Course Name : **MICROCONTROLLERS, PLCs AND APPLICATIONS**
Course Code: **EE 435/EE 435H** **Credits:** **04** **L T P:** **4-0-0**
Pre-Req.: **EE 228/EE 228H**
Design Points: **2**

Lecture wise break up **No. of Lectures**

1. INTRODUCTION (02)

Microcontroller, Comparison of Microprocessor and Microcontroller, microcontroller and embedded processors.

2. THE 8051 ARCHITECTURE (10)

8051 Microcontroller hardware, Input/Output Pins, Ports, and Circuits, External memory, Counter & timers, Serial Data Input/Output, Interrupts.

3. 8051 ASSEMBLY LANGUAGE PROGRAMMING (10)

Introduction to 8051 Assembly programming, Assembling and running an 8051 program. Data types and directives. Addressing modes and accessing memory using various addressing modes. Arithmetic instructions and programs, Logic instructions and programs, Single bit instructions and programming, Jump loop and call instructions, I/O Port programming, Timer/counter programming in the 8051.

4. SERIAL COMMUNICATION (03)

8051 connection to RS 232, 8051 serial communication programming.

5. INTRODUCTION TO PLC (08)

Introduction – Parts of PLC – Principles of operation- PLC sizes – PLC hardware components – I/O section Analog I/O Section Analog I/O modules – digital I/O modules CPU processor memory module – Programming devices.

6. PLC PROGRAMMING (08)

PLC programming simple instructions – Manually operated switches – Mechanically operated and proximity switches – output control devices – Latching relays PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram. Timer instructions ON DELAY, OFF DELAY AND RETENTIVE Timers, UP COUNTER, DOWN COUNTER and UP DOWN COUNTERS, control instructions – Data manipulating instructions, match instructions.

7. APPLICATION OF PLC (08)

Applications of PLC – Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Automatic car washing machine, Bottle label detection and process control application.

BOOKS:

1. Ayala, The 8051 Microcontroller Architecture, Programming & Application, Thomson Publications.
2. Ali Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson.

REFERENCES:

1. David E. Simon, An Embedded Software Primer, Pearson Education
2. John W. Webb, Programmable Logic controllers : Principles & Applications, Prentice Hall.

Honors: Students opting for Honors course will have to over reach academic performance through learning of advanced topics and evaluation in terms of assignments working on related field problems and additional questions for honors students in the examinations.

Course Name: **Utilization of Electric Energy and Illumination Engineering**
Course Code: **EE 436/EE 436H** **Credits:** **4** **L T P:** **4-0-0**
Pre Req: **EE225/EE225H**
Design Points: **02**

Lecture wise break up **No. of Lectures**

1. ELECTRIC ENERGY AS MECHANICAL POWER (06)

Electric Drives: Advantages of electric drives, Characteristics of different mechanical loads, Types of motors used in electric drive. Methods of power transfer by direct coupling by using devices like belt drive, gears, pulley drives etc.

2. ELECTRIC ENERGY AS LIGHT ENERGY (28)

1. Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light.
2. Luminous flux, lux, solid angle, luminous intensity, illumination, Laws of illumination, luminous efficiency, glare, Color, contrast, shadow.
3. Different type of lamps, construction and working of incandescent and discharge lamps – their characteristics, Luminaire required for filament lamp, mercury vapour lamp, fluorescent lamp, metal halide lamp, neon lamp, Compact Fluorescent Lamps, LEDs.
4. General Illumination Design: Calculation of number of light points for interior illumination, depreciation factor, room index and utilization factor, maintenance factor, space to height ratio, reflection factor, calculation of illumination at different points, Selection of equipment, Equipment efficiency. Design of illumination schemes. Cove lighting design, louver design.
5. General ideas bout street lighting, flood lighting, tunnel lighting, monument lighting and decorative lighting, light characteristics etc.
6. Light Control: Materials used for light control, Light –beam control, Surface and Media control, Luminaires for light control, Installation of the luminaires.
7. Maintenance and Economics: Maintenance of luminaire, Luminaire depreciation environment, Efficient light production methods, lighting economics.

3. ELECTRIC ENERGY AS THERMAL ENERGY: (08)

Electric Heating: Advantages of electrical heating, Heating methods: Resistance heating – direct and indirect resistance heating. Induction heating, Electric arc heating, direct and indirect arc heating, Dielectric heating, Infra-red heating, Microwave heating. Electric Welding: Advantages of electric welding, Welding method. Principles of resistance welding, types – spot, projection seam and butt welding. Principle of arc production, electric arc welding, characteristics of arc.

4. ELECTRIC ENERGY AS CHEMICAL ENERGY (06)

Electrolytic Processes: Need of electro-deposition, Laws of electrolysis, process of electro-deposition, Factors affecting electro-deposition, Principle of galvanizing and its applications. Principles of anodizing and its applications, Electroplating on non-conducting materials, Manufacture of chemicals by electrolytic process and by electrolysis process

TEXT BOOKS:

1, John O.Kraehenbuehl, . Electric Illumination, John Wiley & Sons Inc., NewYork.
2. H Partap, "Art and Science of Utilization of Electrical Energy" Dhanpat Rai & Sons, Delhi

REFERENCES

1. H.Howitt & A.S.Vause, "Lamps and Lighting," Edward Arnold (Publishers) Ltd London.
3..W.J.M.Van Bommel, "Road Lighting," Kluwer Technische Boeken, Macmillan.
4. Utilization of Electrical Energy by JB Gupta, Kataria Publications, Ludhiana
5. Open Shaw Taylor, "Utilization of Electrical Energy," Pitman Publications
6. C.L. Wadhwa, "Generation, Distribution and Utilization of Electrical Power," Wiley Eastern Ltd., New Delhi.

Honors: Students opting for Honors course will have to over reach academic performance through learning of advanced topics and evaluation in terms of assignments working on related field problems and additional questions for honors students in the examinations.

Course Name: DEPARTMENAL LAB-6
Course No: EE 437 Credits: 2 L T P : 0-0-3
Design Points: 2

NOTE: Minimum sixteen experiments are to be performed, selecting eight experiments from each of the parts (A) and (B).

(A) MICROCONTROLLERS AND PLC

1. Interface the given keyboard module using 8051 microcontroller.
2. Interface the given stepper motor and control the steps using 8051 microcontroller.
3. Using the display interface module and microcontroller 8051, show the 7 segment LED display.
4. Using the given PLC interface board and 8086 microprocessor, design a Combinational controller and Sequential controller.
5. Speed Control of DC Motor using 8051 microcontroller.
6. Path tracing controlling using microcontroller.
7. BCD to 7 segment decoder design and display using FPGA.
8. Design of a finite state machine (Digital controller circuit) using FPGA.
9. FPGA based simulation of 8255 module.
10. FPGA based simulation of 8279 module.

11. Design of an Adaptive FIR Filter using 8051 microcontroller.
12. FPGA based Traffic light controller design.
13. PLC based design and study of PID controller
14. Closed loop positioning control using synchronizer and DC servo motor
15. Closed loop potentiometer positioning control system training
16. Control system synchronizer and stepper motor
17. Control system of potentiometer and stepper motor.

18 to 20, three experiments, may be added in the list based on requirement.

(B) MODERN CONTROL SYSTEMS

(Using MATLAB/SIMULINK and other design softwares)

1. Pole placement design
2. Design of regulator
3. (i) Design of observer
   (ii) Pole placement design of full order observers and compensators
4. Study of describing function method
5. Phase plane analysis
6. Design of discrete time controller
7. Design of discrete PID controller
8. Neural network based controller for speed control of induction motor
9. Neural network based controller for broom stick balancer.
10. Design of fuzzy logic controller for linear plant.
11. Design of fuzzy controller for nonlinear plant.
12. Fuzzy logic enhanced control of an induction motor.
13. Design of fuzzy logic controller for power system
14. Design of fuzzy logic controller for electric drive.
15. Fuzzy logic control of switched reluctance motor.
16. Modelling and fuzzy control of DC drive.
17. Optimization based design of controllers

18 to 20, three experiments, may be added in the list based on requirement.

Course Name: **DEPARTMENTAL LAB-7**
Course No: **EE 438** **Credits:** **2** **L T P :** **0-0-3**
Design Points: **2**

NOTE: Minimum sixteen experiments are to be performed, selecting eight from each of the parts (A) and (B)..

(A)ILLUMINATION ENGINEERING

List of Experiments

1. Study of Construction and function of each component of road /flood light etc. Luminaires.
2. To plot the candlepower, power consumed, current drawn v/s voltage characteristic curve of an Incandescent lamp and compare with the theoretical curves.
3. To plot the candlepower, power consumed, current drawn v/s voltage characteristic curve of an Fluorescent Lamp and compare with the theoretical curves.
4. To study the effect of reflectors on luminaire intensity distribution.
5. To determine luminous efficiency of a luminaire.
6. To plot the candlepower, power consumed, current drawn v/s voltage characteristic curve of a road lighting luminaire and compare with the theoretical curves.
7. To determine utilization factor of a luminaire.
8. To study of Goniometer for A-α, B- β, C- γ Co-ordinate system of measurement.
9. To plot Intensity Polar-Curves of Indoor Luminaire in at least two planes.
10. To plot Intensity Polar-Curves of Outdoor Luminaire in at least two planes.
11. To plot the candlepower, power consumed, current drawn v/s voltage characteristic curve of
    a flood lighting luminaire and compare with the theoretical curves.
12. To obtain polar curves of the light distribution of a flood lighting luminaire.
13. Study the following:
    i) The effect of the cover glass upon the beam spread and
    ii) (ii) the effect of lamp focus on beam spread.
14. To calculate Glare index of a luminaire.
15. To control light of a luminaire by various method.
16. To plot iso-lux and iso-candela curves of a road luminaire and determine optical characteristics.

17 to 18 , two experiments may be added in the list based on the requirement.

(B) COMMUNICATION ENGINEERING/ BIO MEDICAL ENGINEERING

1. To study amplitude modulation using a transistor and determine depth of modulation.
2. To study generation of DSB-SC signal using balanced modulator.
   To study generation of SSB signal.
3. To study envelope detector for demodulation of AM signal and observe diagonal peak clipping effect.
4. To study super heterodyne AM receiver and measurement of sensitivity, selectivity and fidelity.
5. To study frequency modulation using voltage controlled oscillator.
6. To detect FM signal using Phase Locked Loop.
7. To measure noise figure using a noise generator.
8. To study PAM, PWM and PPM.
9. To realize PCM signal using ADC and reconstruction using DAC and 4 bit/8 bit system.
10. To study delta modulation and adaptive delta modulation.
11. To study PSK modulation system.
12. To study FSK modulation system.

13. To study sampling through a sample hold circuit and reconstruction of the sampled signal and observe the effect of sampling rate and the width of the sampling pulses.
14. To study the ECG machine, pick up ECG signal. Display it on CRO and To find the duration of P, R and T Wave
15. To plot experimentally the relationship b/w the surface EMG and muscular force.
16. To pick up EEG signals and study their patterns.
17. To study an MRI system available in the field.
18. To study the frequency spectrum of EMG on a display devices using a moveable band pass filter.

Course Name: CAPSTONE PROJECT-II
Course No: EE 497 Credits: 4 L T P: 0-0-8

The students may select any topic with application to electrical engineering in the form of hardware/ software simulation involving the concept of detailed problem search, design, fabrication, results, analysis.
The students will be required to submit the complete Capstone Project-I report and the work software/ hardware done on the same topic as decided with the consultation of guide and DUGC committee.
The second phase of the problem taken up in the Capstone Project-I may also be completed in the Capstone Project-II provided that both parts of the work are submitted separately with detailed problem search, design, fabrication, results, analysis.

Course Name : ELECTRICAL MACHINES DESIGN
Course No. : EE-441 Credits : 04 LTP 4-0-0
Pre-requisite: EE214/EE214H, EE312/EE312H

Lecture wise break up **No. of Lectures**

1. GENERAL (06)

Review of materials used in electrical machines- their characteristics and limitations. Classification of insulating materials based on temperature rise. Losses in electric machines, temperature rise calculation, steady state temperature rise, heating and cooling curves. Ratings of machines. Temperature gradients in transformer and rotating machines.

2. VENTILATION (03)

a) Methods of cooling transformers
b) Types of ventilation, methods of cooling 3-phase induction motor
c) Hydrogen cooling, direct water cooling.

3. MAGNETIC CIRCUITS (03)

a) Magnetic circuits of transformers and three phase induction motors.
b) Magnetic loadings of transformers and induction motors.
c) Specific slot permeance and slot leakage of a three phase induction motor.

d) Leakage reactances of cylindrical coils of equal length and sandwich coils of equal width in a transformer.

4. ELECTRIC CIRCUITS (05)

a) Types of low voltage and high voltage windings in transformers.

b)Characteristics of a.c. armature windings. Types of windings used for induction motors. Winding factors.

5. TRANSFORMERS (08)

Design of single-phase and three-phase core type power and distribution transformers, single phase shell type transformers. Magnetic and electric circuit, slot and its insulation, squirrel-Cage and slip ring rotors, no load current, short circuit current, efficiency, no load current, cooling system, over all dimensions and weight.

Computer aided design of induction motors.

6. GENERAL CONCEPTS OF DESIGN OF ROTATING MACHINE (04)

Relation between rating and dimensions of rotating machines, main dimensions, total specific and electric loadings, choice of specific electric loadings, separation of D and L.

7. INDUCTION MOTORS (08)

Design of squirrel-cage and wound rotor type of three Phase induction motor.

Stator and its windings, slot and its insulation, squirrel - cage and slip-ring rotors,, no load current, efficiency, Computer aided design of induction motors.

8. D.C. MACHINES (05)

Introduction, output equation, choice of average gap density and ampere conductors and basic constructional details of stator, poles, armature, commutator and brushes.

9. SYNCHRONOUS MACHINES (05)

Introduction, output equation, choice of specific and magnetic electric loading and basic design of hydro generators and turbo generators.

TEXT BOOK:

1. A.K.Sawhney, A course in Electrical Machine Design , Dhanpat Rai & Sons

REFERENCES:

1. Say and Smith, Design Manual
2. M.G.Say, The Design and Performance of Alternate Current Machines, CBS Publishers and Distributors

Course Name: NEURAL NETWORKS AND FUZZY SYSTEMS
Course Code: EE-442 Credits: 4 L T P 4-0-0
Pre Req: ---

Lecture wise break up No. of Lectures

1. INTRODUCTION NEURAL NETWORKS (03)

Biological neuron, Models of Artificial neural networks (ANN), Characteristics of Neural Networks, Different Types of Learning – supervised, unsupervised & competitive learning.

2. FUNDAMENTAL MODELS OF ANN (04)

Mcculloch – Pitts, Hebbian, Perceptron, Delta, Owstrar, Boltzman, Adalin, Madalin.

3. FEED FORWARD NETWORKS (04)

Back propagation, Radial basis function.

4. SELF ORGANIZING FEATURE MAP (04)

Kohonen Self organizing Maps, Learning Vector Quantization (LVQ), Max. Net, Hamning Net.

5. FEEDBACK NETWORKS (02)

Hopfield Net

6. ASSOCIATIVE MEMORY NETWORKS (03)

Hetero associative memories, Auto Associate Memory network, Bi-directional Associate Memory.

7. SPECIAL NET (04)

Cognitron, Neo Cognitron, Boltzman Machine & Cauchy's Machine.

8. APPLICATION OF NEURAL NETWORK (04)

Application of neural network in Electrical Engineering including power system, control and electric drive.

9. INTRODUCTION FUZZY SYSTEMS: (12)

Fuzzy logic, classical sets and fuzzy sets, operations on fuzzy sets, properties of fuzzy sets, crisp and fuzzy relations, membership functions, fuzzification, defuzzification.

10. FUZZY RULE BASED SYSTEM (05)

Formation of rules, decomposition of rules, aggregation and properties of fuzzy rules, fuzzy inference system.

11. APPLICATIONS OF FUZZY LOGIC (07)

Fuzzy logic applications in various areas including power systems, image processing, control systems, industries.

TEXT BOOKS

1. Introduction to Neural Networks using MATLAB by S.N. Sivanandam, S. Sumati and S.N. Deepa, Tata McGraw Hill, 2006.
2. Introduction to Fuzzy Logic using MATLAB by S.N. Sivanandam, S. Sumati and S.N. Deepa, Springer, 2007.

REFERENCES:

1. Simon Haykin, Neural Networks – A Comprehensive Foundation, Macmillan Publishing Co., New York, 1994.
2. Understanding Neural Networks and Fuzzy logic by S.V.Kartalo Poulos – PHI.
3. NN, FL & GA, Systhesis & App. By S. Rajasekaran & GA Vijaylakshmi Rai, PHI.

4. Introduction to Artificial neural networks, J.M.Jurada, Jaico Publishers Mumbai, 1997.
5. Neural computing: Theory & Practice by Philip D. Wasserman Auza Research Inc. Van Nostrand 1989.

Course Name : **BIOMEDICAL ENGINEERING**

Course Code: **EE 443** **Credits: 04** **L T P: 4 0 0**

Pre Req: **---**

Lecture wise break up **No. of Lectures**

1. INTRODUCTION TO BIO INSTRUMENTATION (03)
Problems encountered in measuring a living system, Electric shock Hazards, safety codes for electro-medical equipment.

2. SOURCES OF BIOELECTRIC POTENTIALS (07)
RESTING AND ACTION POTENTIALS, PROPAGATION of action potential, the bioelectric potential-with special reference to ECG, EEG and EMG.

3. ELECTRODES (03)
Recording electrodes, electrical conductivity of electrodes, jellies and creams.

4. TRANSDUCERS IN MEDICAL EQUIPMENTS (05)
Displacement, pressure, body temperature measurement, photoelectric transducers optical fibre sensors.

5. BIOMEDICAL RECORDERS (05)
Electrocardiograph, electroencephalograph, electro-myograph Biofeedback instrumentation.

6. PATIENT MONITORING SYSTEM (05)
System concepts, cardiac monitor, bedside patient monitoring system, measurement of heart rate, pulse rate, blood pressure measurement, temperature, respiratory rate, catherization of laboratory instrument.

7. ELECTRICAL STIMULATION OF NERVE AND MUSCLE GROUP (04)

8. METHODS OF HEATING TISSUES (03)
Physiological effect of heat, short wave diatherapy, infra-red radiation, microwave diathermy, surgical diathermy.

9. BIOMEDICAL TELEMETRY AND TELEMEDICINE (03)

10. MODERN IMAGING SYSTEM (04)
Computed tomography, magnetic resonance imaging system, thermal camera based on IR sensors

11. THERAPEUTIC EQUIPMENTS (06)
Pacemakers, cardiac defibrillators, pain relief through electrical stimulation, Haemodialysis machine, electronics in anaerhetic machine.

BOOK:

1. John G. Webster, Bioinstrumentation, John Wiley & Sons

REFERENCES:

1. Leslie Cromwell, Fred J. Weibell & Erich A Pfeiffor, Biomedical Instrumentation and Measurements, PHI
2. Khandpur, Handbook of Biomedical Instrumentation, TMH

Course Name: ADVANCED MICROPROCESSORS

Course No: EE 444 Credits: 4 L T P: 4-0-0
Pre-requisite: EE228/EE228H

Lecture wise breakup Number of Lectures

1. **Basic microcomputer system:** Stored Program computers, computer instructions and bus cycles, computer codes, computer programming. **(4)**

2. **8086/88 Architecture an Instruction Set:** 8086/88 cpu architecture, segmented memory addressing modes, data transfer, string, logical and arithmetic instructions, transfer of control instructions, processor control instructions. **(10)**

3. **Microprocessor programming techniques:** modular programming, Time delay loops, procedures, data tables, macros, testing and debugging. **(5)**

4. Interfacing aspects of 8086 cpu: three-bus system architecture, 8086 cpu hardware details, generating control signs, bus types and buffering techniques, 8086 minimum and maximum modes, the 8088 microprocessors. **(6)**

5. **Interfacing Memory to 8086/88 microprocessors:** types of main memory, cpu read/write training, SRAM and ROM, interfacing, address decoding techniques, interfacing dynamic RAM. **(6)**

6**. Interfacing I/O to 8086/88:** parallel I/O, serial I/O, programmed I/O, interrupt driven I/O DMA. **(6)**

7. **Peripheral Controllers for the 8086/88 Family:** 8255 PPI, 8251 A USART, 829A PIC. **(4)**

8. **Data Communication:** current loop interface, EIA RS-232C serial interface standard, IEEE 1888-1978 GPIB standard, error detection and correction. **(4)**

9. Introduction to 8087 Numeric Data Processor and 8089 I/O Processor: **(3)**

BOOK

1. John Uffenbech, The 8086/8088 family : Design, Programming and Interfacing, Prentice-Hall, New Delhi.

REFERENCES:

1. Douglas V.Hall, Microprocessors and Interfacing, TMH, New Delhi.
2. Yu-Cheng Liu and G.A.Gibson, Microcomputer System:The 8086/8088Family PHI, New Delhi.

Course Name: DIGITAL CONTROL SYSTEMS
Course Code: EE 445 Credits: 4 L T P: 4-0-0

Pre Req: **EE 315/EE 315H**

Lecture wise breakup **No. of lectures**

1 INTRODUCTION (03)

Control system terminology, computer based control, control theory (history &trends).

2 SIGNAL PROCESSING IN DIGITAL CONTROL (11)

Advantages of digital control, basic digital control scheme, principle of signal conversion, basic discrete-time signals, time domain &transfer function models, stability in z –plane, sampling, sampled spectra & aliasing, filtering, principles of discretization.

3 MODELS OF DIGITAL CONTROL DEVICES AND SYSTEMS (08)

Z-domain description of sampled continuous, time plants, z- domain description of systems with dead- time, implementation of digital controllers.

4 DESIGN OF DIGITAL CONTROL ALGORITHMS (08)

Z-plane specifications of control system design, digital compensator design using frequency response and root locus plots, z- plane synthesis.

5 STATE VARIABLE ANALYSIS OF DIGITAL CONTROL SYSTEM (10)

State description of digital processors, state description of sampled continuous-time plants, solution of state difference equations controllability and observability.

6 DIGITAL CONTROL (08)

Digital Control System with State Feedback, dead beat control by state feedback and dead beat observers, Lyapunov stability analysis for discrete –time systems.

BOOKS:

1. Digital Control and State Variable Methods by M. Gopal, Tata McGraw Hill
2. Discrete-Time Control Systems by K. Ogata, Prentice Hall

REFERENCES:

1 Digital Control Systems, by B. C. Kuo, Springer

2 Digital Control of Dynamics Systems by G.F. Franklin, J.D. Powell and M.L. Workman, Prentice Hall

Course Name: APPLIED MECHATRONICS
Course Code: EE 446 Credits: 4 LTP: 4-0-0
Pre-Req: ---
Lecture wise break up **No. of Lectures**

1. MECHATRONICS INTRODUCTION (03)

2. **SYSTEM DESIGN (05)**

Performance terminology, Displacement, position and proximity, Velocity and motion, Temperature, Light sensors, Selection of sensors.

3. **INPUT DESIGN** **(07)**
Signal conditioning, the operational amplifier, Digital signals, Multiplexers, Data acquisition, Pulse-modulation.

4. **DATA PRESENTATION SYSTEMS** **(07)**
Displays, Data presentation elements, Data acquisition systems.

5. **ELECTRICAL ACTUATION SYSTEMS** **(06)**
Electrical systems, Mechanical switches, Solid-state switches, D.C. motors.

6. **BASIC SYSTEM MODELS** **(03)**
Mathematical models, Electrical system building blocks.

7. ELECTROMECHANICAL SYSTEM MODELS. **(03)**

8. **CLOSED LOOP CONTROLLERS** **(05)**
Continuous and discrete processes, Control models, Proportional mode, Derivative control, Integral Control, PID Controller, Digital controllers, Control system performance, Controller tuning, Velocity control.

9. **INTERFACING** **(05)**
Microprocessors Control, Microcontrollers, Applications.

10. **INPUT/OUTPUT SYSTEMS** **(04)**
Interfacing, Input/output ports, Interface requirements, Serial communications interface.

BOOKS:

1.David G.Alciator, Michael B. Histand, Introduction to Mechatronics and Measurement Systems, 3rd Edition, McGraw Hill, 2007.

REFERENCES:

1.W.Bolton, Mechatronics, 3rd Edition, Prentice Hall, 2003

Course Name: **ADVANCED POWER ELECTRONICS**
Course Code: **EE 447 Credits: 4 L T P: 4-0-0**
Pre Req: **EN204**

Lecture wise breakup **No. of lectures**

1 INTRODUCTION **(02)**
Review of semiconductor devices- diodes, GTO, SCR, IGCT, IGBT etc.

2 CONVERTERS **(20)**
Single-phase and three-phase half and full wave controlled converters, voltage and current expressions, input power factor and distortion factor, effect of load impedance, improvement of current waveform, PWM converter, three-phase dual converter, 12-pulse converter, firing circuits, power factor improvement techniques, harmonic reduction, single-phase buck and boost converter, force commutated converter, single-phase and three-phase AC voltage regulators.

3 DC-DC CONVERTERS **(10)**

Different types of choppers and expressions for voltage and current, design of reactive components (L, C), analysis, switching-mode regulators: Buck regulators, Boost regulators, Buck Boost regulators and Cuk regulators.

4 INVERTERS (11)

Single-phase and three-phase inverters (VSIs and CSIs), different modes of operation, frequency and voltage control, different modulation techniques, control of harmonic content, multilevel inverters: different topologies and applications

5 CYCLOCONVERTER (05)

Single-phase and three-phase cyclo-converters

BOOKS:

1. Thyristorised Power Controllers by G K Dubey, New Age International
2. Power Electronics Circuits, Devices and Applications by M H Rashid, PearsonEducation

REFERENCES:

1. Power Electronics Converter, Applications and Design by Ned Mohan, AtlanticPublication
2. Modern Power Electronics and AC Drives by B.K Bose, PHI

Course Name : NON-CONVENTIONAL ENERGY SYSTEMS
Course No. : EE 448 Credits: 04 LTP: 4-0-0
Pre Req: ---

Lecture wise break up No. of Lectures

1. INTRODUCTION TO ENERGY SOURCES (05)

World energy future, conventional energy Sources, Non-Conventional energy Sources, Prospects of Renewable energy sources.

2. SOLAR ENERGY (15)

a)Introduction to solar radiation and its measurement, introduction to solar energy collectors and storage.

b)Application of solar energy: Solar thermal electric conversion, Thermal electric conversion systems, solar electric power generation, solar photo-Voltaics, solar cell principle, semiconductor junction, conversion efficiency and power output, Basic photo-voltaic system for power generation.

3. WIND ENERGY (10)

a)Introduction to wind energy conversion, the nature of the wind, Power in the wind.

b)Wind Energy Conversion: Wind data and energy estimation, site selection considerations, basic components of wind energy conversion system, classification of WEC Systems, Scheme for electric generation using synchronous generator and induction generator, wind energy storage.

4. DIRECT ENERGY CONVERSION PROCESSES (15)

a) Magnetic Hydro Dynamic Power Generation: Principles of MHD power

generation, open cycle systems, Closed cycle systems, Voltage and power output, material for MHD Generators.

b) Thermo Electric Generation: Basic principles of thermo-electric power-generation, Seebeck, Peltier, Thomson effects, thermo-Electric power generator, Analysis, materials.

c)Thermionic Generation: Thermionic emission and work function, Basic thermionic generator.

d)Fuel Cells: Classification of fuel cells, types, advantages, Electrodes, Polarization.

e)Thermo Nuclear fusion Energy: the basic Nuclear Fusion and reactions Plasma confinement, Thermo Nuclear reactors.

5. ENERGY FROM BIOMASS (05)

a) Introduction: Biomass conversion technologies, photosynthesis, Bio-gas generation, types of Bio-gas plants.

b) Biomass as Source of Energy: Methods for obtaining energy from Bio-mass, Bio-logical Conversion of solar energy.

TEXT BOOK:

1. Non-Conventional Sources of Energy by G.D. Rai, Khanna Publishers
2. Renewable energy sources and conversion technology by M.K. Bansal, M.Kleemann, M.Heliss, Tata Mc-Graw-Hill 1990.

REFERENCES:

1. Bio Energy by David Boyles Elis Horwood Ltd.
2 .Direct Energy Conversion by R.A.Coombie, Pitman.
3. Learning about Energy by David J.Rose, Plenum Press 1986.
4. Bio Energy Spectrum, Bio Energy and wasteland Development Organization by O.P.Vimal and Tyagi

Course Name: DIGITAL SIGNAL PROCESSING AND APPLICATIONS
Course No.: EE 449 Credits : 04 LTP : 4-0-0
Pre Req: ---

Lecture wise breakup: Number of Lectures

1. SIGNAL & SIGNAL PROCESSING (03)

Classification of signals, typical signal processing operations, typical signal processing applications, why digital signal processing

2. **TIME DOMAIN REPRESENTATION OF SIGNALS & SYSTEMS (08)**

Discrete- time signals, operations on sequences, the sampling process, discrete-time systems, time-domain characters tics of LTI discrete-time systems, state space representation of LTI discrete time systems.

3. **TRANSFORM (08)**

Domain representation of signals: the discrete-time Fourier transform, discrete Fourier transform, computation of the DFT of real sequences, linear convolution using the DFT, the z- transform, the inverse z- transform.

4. TIME DOMAIN REPRESENTATION OF LTI SYSTEMS (06)

The frequency response, the transfer function. , Digital two-pairs stability test.

5. **DIGITAL PROCESSING OF CONTINUOUS TIME - SIGNALS (06)**

Sampling of continuous time signals, analysis filter design, anti- aliasing filter design, reconstruction filter design**.**

6. DIGITAL FILTER STRUCTURES (10)

Block diagram representation, signal flow graph representation, equivalent structures, Basic FIR digital filter structures, Basic IIR filters structures, all pass filters, tunable structures**.**

7. DIGITAL FILTER DESIGN (10)

Preliminary conditions, impulse invariance method of IIR filter design, bilinear transform method of IIR filter design, design of filter IIR notch filters, FIR filter design based on truncated Fourier series, FIR filter design based on frequency sampling approach, computer-aided design of digital filters.

TEXT BOOKS

1 Mitra, Sanjit .K, Digital Signal Processing, Tata-McGraw-Hill.

REFERENCES:

1. Antoniou, A., Digital Filters: Analysis & Design, McGraw –Hill

2. Sterms, S.D., Digital signal Processing. Englewood cliffs, N.J.:Prentice-Hall Inc.

Course Name: STATIC REACTIVE POWER CONTROL AND FACTS
Course No.: EE 450 Credits: 4 LTP: 4-0-0
Pre Req: EE 225/EE 225H

Lecture wise break up No. of Lectures

1. INTRODUCTION (04)

Basis of power transmission, reactive power control in AC transmission lines, Reactive power and voltage regulation relationship.

2. FACTS (04)

Concepts of Flexible AC Transmission System (FACTS). FACTS controllers Types, description and definitions. Application of FACTS controller in transmission and distribution systems

3. REACTIVE POWER COMPENSATION (04)

Reactive Load, analysis of uncompensated line, Compensation of reactive power, passive reactive power compensation, series and shunt compensation.

4. POWER SEMICONDUCTOR DEVICES (06)

Perspective of power Devices, power device material, Thyristor, GTO, MTO, IGBT, MCT.

5. VOLTAGE-SOURCED CONVERTERS (06)

Basics of voltage source converters, single-phase, three-phase bridge converter operation, Pulse width modulation converter, harmonic elimination.

6. SELF AND LONE-COMMUTATED CURRENT-SOURCED CONVERTERS (06)

Basic concept of current-sourced converters, three-phase full-wave diode rectifier, Thyristor based converter, current-sourced converter with turn-off devices.

7. STATIC VAR COMPENSATOR (06)

Objective of compensation, methods of controllable var generation, Static Var compensators, analysis of SVC, STATCOM. Comparison between SVC and STATCOM. Modeling and application of SVC

8. STATIC SERIES COMPENSATORS (06)

Series compensation, variable impedance type series compensator, switching converter type series compensator, control for reactive power compensators. Modeling and application of SSC

9. UNIFIED POWER FLOW CONTROLLER (06)

Basic operating principles, convetional transmission control capabilities, independent control of active and reactive power, dynamic performance, operation with other reactive power control devices, Modeling and applications of UPFC.

BOOKS:

1. N.G. Hingorani and L.Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, Standard Publishers-Distributors.
2. K.R. Padiyar, FACTS Controllers in Power Transmission & Distribution, New Age International Publisher, 2007.

REFERENCES:

1. Miller T.J.E., Reactive Power Control in Electric Systems, John Wiley.
2. Abhijit Chakraborty, Sunita Halder, Power System Analysis Operation & Control, , PHI.

Course Name: HIGH VOLTAGE ENGINEERING

Course No. : EE451 Credits: 4 LTP: 4-0-0

Lecture wise break up No. of Lectures

1. DISCHARGES IN GASES (10)

General characteristics of gaseous insulation, Basic processes of ionisation in a gas: Discharges in uniform and non-uniform fields; Townsend Mechanism, Townsend first and second ionization coefficients, Paschen's Law; Corona discharges due to direct and alternating voltage. Vacuum breakdown mechanisms. Practical methods of calculating Corona Loss on transmission lines. Commonly used gases for insulation and their properties.

2. BREAKDOWN OF SOLIDS AND LIQUIDS (10)

Basics of solid insulating materials, Types of insulating materials, temperature classification, factors affecting dielectric strength, Different mechanisms of breakdown of solids; intrinsic breakdown; Theories of intrinsic breakdown; Different theories of breakdown in liquids; commonly used solid and liquid insulation materials and their properties.

3. LIGHTNING PHENOMENON (06)

Change accumulation in clouds: formation of lightning stroke; characteristics of lightning stroke; Current and Voltage magnitudes;

4. HIGH VOLTAGE TESTING EQUIPMENT (06)

Power frequency high voltage testing transformer, Cascade connection of transformers. Generation of high direct voltage by voltage doubler circuit and cockrort Walton Circuit.

5. IMPULSE GENERATOR (04)

Definition of impulse wave; single stage and multi stage impulse generators and equivalent circuits,

6. HIGH VOLTAGE MEASUREMENTS (08)

Measurements of A.C., D.C. and Impulse Voltage; Sphere gap, resistance and capacitance potential dividers, Standard capacitors: High Voltage measurements by measuring rectified current of a standard capacitors: Crest Voltmeter, Electrostatic voltmeter. Impulse voltage measurement by Cathode Ray Oscillograph.

7. NON-DESTRUCTIVE HIGH VOLTAGE TESTING (07)

H.V. testing of Cables and transformers. Testing of transformer oil for electric strength. General idea about dielectric constant and loss factor. Application of H.V. Schering Bridge for tests.

TEXT BOOKS:

(1) C.L. Wadhwa, High Voltage Engineering, New Age International Ltd.

REFERENCES:

(1) M.S.Naidu and V.Kamaraju, High Voltage Engineering, McGraw-Hill, 3rd edition, 1995.

(2) Dielker Kind , Kurt Feser, High Voltage Test Technique

(3) E.Kuffel and W.S.Zaengl , High Voltage Engineering Fundamentals, Newness, 2nd edition,

Course Name: OPTIMIZATION TECHNIQUES

Course Code: EE 452 Credits: 4 LTP: 4-0-0

Pre Req:

Lecture wise breakup No. of Lectures

1. INTRODUCTION (04)

Historical Development, Engineering application of Optimization, Formulation of design problems as mathematical programming problems, classification of optimization problems

2. LINEAR PROGRAMMING (10)

Graphical method, Simplex method, Revised simplex method, Duality in linear programming (LP), Sensitivity analysis, other algorithms for solving LP problems, Transportation, assignment and other applications.

3. NON LINEAR PROGRAMMING (14)

Unconstrained optimization techniques, Direct search methods, Descent methods, Constrained optimization, Direct and indirect methods, Optimization with calculus, Khun-Tucker conditions.

4. ADVANCED TECHNIQUES OF OPTIMIZATION : **(10)**

Search based techniques techniques, heuristics, evolutionary algorithms – Genetic algorithms, evolution strategies, evolutionary Programming, Genetic programming, multi-modal function optimization.

5. MULTI-OBJECTIVE OPTIMIZATION: (10)

Multi-Objective Optimization Problem, Principles of Multi-Objective Optimization, Dominance and Pareto-Optimality, classical methods

BOOKS

1. S.S. Rao, "Engineering Optimization: Theory and Practice", New Age International (P) Ltd., New Delhi, 2000.
2. K. Deb, "Optimization for Engineering Design – Algorithms and Examples", Prentice-Hall of India Pvt. Ltd., New Delhi, 1995.
3. K. Deb, "Multi-Objective Optimization using Evolutionary Algorithms", John-Wiley and Sons, Ltd, England.

Course Name: ELECTRICAL INSTRUMENTATION AND PROCESS CONTROL

Course Code: EE 453 Credits: 4 LTP: 4-0-0

Pre-requisite : ---

Lecture wise break up No. of Lectures

1. TRANSDUCER-I (08)

Definition, advantages of electrical transducers, classification, characteristics, factors affecting the choice of transducers, Potentiometers, Strain gauges, Resistance thermometer, Thermistors, Thermocouples, LVDT, RVDT.

2. TRANSDUCER-II (06)

Capacitive, Piezoelectric Hall effect and opto electronic transducers. Measurement of Motion, Force pressure, temperature, flow and liquid level.

3. TELEMETRY (07)

General telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter. Data.

4. ACQUISITION SYSTEM (08)

Analog data acquisition system, Digital data acquisition system, Modern digital data acquisition system.

5. DISPLAY DEVICES AND RECORDERS (05)

Display devices, storage oscilloscope, spectrum analyzer, strip chart & x-y recorders, magnetic tape & digital tape recorders.

6. RECENT DEVELOPMENTS (05)

Computer aided measurements, fibre optic transducers, micro sensors, smart sensors, smart transmitters.

7. PROCESS CONTROL (08)

Principle, elements of process control system, process characteristics, proportional (P), integral (I), Derivative (D), PI, PD and PID control modes. Electronic, Pneumatic & digital controllers.

BOOKS:

1. A.K.Sawhney, Advanced Measurements & Instrumentation, Dhanpat Rai & Sons.
2. B.C.Nakra and K.Chaudhry, Instrumentation, Measurement and Analysis, Tata Mc Graw Hill, 2nd Edition.
3. Curtis Johns, Process Control Instrumentation Technology, Prentice Hall.

REFERENCES

1. E.O. Deeblin, Measurement System – Application & design, Mc Graw Hill.
2. W.D. Cooper and A.P. Beltried, Electronics Instrumentation and Measurement Techniques" Prentice Hall International.
3. M.M.S. Anana, "Electronic Instruments and Instrumentation Technology" PHI Learning.

Course Name: **DATA STRUCTURES USING C**
Course code: EE 454 Credits: 4 L T P : 4-0-0
Pre Req: ---
Lecture wise break up No. of Lectures

1. INTRODUCTION TO DATA STRUCTURES (10)

Introduction, Analyzing the Performance of Data Structures Linear, Direct Access, Homogeneous Data Structure: The Array , Creating Type-Safe Reusable Data Structures,The List – a Homogeneous, Self-Re-dimensioning Array

2. THE QUEUE, STACK AND HASHTABLE (08)

Providing First Come, First Served Job Processing, A Look at the Stack Data Structure: First Come, Last Served, The Limitations of Ordinal Indexing, The System Collections Hash table Class The System. Collections , Generic, Dictionary Class

3. BINARY TREE AND THE BST's (08)

Arranging Data in a Tree, Understanding Binary Trees, Improving the Search Time with Binary Search Trees (BSTs),Binary Search Trees in the Real-World

4. BUILDING A BETTER BINARY SEARCH TREE (08)

Self-Balancing Binary Search Trees, A Quick Primer on Linked Lists, Skip Lists: A Linked List with Self-Balancing BST-Like Properties

5. FROM TREES TO GRAPHS (08)

Examining the different classes of edges, creating a graph class, a look at some common graph algorithm

6. EFFICIENTLY REPRESENTING SETS (06)

The Fundamentals of Sets, Implementing an Efficient Set Data Structure Maintaining a Collection of Disjoint Sets

TEXT BOOKS:

1. Data Structure through C by Y Kanetkar, Infinity Publications
2. Data Structure using C by Tanenbaum, Dorthy Kinderseley

Course Name: HUMANITIES III (CORPORATE FINANCE)

Course Code : HU 404 Credits-4 : L T P: 4-0-0
Pre Req:
Lecture wise breakup No. of Lectures

1. INTRODUCTION (07)
Finance, Financial Decisions, Objectives of Corporate Financial Decisions and factors influencing financial decisions.

2. INDIAN FINANCIAL SYSTEM (07)
Nature and role of financial system in Indian Economy.

3. FINANCIAL MARKETS (08)
Concepts, Type of markets and their relevance in present scenario.

4. FINANCIAL INSTRUMENTS AND FINANCIAL SERVICES (08)
Capital and Money Market Instruments, Services.

5. WORKING CAPITAL (05)
Types and factors affecting the requirements of working capital.

6. SOURCES OF FINANCE (05)
Short term and long term.

7. TIME VALUE OF MONEY AND CAPITAL BUDGETING (05)
Concept of Compounding and Discounting, Nature of Investment Decisions, Investment, Evaluation Criteria: Pay Back Period Method, Accounting Rate of Return Method, Internal Rate of Return Method and Net Present Value Method.

8. FINANCIAL LEVERAGE (03)
Meaning (trading on equity) and measures.

9. DIVIDEND POLICY (05)

Objectives of Dividend Policy, factors influencing firm's dividend policy.

10. CAPITAL STRUCTURE (03)

Essentials of Capital Structure, Approaches to establish target capital structure.

BOOKS:

1. Pandey I.M., Financial Management, Vikas Publishing House Pvt.Ltd.

2. Khan M Y, Indian Financial System, Tata McGraw Hill.

3. Bhole LM and Mahakud Jitendra, Financial Institutions and Markets,

Tata McGraw Hil

REFERENCES:

1. Chandra Prasanna, Financial Management Theory and Practice, Tata McGraw Hill
2. Lasher William R., Practical financial Management, Thomson
3. Van Horne J.C., Financial Management and Policy, Prentice Hall
4. Apte, P.G., International Financial Management, Tata McGraw Hill

HU404H (Humanities III) -In addition to the contents of HU404, additional topics:

Capital Market Intermediaries and their Regulation.
Functions and Operations of Money Market.
Foreign Exchange Market –From FERA to FEMA.
Role of Banks and Financial Institutions in Economic Development.

Course Name: HUMANITIES III (BUSINESS ENVIRONMENT& INDUSTRIAL LEGISLATION)

Course Code: HU 402 Credits: 4 L T P : 4-0-0

Pre Req:

Lecture Wise Breakup **No. of Lectures**

1. **INTRODUCTION** **(07)**
   Scope of business, Characteristics of business and its forms.
2. **BUSINESS ENVIRONMENT**
   Economic, Political and Technological. **(07)**
   Ecological and Global Environment and their relevance in present scenario. **(08)**
3. **SOCIAL RESPONSIBALITY OF BUSINESS** **(05)**
   Concept, Social Responsibility toward different interest groups and Business Ethics.
4. **GLOBALIZATION** **(07)**
   Meaning, Rationale for globalization, features of current globalization, Pros and Cons of globalization.
5. **WTO** **(07)**
   Functions of WTO. WTO structure, and Implications for India.
6. **CORPORATE GOVERNANCE** **(05)**
   Concept, Essentials of good Corporate Governance, One case study.
7. **CONTRACT ACT** **(05)**
   Concept of Contract, types and its essentials.
8. **SALE OF GOOD ACT** **(05)**
   Essential of sale of goods Act.

BOOKS:

1 Francis Cherunilam, Business Environment, Himalaya Publications.
2 K.C.Garg,V.K.Sareen,MukeshSharma andR.C.Chawla, Commercial & Labour Laws, Kalyani Publishers.

REFERENCES:

1. K Aswathappa, Essential of Business Environment, Himalaya Publication.
2. S.S.Gulshan, Mercantile Law, Excel Books.
3. S.S. Gulshan & G.K. Kapoor, Business Law, New Age International (p) Ltd.,Publisher.
4. S Singh, Corporate Governance – Global Concepts & Practices, Excel Books.
5. Roger Benett, International Business, Addison Wesley Longhran, Delhi.
6. Y K Bhushan, Business Organization & Management, Sultan Chand & Sons.

HU402H (Humanities III) -In addition to the contents of HU402, additional topics:

Cluster Growth Model Vs SEZ
Innovative Dynamics of the Company
Foreign Market Entry Strategies
Competition Policy and Law
Corporate Social Responsibility-Two Case Studies