EX- 701
Utilization of Electrical Energy

Unit-I Illuminations: Definitions, laws of illuminations, polar curves, luminous efficiency, photometer, incandescent lamps, filament materials, halogen lamp, electric discharge lamps, sodium vapor lamp, mercury vapour lamp, fluorescent lamp, light calculations: commercial, industrial, street and flood lighting

Unit-II Electric Heating: Different methods of electric heating, principle of high frequency induction and dielectric heating, construction, operation, performance and applications of arc furnace and induction furnace
Electric Welding: Welding process, welding transformer, classification of electric welding: arc welding, resistance welding, welding of various metals.

Unit-III Electrolytic Process: Principles and applications of electrolysis, electro-deposition, manufactures of chemicals, anodizing, electro-polishing , electro-cleaning, electroextraction, electro-refining, electro-stripping (parting) power supplies for electrolytic process.

Unit-IV Electric Traction: Systems of Electric Traction: DC & AC Systems, power supply for electric traction system: comparison and application of different systems, sub-station equipment and layout, conductor rail & pantograph.

Unit-V Traction Methods and control: Types of services, speed time and speed distance curves, estimation of power and energy requirements, mechanics of train movement, Co-efficient of adhesion, adhesive weight, effective weight, traction motor controls: DC and AC traction motors, series parallel starting, methods of electric braking of traction motors.

References:

1. C. L. Wadhwa: Utilization of Electric Traction Electric Power. 1989
2. H. Partab: Art and Science of Electrical Energy, Dhanpat Rai & Sons
3. Gupta, J.B., Utilization of Elect. Energy , Katariya and sons, New Delhi.
4. Garg, G.C., Utilization of Elect. Power and Elect. Traction.
5. N V Suryanarayan, Utilization of Elect. Power including Electric Drives and Elect.

EX-702
Digital Signal Processing

Unit I- Discrete-Time Signals and Systems: Discrete-time signals, discrete-time systems, analysis of discrete-time linear time-invariant systems, stability and causality, discrete time systems described by difference equation, solution of difference equation, implementation of discrete-time systems ,block diagrams and flow graph, convolution representation of digital network, matrix representation.

Unit II- The Z-Transform: The Direct z-transform, properties of the z-transform, , inversion of the z-transform, rational z-transforms, ROC and their properties, analysis of linear time-invariant systems in the z- domain , convolution theorem, parseval's relation, laplace transform, properties of laplace transform.

Unit III- Frequency Analysis of Discrete Time Signals: Discrete Fourier Series (DFS), properties of the DFS, Discrete Fourier Transform (DFT), properties of DFT, two dimensional DFT, circular convolution.

Unit IV- Computation of the DFT: FFT algorithms, decimation in time algorithm, decimation in frequency algorithm, linear Convolution using DFT, decomposition for 'N' composite number.

UnitV- FIR Filters: Analog filter Design, Butterworth & Chebyshev, design of IIR and FIR digital filters, impulse invariant and bilinear transformation, , Henning, Hamming & Kaiser, Windowing, rectangular and other windows, examples of FIR filters, design using Windows.

References:

1. A.V. Oppenheim and R. W. Schafer: Digital Signal Processing, Prentice Hall.
2. L.R. Rabiner and B. Gold: Theory and Application of Digital Signal Processing, Prentice Hall
3. John. G. Proakis and Monolakis: Digital Signal Processing, Pearson Education
4. Johnny R. Johnson: Introduction to Digital Signal Processing, PHI, New Delhi.
5. S. Ghosh: Signal and Systems, Pearson Education.
6. Schilling and Harris: Fundamentals of DSP using MATLAB, Cengage Learning

List of Experiments:

1. MATLAB simulation of discrete time signals: time domain representation.
2. Write a MATLAB code to generate sum of sinusoidal signals.
3. Write a MATLAB code to design IIR Butterworth lowpass filter and verify its characteristics.
4. Write a MATLAB code to design IIR Chebyshev type I highpass filter.
5. Write a MATLAB code to design a LPF of FIR type using Keiser window function with order 25.
6. Write a MATLAB code to compute the linear convolution of two discrete sequences
7. Write a MATLAB code to compute the circular convolution of two discrete sequences.
8. Write a MATLAB code to compute the DFT of a sequence
9. Write a MATLAB code to compute the IDFT of a sequence

EX- 703
Electrical Drives

Unit I- Introduction to Electric Drives: Elements of drive systems, requirement of electric drives, rating & selection of drives, groups and individual drives, constant power and constant torque drives. Review of characteristics of AC & DC motors, load torque, load-drive, speed torque characteristics, quadrant speed torque characteristics, load equalization, stability of electric drives, moment of inertia and torque of motor load combination.

Unit II-DC Drives: Starting, braking, transient & steady state analysis phase controlled and chopper controlled drives, speed control, energy recovery systems, dual converter.

Unit III- Induction Motor Drives: Starting braking and speed control, PWM, voltage source inverter and current sources fed im drives, cyclo converter fed drive, vector control drives, slip power recovery, conventional control methods, rotor impedance control, converter controlled-Static Scherbius & Static Krammers drives.

Unit IV- Synchronous Motors Drives: Starting, braking, transient analysis, synchronous motors variable speed drives, V/F control, cyclo converter fed synchronous motor drive.

Unit V- Special Motor Drives: Fundamentals of switched reluctance motors, stepper motors, permanent magnet motor, vector control, digital control of drives.
Traction: Electric traction, machine tool drive, electric cars, steel & cements plants, textile & paper mills.

References:

1. G.K. Dubey "Fundamentals of Electrical Drives"-. Narosa Publications
2. 2. Gopal K. Dubey "Power semiconductor Controlled Drives"- PHI
3. S.K. Pillai, "A first course of Electrical Drive" New age International.
4. Ned Mohan Electrical Drive Wiley India
5. V. Subramanyam "Thyristor control of Electric Drive" Tata Mc Graw Hill Pub.
6. S.Shiva Nagaraju power semiconductor drive PHI learning

List of Experiments:

1. To study the starting and running characteristics of converter fed DC traction motor.
2. To study the energy recovery systems and braking of a DC drive.
3. To study the braking methods of a three-phase induction motor.
4. To study the performance of VSI fed three-phase induction motor using PWM technique.
5. To control the speed of a three phase slip ring Induction motor using rotor impedance control.
6. To study the performance of Vector Controlled three phase Induction motor drive.
7. To Study frequency Controlled Synchronous motor drive

EX- 704 [A]
High Voltage Engineering

Unit –I Introduction: Basics of HV technology, advantages of transmitting electrical power at high voltages, need for generating high voltages in laboratory, applications of high voltage.

Unit –II Insulation & Breakdown: Classification of HV insulating media, its properties, gaseous dielectrics, ionizations, Townsend's theory & its limitations, streamer's theory breakdown in non uniform fields, corona discharges, Paschen's law and its significance, time lags of breakdown, breakdown in solid dielectrics, intrinsic breakdown, avalanche breakdown, thermal breakdown, and electro mechanic breakdown, breakdown of liquids dielectric, suspended particle theory, electronic breakdown, electro convection breakdown, cavity breakdown (bubble's theory).

Unit –III High Voltage AC DC : HV AC transformer, need for cascade connection, working of transformers units connected in cascade, series resonant circuit, principle of operation and advantages, tesla coil, HV DC voltage doubler circuit, Cock Croft- Walton type high voltage DC set.

Unit –IV: Impulse Voltage and current Introduction to standard lightning and switching impulse voltages, analysis of single stage impulse generator, expression for output impulse voltage, multistage impulse generator, its components, triggering of impulse generator by three electrode gap arrangement, triggering gap, oscillograph time sweep circuits, generation of switching impulse voltage, generation of high impulse current.

Unit –IV High Voltage Tests on Electrical Apparatus: Definitions of technologies, tests on isolators, circuit breakers, cables insulators and transformers.

Unit –V Measurement of High Voltages: Electrostatic voltmeter, generating voltmeter, series resistance micro ammeter, HV DC measurements, standard sphere gap measurements of HV AC & HV DC, potential dividers, resistance dividers, capacitance dividers, mixed RC potential dividers, surge current measurement.

References:

1. E. Kuffel and W.S. Zaengl, "High voltage engineering fundamentals", 2nd edition, Elsevier, press, 2005.
2. M.S.Naidu and Kamaraju, "High Voltage Engineering", 3rd edition, THM, 2007.
3. L. L. Alston, "High Voltage technology", BSB Publication, 2007..
4. Rakosh Das Begamudre, Extra High voltage AC transmission engineering, Wiley Easternlimited, 1987.
5. Transmission and distribution reference book-Westing House.
6. C.L.Wadhwa, High voltage engineering, New Age International Private limited, 1995.

EX- 704[B]

Generalised Theory of Electrical Machines

Unit I Generalized Theory: Conversions, basic two pole machines, transformer with movable secondary, transformer voltage and speed voltage, Kron's primitive machine , analysis of electrical machines, voltage and torque equation.

Unit II Linear Transformations: Invariance of power, transformations from displaced brush axis, three phases to two phase, rotating axes to stationary axes, transformed impedance matrix, torque calculations.

Unit III DC Machines: Generalized representation, generator and motor operation, operation with displaced brushes, steady state and transient analysis, sudden short circuit, sudden application of inertia load ,electric braking of dc motors.

Unit IV Synchronous Machines: Generalized representation, equivalent circuit, steady state analysis, transient analysis , phasor diagrams, electromechanical transients.
Induction Machines: Generalized representation, performance equation, equivalent circuit, steady state analysis, transient analysis, phasor diagrams, double cage machine, harmonics, voltage & torque equation for steady state operation of induction motor & Scharge motor.

Unit V Special Machines: Generalized representation, steady state analysis of reluctance motor, brushless dc motor, variable reluctance motor & single phase series motor.

References:

1. P.C.Krause, Analysis of Electric Machinery, Wiley India.
2. B.Adkins, The General theory of Electrical Machines.
3. B.Adkins & R.G.Harley, The General theory of AC Machines.
4. P.S.Bhimbra, Generalised theory of Electrical m/c
5. White & Woodson, Electro Mechanical Energy Conversion.

EX- 705[A]

Computer Aided Design of Electrical Machines

Unit-I Computer Aided Design Philosophy of computer aided design, advantages, limitations, analysis and synthesis methods, selection of input data and design variables, flow charts for design of induction motor and synchronous machine, optimization of design constrained and unconstrained optimization problem

Unit-II DC machine:-Design of armature windings & field systems, selection of variables for optimal design, formulation of design equations, objective function, constraint functions, algorithms for optimal design.

Unit-III Power Transformer:-Design of magnetic circuit, design of windings, selection of variables for optimal design, formulation of design equations, objective function, constraint functions, algorithms for optimal design.

Unit-IV Single Phase Induction Motor-Calculation of main dimensions of stator, complete design of stator with its punching details, design of main and auxiliary winding, design of rotor, performance calculation of designed rotor and performance by equivalent circuit approach.
Three Phase Induction Motor -Design of stator, windings design of squirrel cage rotor, design of slip ring rotor, selection of variables for optimal design, formulation of design equations, objective functions constraint functions, algorithms for optimal design.

Unit-V 3-Phase Alternator:-Design of stator, windings, design of field systems for salient pole and non-salient pole machines, selection of variables for optimal design, formulation of design equations, objective function, constraint functions, algorithms for optimal design.

References:

1. Computer- Aided Design of Electrical Equipment- by Dr. M. Ramamoorthy-Affiliated East-West press Pvt. Ltd. New Delhi.
2. Electrical Machine Design- by A.K. Sawhney, Dhanpat Rai & Sons.
3. Performance and Design of A.C. Machines-M.G. Say, Affiliated East West Press Pvt. Ltd., New Delhi.
4. Performance and Design of D.C. Machines- Clayton & Hancock.
5. Principles of Electrical Machine Design with Computer Programmes by- S.K. Sen, Oxford & IBH Publishing Co.

EX- 705[B]

Artificial Intelligence

Unit 1: Introduction: Organization of the brain, biological neuron, biological and artificial neuron models, historical developments, essentials of artificial neural networks, artificial neuron model, operations of artificial neuron, types of neuron activation function, ANN architectures

Unit 2: Classification Taxonomy of ANN: Connectivity, neural dynamics (activation and synaptic), learning strategy (supervised, unsupervised, reinforcement), learning rules. perceptron models: training algorithms: discrete and continuous perceptron networks, perceptron convergence theorem. multilayer feed forward neural networks

Unit 3: Memory: Associative memory, bi-directional associative memory, architecture, BAM training algorithms, storage and recall algorithm, BAM energy function, self-organizing maps (SOM) and adaptive resonance theory (ART).

Unit 4: Fuzzy Logic system: Fuzzy versus crisp, fuzzy sets, membership function, basic fuzzy set operations, properties of fuzzy sets, fuzzy relations, fuzzy control**,** predicate logic (interpretation of predicate logic formula, inference in predicate logic), fuzzy logic (fuzzy quantifiers, fuzzy inference), fuzzy rule based system, defuzzification methods.

Unit 5: Intelligent Tools: Introduction to genetic algorithm, biological background, GA operators, selection, encoding, crossover, mutation, chromosome, expert system, software architecture, rule base system.

References:

1. Simon Haykin, "Neural Networks: A Comprehensive Foundation", 2nd Edition, Pearson Education
2. S. Rajsekaram, G. A. Vijayalaxmi Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms Synthesis & Applications", Practice Hall India
3. James A. Anderson, "An Introduction to Neural Networks", Practice Hall India Publication
4. Mohamed H. Hassoun, "Fundamentals of Artificial Neural Network", Practice Hall
5. Kelvin Waruicke, Arthur Ekwlle, Raj Agarwal, "AI Techniques in Power System", IEE London U.K.
6. S. N. Sivanandam, S. Sumathi, S. N. Deepa, "Introduction to Neural Network Using MATLAB 6.0", Tata McGraw Hill.

EX-706
Major Project Synopsis-I

The students have to keep in mind that in final semester they would be required to implement whatever has been planned in the **Major Project Synopsis-I** in this semester. It is possible that a work, which involves greater efforts and time may be taken up at this stage and finally completed in final semester, but partial completion report should be submitted in this semester and also evaluated by an external examiner. At the end of semester, all students are required to submit a synopsis.

EX-707
Industrial Training –I

Duration: 2 weeks after the VI semester in the summer break, Assessment in VII semester.

Students must observe following to enrich their learning during industrial training:

- Industrial environment and work culture.
- Organisational structure and inter personal communication.
- Machines/ equipment/ instruments - their working and specifications.
- Product development procedures and phases.
- Project planning, monitoring and control.