TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

4-Year Bachelor of Technology (B.Tech.) Curriculum and Syllabus for Electrical Engineering (EE)

Eighth Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-UEE-T400	Career Advancement &Skill Development	2	1	0	3
TIU-UEE-T402	Utilization of Electric Power & Illumination Engineering	3	1	0	4
TIU-UEE-T404	Communication Engineering	3	1	0	4
TIU-UEE-E406 TIU-UEE-E402	Digital Control Systems (Elective–I) Special Electrical Machines (Elective–I)	3	1	0	4
TIU-UEC-E422 TIU-UCS-E406	Renewable Energy Systems(Elective–II) AI and Soft-computing(Elective–II)	3	1	0	4
Practical					
TIU-UEE-E408 TIU-UEE-E404	Digital Control Systems (Elective–I Lab) Special Electrical Machines (Elective–I Lab)	0	0	3	2
Sessional					
TIU-UES-S498	Entrepreneurship Skill Development	0	0	2	2
TIU-UEE-G498	Project Work–II	0	0	2	2
TIU-UEE-P498	General Viva Voce	0	0	2	2
Total Credits					27

Detailed Syllabus

Career Advancement & Skill Development
TIU-UEE-T400
LTP: 2-1-0

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Credits: 3

Atomic structure: Rutherford's Model and Bohr's Model related to simple Hydrogen atom; Nuclear binding energy and mass defect. Wave nature of matter: Wave mechanical theory of atomic structure; Energy states. Atomic bonding: Stable interatomic distance; Ionic, covalent, metallic and Van der Waals Bonding. Crystal Structures: Unit cells; FCC, BCC and diamond structures; crystal defects. Electron energy levels: Band theory of solids; Conductors, Insulators and Semiconductors. Properties of insulating materials: Mechanical, Chemical and Thermal; Electrical properties: Volume and surface resistivity, dielectric constant, dielectric dissipation factor and dielectric strength. Polarization of dielectrics: Non-polar and polar dielectrics; Electronic, relaxation, ionic and dipole polarization; Classification of dielectrics by polarization mechanism; Dielectric polarization and permittivity. Dielectric Materials: Solid, liquid and gaseous. Gaseous dielectrics: Properties of pure and mixed gases, breakdown phenomena. Liquid dielectrics: Natural and synthetic dielectrics; Factors influencing dielectric properties of liquids. Solid insulating materials: Natural and synthetic resins; elastomers; fibrous materials; ceramic materials; mica and micanites. Varnishes, compounds, oil- paper insulation and impregnating process. Composite insulating materials: Advantages of using composite insulation; Concept of reinforced materials; Base and filler materials; Applications. Conductors: Electrical conductivity of metals, Lorentz theory, free electron theory, electron scattering, Intrinsic materials and alloys. Resistivities of conductors including alloys. High resistivity conducting materials and their applications, contact materials. Magnetic Materials: Atomic interpretation of ferromagnetic materials, Atomic exchange force, crystallographic forces, magnetic anisotropy, magnetostriction, Curie- Weiss law, Curie law, Curie temperature of ferromagnetic materials, soft magnetic material, CRGO,
Ni- Fe alloy and applications, hard magnetic materials Alnico, Alcomax and application. Ferrite-ferromagnetic materials and their applications, Piezo- electric materials. Super Conductivity: Theory of super conductivities, critical field, critical current density, transit ion temperature normal and superconductivity steps, types of super conductor, high temperature superconductor and applications.

Recommended Textbooks

- Electrical Engineering Material by A.J. Dekker
- Electrical Engineering Material by B.M. Tareev
- Dielectric Materials and applications by A. Von Hipple
- Transistors : D.L. Croissett

Utilization of Electric Power & Illumination Engineering
TIU-UEE-T402
LTP: 3-1-0
Credits: 4

Harmonic current generation due to non-linear loads. Effect of Harmonic currents on power supply system and its components. Power factor degradation due to harmonics. Displacement Factor, Distortion

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Factor and Harmonic Factor. Power line filters. Concepts of static VAr compensators. Introduction to near-unity power factor rectifiers and Active Power Filters.

Electric heating : Basic advantages, classification of furnaces and ovens. Industrial application areas. Resistance Heating : basic principles of direct and indirect heating types. Control of heating : on-off control, graded resistance, tapped inductor. Solid state control - SCR on/offcontrol, AC phase control, integral cycle control. Arc Furnaces : basic principles of direct and indirect heating types. 1-phase and 3-phase AC and DC arc types. Their power supply regulator system. Electrode position control system.Induction Heating : basic principles and applications. Induction Furnaces : basic principles of coreless and core types. Their power supply systems. SCR resonant inverters for induction heating.Dielectric Heating : basic principles and applications ,limitations of Dielectric Heating. Principle of Thermostat control for cooling.

Storage Batteries : common types and their characteristics. Principles of charging, modes of charging, eg., tickle, float, boost, constant current, constant voltage etc. Charge termination methods, common charger types. Temperature compensation of charging voltage. Battery size estimation. Uninterruptible Power Supplies : Basic concepts, schemes, back-up, redundancy, transfer switch. AC Voltage Stabilisers : Basic principles like tap-changing, servo-controlled buck-boost transformer, Constant Voltage Transformer.

Light and electromagnetic radiation; sources of light-thermal radiator-blackbody radiator, laws of thermal radiation; daylight and artificial light, spectral power distribution (SPD) of light sources, Radiometric and Photometric quantities, visual response curve of standard observer , relation between lumen and watt, photometric standards, Laws of illumination, perfect diffuser, Lambert's law. Photometry-visual & physical photometry, Bench Photometer, Luxmeter, Distribution photometer. Computation of lumen output from Luminaire from luminous intensity distribution-zone factor, zonal lumen, Integrating Sphere. Lamps-general classification, incandescent, tungsten halogen,fluorescent, compact fluorescent, misc. High Intensity Discharge lamp , Solid State lamps,etc.construction, principle of operation,features etc. Ballast-its function, electromagnetic and electronic type-principle of operation. Luminaire-its function and classification. Elementary lighting design parameters,BIS recommendation, ECBC code, etc. for general indoor lighting design by Lumen method. Concepts of energy efficient lighting design and payback calculation.Elements of Outdoor Lighting. Concept of humancentric lighting.

Recommended Textbooks

- Utilization of Electric Energy: Taylor
- Art & Science of Utilisation of Electrical Energy: Partab
- Lamps and Lighting: J.R.Coaton and A.M.Marsden
- Applied Illumination Engineering: Jack L Lindsey

Communication Engineering
TIU-UEE-T404
LTP: 3-1-0
Credits: 4

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Review of Fourier Transform and Random Process, Power Spectral Density (PSD), Auto-Correlation and Cross-Correlation Functions, Geometric Representation of Signals, Analog and Digital Signal Transmission and Reception, Channel and Noise, White Noise, Baseband and Carrier Communications. Analog Communication: Amplitude Modulation (AM), Modulation Index, Double Sideband -Suppressed Carrier (DSB-SC) , Conventional Double Sideband (DSB) and Single Sideband (SSB) Modulation, Demodulation of AM Signals, AM Modulators (Power-law Modulators, Switching Modulator, Ring Modulator) and Demodulators (Synchronous Demodulator, Rectifier Detector, Envelop Detector), Frequency Division Multiplexing (FDM), Angle Modulation: Frequency and Phase Modulations (FM & PM), Narrowband and Wideband FM, FM Modulators and Demodulators, Direct and Indirect FM, Balanced Discriminator, FMFB and PLL FM Demodulators, AM and FM Radio Broadcasting, Superheterodyne AM and FM Receivers. Digital Communication: Digital Communication Systems, Communication Channels (AWGN, Bandlimited, Multipath and Fading Channels), Introduction to Baseband and Bandpass Digital Modulations, Concepts of Power Efficiency, Bandwidth Efficiency, Inter-Symbol Interference (ISI), Bit-Error Rate (BER), Formatting And Baseband Modulation, Messages, Characters, and Symbols, M-ary Communication, PAM, PDM, PPM, Pulse Code Modulation (PCM), Delta Modulation, Uniform and Non-Uniform Quantizations, Companding, Time-Division Multiplexing (TDM), Baseband Demodulation, Digital Bandpass Modulation & Demodulation (Detection), Coherent Detection, Non-Coherent Detection, Frequency Shift Keying (FSK), Binary FSK Signals (BFSK), BFSK Modulator, BFSK Coherent and Non-Coherent an Demodulators, Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), BPSK, BPSK Modulator, BPSK Coherent and Non-Coherent and Demodulators, Overview of M-ary PSK, Quadrature PSK and Minimum Shift Keying (MSK). Spread-Spectrum (SS) Modulation: Direct-Sequence (DS) and Frequency-Hop (FH) SS, Concept of Pseudo-Noise (PN) Sequences, Generation of PN Sequences, SS Modulation for Baseband Transmission, DS SS with Coherent BPSK (DS/BPSK), DS/BPSK Transmitter and Receiver, Processing Gain, FH/MFSK Transmitter, Slow Frequency Hopping and Fast Frequency Hopping. Wireless Communications: The Cellular Concept, Personal Communication Services (PCS), Hierarchical Architecture of a Personal Communication Services Network (PCSN), Radio Resource Management in PCS, Multiple-Access Techniques, FDMA, TDMA, CDMA, Channel Assignment, Frequency Reuse, Cell Splitting, Mobility Management, Handoff Management, Inter-Switch Handoff, Location Management, Location Update, Call Delivery and Terminal Paging, GSM (2.5 G) and UMTS (3G)Architectures.

Recommended Textbooks

- Communication Systems Engineering: John G. Proakis and Masoud Salehi
- Communication Systems: Simon Haykin

Digital Control Systems (Elective-I)
TIU-UEE-E406

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LTP: 3-1-0
Credits: 4

Introduction: Introduction,Advantages and disadvantages of digital control,Configuration of the basic digital control scheme, Examples of practical digital control systems. Review of Signal Conversion and Processing:Comparative study of basic features of Continuous-time analog signal, Continuous-time quantized signal, Sampled-data signal, and Digital signal,Sampling, quantization and coding of an analog signal,Sample-and-Hold devices and their characteristics: Sampling duration, Sampling period, Acquisition time, Aperture time, Settling time, and Hold mode droop,Choosing the minimum and maximum sampling frequency, Concept of Hold operation and Zero Order Hold (ZOH),Transfer function of ZOH, Ideal sampled signal,Discrete-time vs. Digital Control Systems,Block diagram representation of the various signals associated at different subsystems of a digital control system. Modeling of Discrete-time Control Systems:Time-domain model-State variable model,Difference equation model,Impulse response model; Transfer Function modelPulse
Transfer Function,Transfer Function of unit delayer, Derivation of equivalent Pulse Transfer Function of Open Loop and Closed Loop system by Block Diagram reduction techniques.

Time Domain Analysis and Design of Discrete-time Control System: Time response calculation of discrete time control systems (open loop and closed loop) for standard test input using Pulse Transfer Function model, Mapping between s-plane and z-plane,Stability analysis of closed-loop systems in the z-plane, Method of testing absolute stability-The Jury stability test, Transient and Steady State response of discrete-time systems -Transient response specifications, Static error constants;

Discrete-time Control system design by Root-Locus method.

Frequency Domain Method of Analysis and Design of Discrete-time Systems: Bilinear transformation, Bode diagram of discrete-time system- Gain margin and Phase margin, Design of compensators using Bode diagram for discrete-time system, Design on the W-plane and W'-plane

State-Space Analysis of Discrete Time Control System: Discrete-time state space equations, Canonical and Diagonal forms of state-space equations, Solving discrete-time state-space equations, Similarity transformation, Discretization of continuous-time state-space equations.

Digital PID Controller Design: Conventional design, Model based design.

Controllability and Observability of Discrete Time Systems: Definition of controllability for discrete-time system, Test for controllability for discrete-time system, Definition of observability for discrete-time system, Test for observability for discrete-time system,
Pole Placement and Observer Design for Discrete Time Systems: Design of a discrete-time state regulator by pole placement, Design of a discrete-time state feedback control system with reference input by pole placement, Design of full order and reduced order state observers, Compensator design by separation principle

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Advanced Digital Control Systems: Basic Principles of Intelligent Control: Fuzzy Logic Control, Artificial Neural Network based Control, Neuro-Fuzzy Control. Basic Principles of Embedded Digital Control System Design.

Recommended Textbooks

- Discrete-Time Control Systems: Ogata
- Digital Control and State Variable Methods: Gopal
- Digital Control Systems: Kuo.
- Digital Logic and State Machine Design: David J. Comer, Hold, Rinehart and Winston
- Microprocessor Architecture, Programming and Applications with the 8085A/8080A, Ramesh S. Gaonkar, Wiley Eastern Limited.

Special Electrical Machines (Elective-I)
TIU-UEE-E402
LTP: 3-1-0
Credits: 4

AC Commutator motors: Transformer and rotational emf's in phase and commutator windings. Expression for torque and power. Action of commutator as frequency converter. Study of the AC Plain Series motor, its phasor diagram, commutation, brush emf's, design features. Use of compensating and compole winding to improve power factor and commutation.

Special machines: Reluctance motor, Switched Reluctance motor, Brush-less DC motor, Hysteresis motor, Servo-motor, Stepper Motor. Electronic excitation schemes for these. Permanent magnet DC machines. PM synchronous motor and generator, 1-phasealternator, Linear Induction motors. Energy efficient motors. Induction regulators: Basic principles.

Recommended Textbooks

- Power Electronics and Motor Control: W. Shepherd, L.N. Hulley & D.T.W. Liang
- Modern Power Electronics and AC Drives: B K Bose
- Electric Motor Drives: R. Krisnan
- Principles of Electric Machines and Power Electronics: P C Sen
- Electric machinery: Fitzgerald & Kingsley
- Fractional & Sub-fractional Horsepower Motors: C. G. Veinott
- Electrical machines: P.K. Mukherjee & S. Chakravorti
- Permanent Magnet Motor Technology: J. Gieras

Renewable Energy Systems (Elective-II)

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TIU-UEC-E422
LTP: 3-1-0
Credits: 4

Energy Resources in general, present scenario, Energy consumption and acts,
Environmental aspects of Thermal, Nuclear and hydroelectric power generation, types of emission from various sectors, co-relation between emission & pollution. Kyoto protocol, and carbon credit etc. Energy audit: primary and detail auditing. Energy management: Demand side management (DSM) and Supply side management (SSM), Supply side management through energy price control, Smart Grid – functions, features and technologies. The role of Reactive power management. Distributed generation (DG) and Microgrids: - features of distributed generations, technical issues of DG connection at distribution voltage level. Composition of Microgrid. Renewable energy resources: Solar- solar thermal, solar PV, wind energy- prospects and status in national and global context, principles of wind energy conversion, wind monitoring system, VAWT and HAWT, selection of site for WTGS. Geothermal, Tidal, Bioenergy-Biomass and bio gas with gasifiers etc. fuel cell. Mini and micro hydel power plant, micro turbine. Energy storage and conservation:- Types and methods of energy storage, Energy storage setups like Chemical, Thermal, Magnetic, fly wheel storage etc. Energy conservation - Concept of co-generation, combined heat and power (CHP).

Recommended Textbooks

- Energy Management Handbook: Wayne C. Turner & Stev Doty
- Guide to energy management: Barney L. Capehart, Wayne C. Turner, William J. Kennedy
- Power Station Engineering and Economics: Skortzki, B. G. A. and Vopat W. A.
- Solar Energy Engg: Sayigh A. A. M - Academic Press.
- Non-Conventional Energy resources: D. S. Chauhan, S. K. Srivastava

AI and Soft-computing (Elective-II)
TIU-UCS-E406
LTP: 3-1-0
Credits: 4

Numerical solutions of Boundary Value problems: Finite Difference Method – derivation of FDM equations from Tailor series in three dimensional single and composite media systems. Finite Element Method – derivation of nodal equations from minimum energy constraint in two dimensional and composite media systems. Formation of coefficient matrix, solution of sparse coefficient matrix. Generalised function estimation techniques: Artificial Neural Networks – Perceptron, supervised and unsupervised learning,multilayer feed-forward network, error back propagation, resilient propagation, Kohonen's self-organizing map. Fuzzy Systems – Properties of fuzzy sets, fuzzy membership function, knowledge base, inference engine, defuzzyfication. Fuzzy inferencing systems, introduction to neuro-fuzzy systems.

Classical optimization techniques: Non linear programming: Necessary and sufficient conditions for optimality, convexity, Lagrangian multiplier method, KKT condition for optimality, non-linear

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programming algorithms, direction vector, Steepest descent method, Newton's method, Quasi Newton's methods, direct search methods. Introduction to constrained optimization problem.

Linear Programming: LP problem, Simplex Algorithm, two phase method. Integer Programming: Branch and bound algorithm. Stochastic optimization techniques: Genetic Algorithms – Concept of chromosome, reproduction, Crossover & mutation, fitness function. Real coded Genetic Algorithms. Simulated Annealing technique – Annealing in metal crystalization, Boltzmandistribution, Initial temparature, cooling rate, metropolis algorithm.

Reasoning, Machine Learning, Intelligent Search, Intelligent Planning, Perception, Applications in Expert Systems, Machine Vision and Robotics, Control, Signal Processing and Pattern Recognition.

Recommended Textbooks

- Artificial Intelligence and Soft Computing: Konar
- Artificial Intelligence: A Modern Approach: Stuart
- Soft Computing: D K Pratihar