIGN

L T P
3 1 0

Credits:4

Unit I

Introduction: Control System Architecture, Design Specifications Functional in-equally specifications, multi-criteria optimization, norms of scalar & vector signals, norms of SISO LTI & MIMO LTI systems, state space methods for computing norms, design specifications as sets, affine & convex sets and functions, closed loop convex design specifications, convexity & duality

(12 Hrs)

Unit II

Design Specifications: Reliability & closed loop stability, I/O specifications, regulation specifications, actuator effort, combined effect of disturbances & commands, differential sensitivity specifications, robustness specifications via gain bounds

(12 Hrs)

Unit III

Compensators & Controllers Design: Selection criteria and design of lead, lag, lead-lag and cascade type of compensators using Root locus & Bode plots, Rate feedback. Controllers – configuration and fundamentals of design, cascade and feed back compensation using various controllers

(12 Hrs)

Unit IV

State Variable Feed Back Design: Introduction to state variable analysis, controllability and observability, state feed back for SISO system, state feed back design of SISO system using control canonical form. State variable feedback _ steady state error analysis, Use of steady state error coefficients, design of state observers, Introduction to design of MIMO systems. Introduction to design of non-linear system and software

(12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Linear control analysis & design	By John J. D'azzo & C. H. Houpis	Mc-graw Hill
Control Systems – Principle & Design	M. Gopal	TMH publication
Reference Books		
Linear controller designs – limits of performance	Stephen P. Boyd & Craig H. Barratt	Prentice Hall International
Modern Control Systems – A manual of design methods	John A. Borrie	Prentice Hall International

IE-8205F NEURO FUZZY CONTROL

L T P
3 1 0

Credits:4

Unit I

Introduction: Expert systems, fuzzy sets and control theory; representation, reasoning and acquisition; inference engines and functions approximator, model based and training based fuzzy control; neural networks and fuzzy systems; fuzzy-neural control: ideas & para-diagrams

(12 Hrs)

Unit II

Approximate Reasoning Approach: Introduction, Reasoning models, rule aggregation and operator selection, reasoning with uncertain data and rules, architecture of multivariable fuzzy control

(12 Hrs)

Unit III

Rule Base Construction By Self- Learning: Description of system structure, proposed learning algorithm, convergence analysis, error and derivative correction, fuzzy control algorithm, extracting rules from recorded data

(12 Hrs)

Unit IV

Fuzzy Controller With Self Learning Teacher: Formulation of the problem, solution using neural networks (BNN network, isomorphic mapping of functionality), BNN based fuzzy controller, learning & rules extracting, hybrid neural network, system structure, dynamical self organizing, adaptive mechanisms, simplified fuzzy control algorithms, representation and reasoning by CPN, self construction of rule base, description of the CMAC and RBF, connecting the CMAC and RBF to the SFCA, self construction of the fuzzified network based controller

(12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Introduction to Neural Systems	J.M.Zurada	Jaico Publishers
Neural Networks and Fuzzy Logic	Dr. V.B.Rao and Sh. H.V. Rao	BPB Publications
Reference Books		
Fuzzy- Neural Control: Principles, algorithms and Applications	Junhong Nie and Deret Linkens	PHI
C++ Neural Network and fuzzy logic	Rao & Rao	M&T books

IE-8205G ADVANCED MICROPROCESSOR BASED SYSTEMS

L T P
3 1 0

Credits:4

Unit I

Architecture of Microprocessor: Introduction to evolution of microprocessors, 8086 architecture; block diagram and pin configuration, comparison of 80186, 80286, 80386, 80486 and Pentium; architecture based

(12 Hrs)

Unit II

Programming of 8086 Microprocessor: Assembly language programming of 8086 microprocessor, addressing techniques, subroutines, macros, co-routines, functions

(12 Hrs)

Unit III

Interfacing of 8086 Microprocessor: Interfacing with general purpose peripheral devices; 8255, 8253, 8259, 8279 and memory Disk controller, CRT controller and printer controller

(12 Hrs)

Unit IV

Applications of 8086 Microprocessor: Applications: stepper motor control, traffic control, DAS

(12 Hrs)

RECOMMENDED BOOKS

Title

Author

Publisher

Text Books

Microprocessors and Interfacing, Programming and Hardware

Douglas V Hall

McGraw Hill

Advanced microprocessor and peripherals, architecture, programming and interfacing

A K Ray & K M Bharchandi,

TMH

Reference Books

The Intel Microprocessor 8086, 80186, 80286, 80386, 80486, Pentium: architecture, programming & interfacing

Berry Brey

PHI

Windows Assembly Language & Systems Programming: 16- And 32-Bit Low-Level Programming for the PC and Windows

Barry Kauler

CMP Books

IE-9101 VIRTUAL INSTRUMENTATION AND DATA ACQUISITION

L T P
3 1 0

Credits:4

Unit I

Introduction: Virtual Instrumentation — Definition, flexibility — Block diagram and Architecture of Virtual Instruments — Virtual Instruments versus Traditional Instruments — Review of LABVIEW software in virtual Instrumentation and programming techniques
(12 Hrs)

Unit II

Data Acquisition In Virtual Instrumentation: A/D, D/A converters, plug-in Analog input/output cards - Digital Input/Output cards, Organization of the DAQ VI system - Opto isolation - Performing analog input and analog output - Scanning multiple analog channels - Issues involved in selection of data acquisition cards - Data acquisition modules with serial communication
(12 Hrs)

Unit III

Communication Networked Modules: Introduction to PC Busses — Local busses: ISA — PCI — RS232 — RS422 — RS485 — Interface Busses — USB, PCMCIA, VXI ,SCXI , PXI. - Instrumentation Busses : Modbus — GPIB - Networked busses — ISO/OSI Reference model, Ethernet — TCP/IP protocols
(12 Hrs)

Unit IV

Real Time Control In Virtual Instrumentation and Applications: Design of ON/OFF controller, simulation of industrial instruments and systems, VI functions and objects including signal processing and analysis. Typical instruments and systems -digital storage oscilloscope, spectrum analyzer, waveform generator, Data visualization from multiple locations; Distributed monitoring and control devices
(12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Labview for everyone	L K Wells & J Travis,	Prentice Hall
PC interfacing for data acquisition and process control	S. Gupta and J.P. Gupta	ISA
Reference Books		
Labview — Applications and solutions	Rahman Jamal and Herbert Picklik	National Instruments Release
Labview Graphical programming	Gary Jhonson	Mc Graw Hill

IE-9102A**BIO-INFORMATICS****L T P**
3 1 0**Credits:4****Unit I****Bioinformatics:** Data mining - similarity measures (Eudedean, Mahalonobis etc.), Dissimilarity index - hierarchical & non-hierarchical elements, cluster analysis

(12 Hrs)

Unit II**Classification of data bases:** Bibliographic, numeric and structure 2D 3D), Biotechnology, Esbiobase, D-gene, SQL - Representation of a data record by relational, frame, hierarchical and object modes, Searching of database - Natural language query-keywords - search strategies - Boolean, Hands on experience on current content abstract database

(12 Hrs)

Unit III**Molecular modeling (Unit-I):** 2D structure, entry to 2D to 3D conversion, methods Of Structure representation - Cartesian coordinates - internal coordinates, Z-matrix - Dummy atom - ignoring connection

(12 Hrs)

Unit IV**Molecular modeling (Unit-II):** Z-matrix for H₂O, Glucine, methyl cyanide, ATP are to be practiced, Geometry optimization molecular mechanics. Genomics and proteomics

(12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Bioinformatics methods and protocols	Stephen Misener, S.A. Krawez	Humana Press
Molecular modeling basic principles and applications	Hans-Dieter Holtfe and Gerd Folkers	Humana Press
Reference Books		
Practical Biochemistry	Keith Willson & J. Walker	Cambridge University Press
Bioinformatics Technologies	Yi-Ping Phoebe Chen	Springer

Unit I

Introduction to Motor Drives: Components of Power Electronic Drives - Criteria for selection of Drive components - Match between the motor and the load - Thermal consideration - Match between the motor and the Power Electronics converter - Characteristics of mechanical systems - stability criteria

(12 Hrs)

Unit II

D.C Motor Drives: System model motor rating - Motor-mechanism dynamics - Drive transfer function - Effect of armature current waveform - Torque pulsations - Adjustable speed dc drives - Chopper fed and 1-phase converter fed drives - Effect of field weakening

(12 Hrs)

Unit III

Induction Motor Drives: Basic Principle of operation of 3 phase motor, Equivalent circuit - MMF space harmonics due to fundamental current, Fundamental spatial MMF distributions due to time harmonics. Simultaneous effect of time and space harmonics - Speed control by varying stator frequency and voltage - Impact of non-sinusoidal excitation on induction motors - Variable frequency converter classifications - Variable frequency PWM-VSI drives, Variable frequency square wave VSI drives - Variable frequency CSI drives. Comparison of variable frequency drives - Line frequency variable voltage drives - Soft start of induction motors - Speed control by static slip power recovery. Vector control of 3 phase squirrel cage motors - Principle of operation of vector control

(12 Hrs)

Unit IV

Synchronous Motor Drives: Introduction - Basic principles of synchronous motor operation methods of control - operation with field weakening - load commutated inverter drives

(12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Power Electronics	Ned Mohan	Wiley
Power Electronics Drives	Dubey	Wiley Eastern
Reference Books		
Power Electronics & Control of Motor	W.Shepherd, L N Hulley	Cambridge University Press
Power Electronics & Drives	G.K.Dubey & C.R.Kasaravada	TMH

IE-9102C

RANDOM SIGNALS AND STOCHASTIC PROCESSES

L T P
3 1 0

Credits:4

Unit I

Introduction: Probability and induction, causality vs. randomness, set theory, probability space, conditional probability, combined experiments, Bernoulli trials, Bernoulli's theorem
(06 Hrs)

Random variables: Distribution and density functions, specific random variables, conditional distributions, function of random variable $g(x)$, distribution of $g(x)$, mean and variance, moments, characteristics functions
(06 Hrs)

Unit II

Two random variables: Bivariate distributions, one function of two random variables, two functions of two random variables, joint moments, joint characteristics functions, conditional distributions, conditional expected values
(06 Hrs)

Sequences of random variables: Introduction, conditional densities, characteristics functions and normality, mean square estimation, stochastic convergence and limit theorems, random numbers (meaning and generation)
(06 Hrs)

Unit III

Stochastic processes: Definitions, systems with stochastic inputs, power spectrum, discrete time processes, random walks, Poisson points and shot noise, modulation, cyclostationary processes, bandlimited processes and sampling theory, deterministic signals in noise, bispectra and system identification
(12 Hrs)

Unit IV

Spectrum estimation: Factorizations and innovations, finite order systems and state variables, Fourier series and Karhunen-Loeve expansions, spectral representation of random processes, ergodicity, spectrum estimation, extrapolation and system identification, general class of extrapolation spectra and Youla's parameterization
(08 Hrs)

Mean square estimation: Introduction, prediction, filtering and prediction, Kalman filters
(04 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Probability, random variables and stochastic processes	A. Papoulis, S. U. Pillai	TMH
Statistical digital Signal Processing and modeling	M.H.Hayes	John Wiley & Sons
Reference Books		
Probability and Random Processes with applications to signal processing	H.Stark and John W.Woods	Pearson Education
Random Signal: Detection ,Estimation and Data Analysis	K.Sam Shanmugan	John Wiley & Sons

IE-9102D

SYSTEM IDENTIFICATION AND PARAMETER ESTIMATION

**L T P
3 1 0**

Credits:4

Unit I

Principles of Modelling and Transfer function identification: System Identification and Stochastic Modeling- Structure and parameter estimation, Properties of estimates - validation of models-impulse Response. Step Response. Frequency response- transfer function from these.- disturbances and transfer function, State Space Models- Distributed parameter models- model structures, Identifiability of model structures. Signal spectra, Signal realization and ergodicity. Multivariable systems, Transfer functions from frequency response, Fourier Analysis and Spectral analysis- Estimating Disturbance Spectrum, Correlation Identification, Practical Implementation, Pseudo random binary signals, Maximum length sequences, Generation using hardware, random number generation on digital computer

(12 Hrs)

Unit II

Parameter Estimation Methods: Guiding principles behind parameter estimation methods, Minimizing prediction errors, Linear regression and least squares methods, Statistical framework for parameter estimation, Maximum likelihood estimation, Correlating prediction errors with past data, Instrumental variable method, Consistency and identifiability- Recursive methods, RLS Algorithm, Recursive IV Method- Recursive Prediction Error Method, Recursive pseudo-linear regressions, choice of updating step

(12 Hrs)

Unit III

Identification of Multivariable Systems and Closed Loop Systems: Transfer function matrix representation of MVS- state space method input output difference equation method - canonical models for MVS, Comparison of different models, Identification of continuous MV systems from input output data, Identification of closed loop systems, Reduction of higher order systems, Aggregation method, Aggregation with partial realization, Singular perturbation method, Optimum approximation, comparison of different methods of model reduction

(12 Hrs)

Unit IV

Experiment Design and Choice of Identification Criterion: Optimal Input design, Persistently exciting condition, Optimal input design for higher order black box models, Choice of sampling interval and pre-sampling filters, Choices of Identification criterion, Choice of norm, variance: optimal instruments

(12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Linear Estimation	Thomas Kailath	PH
Parameter Estimation	Harold W Sorensen	Marcel Dekker Inc
Reference Books		
Identification of Systems	Daniel Graupe	Van Nostrand
System Identification Theory for the User	Lennart Ljung	Prentice Hall Information Systems Science Series

Unit I

Reliability Fundamentals: Introduction, Importance of reliability, Reliability functions, Failure and Failure Modes, causes of failure, Instantaneous failure rate, General reliability Function

(06 Hrs)

Component Reliability and Hazard Model: Component reliability from Test data, failure data (Failure density, failure rate, reliability, probability of failure) mean failure rate MTTF, MTBF. Hazard Models (Time dependent Hazard models, Constant Hazard model, Linear Hazard model, on-linear hazard model)

(06 Hrs)

Unit II

System Reliability: Reliability evaluation of non-maintained systems, series, parallel, series- parallel, non-series, standby configuration, k out of n configuration, complex system, Markov's Method, Fault tree technique, Event space, path Tracing methods, cut-set and tie set method

(12 Hrs)

Unit III

Reliability Improvement: Introduction, Improvement of components, redundancy: standby with perfect and imperfect switching .Comparison of component redundancy to system/unit redundancy, mixed redundancy, stand by redundancy

(06 Hrs)

Reliability Allocation: Introduction, Redundancy allocation and techniques for reliability allocation

(06 Hrs)

Unit IV

Availability and Maintainability: Concepts of reliability ,availability and maintainability, types of availability, objectives of maintenance, classification and factor effecting maintenance, maintenance levels, Inventory control of spare parts, Preventive maintenance of some electrical appliances

(12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Reliability Engineering	L.S. Srinath	Affiliated East –West Press
Reliability Engineering	E. Balagurusamy	Tata McGraw Hill
Reference Books		
Reliability Evaluation of Engg. Systems: Concepts & Techniques	R. Billinton & Ronald N. Allan	Plenum Press
Reliability Engineering	K K Aggarwal	Academic Press

Unit I

Artificial Intelligence: History and Applications, Production Systems, Structures and Strategies for state space search- Data driven and goal driven search, Depth First and Breadth First Search, DFS with Iterative Deepening, Heuristic Search- Best First Search, A* Algorithm, AO* Algorithm, Constraint Satisfaction, Using heuristics in games- Minmax Search, Alpha Beta Procedure

(12 Hrs)

Unit II

Knowledge representation: Propositional calculus, Predicate Calculus, Theorem proving by Resolution, Answer Extraction, AI Representational Schemes- Semantic Nets, Conceptual Dependency, Scripts, Frames, Introduction to agent based problem solving

(12 Hrs)

Unit III

Machine Learning: Symbol based and Connectionist, Social and Emergent models of learning, The Genetic Algorithm- Genetic Programming, Languages and Programming Techniques for AI- Introduction to PROLOG and LISP-features. Basics of search strategies and Logic Programming in LISP

(12 Hrs)

Unit IV

Overview of Expert System Technology: Rule based Expert Systems, Expert systems Inference: Forward chaining and backward chaining, Deduction process, Languages and tools, Knowledge acquisition and uncertainty: Explanation facilities, knowledge acquisition, dealing with uncertainty, fuzzy reasoning, Introduction to natural language processing, Understanding, perception, learning; explanation facilities and knowledge acquisition

(12 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Introduction to Artificial Intelligence and Expert Systems	D. W. Patterson	PHI
Artificial Intelligence	Rich and K. Knight	TMH
Reference Books		
Principles of Artificial Intelligence & Expert Systems Development	D. W. Rolston	TMH
Artificial Intelligence- Structures and Strategies for Complex Problem Solving	G. F. Luger	Pearson

IE-9102G**CRYPTOGRAPHY****L T P**
3 1 0**Credits:4****Unit I****Introduction:** Confidentiality, Data Integrity, Authentication, Non-Repudiation, and Overview of Issues involved

(06 Hrs)

Classical Encryption Techniques: Mono-alphabetic, Substitution Methods, Poly-alphabetic Substitution Methods, Permutation Methods, Cryptanalysis of these Methods

(06 Hrs)

Unit II**Modern Encryption Techniques:** Simplified DES, DES, Triple DES, Block Cipher, Design Principles, Block Cipher Modes of Operation. IDEA, Security Issues Involved with these methods

(06 Hrs)

Confidentiality Using Conventional Encryption: Placement of Encryption, Traffic Confidentiality, Key Distribution, Random Number, Generation

(06 Hrs)

Unit III**Introduction to Number Theory:** (Basics Pertaining to Security Related Algorithms). Public Key Cryptography : Principles -- RSA Algorithm, Message Authentication and Hash Functions -- Hash and MAC Algorithms, Digital Signatures and Authentication Protocols -- Authentication Applications

(12 Hrs)

Unit IV**Basic Overview of:** Electronic Mail Security, IP Security, WEB Security

(06 Hrs)

System Security: Intruders, Viruses and Worms, Firewalls

(06 Hrs)

RECOMMENDED BOOKS

Title	Author	Publisher
Text Books		
Network Security: The Complete Reference	Roberta Bragg, Mark Phodes-Ousley, Keith Strassberg	Tata Mcgraw-Hill
Handbook of Applied Cryptography	Alfred J. Menezes	CRC Press
Reference Books		
Cryptography : A very short Introduction	Fred Piper	Oxford University Press
Cryptography and Network Security	William Stallings	PHI