Department Of Electrical Engineering

Academic Scheme

For

B. Tech Electrical Engineering

Four Years Programme

Syllabus

(V – VIII Semesters)

(For Batches 2015 onwards)

Vetted in BOS 2017

Department of Electrical Engineering

Department Of Electrical Engineering

5th Semester

Course Code	Course Title	Type of Course	L – P	Credit
ELE- 511T	Electrical Machines-II	C	4 – 0	4
ELE-512T	Power Systems – I	C	4 – 0	4
ELE-513T	Advanced Control System	C	4 – 0	4
ELE-514T	Microprocessors	C	4 – 0	4
MTH-511T	Numerical Analysis	C	4 – 0	4
XXX-xxxX	Elective-III	E		X
ELE-515P	Electrical Machines-II Lab	C	0 – 2	1
ELE-516P	Power System-I Lab	C	0 – 2	1
ELE-517P	Microprocessors Lab	C	0 – 2	1
	Total Credits		**20 – 6**	**23+X**

6th Semester

Course Code	Course Title	Type of Course	L – P	Credit
ELE-611T	Power Systems-II	C	4 – 0	4
ELE-612T	Power Electronics	C	4 – 0	4
ELE-613T	Renewable Energy Sources	C	4 – 0	4
ECE-618T	Communication Systems	C	4 – 0	4
XXX- xxxX	Elective-IV	E		X
XXX-xxxX	Elective-V	E		Y
ELE-614P	Power System-II Lab	C	0 – 2	1
ELE-615P	Power Electronics Lab	C	0 – 2	1
	Total Credits		**16 - 4**	**18+X+Y**

7 th Semester

Course Code	Course Title	Type of Course	L – P	Credit
ELE-711T	Switchgear & Protection	C	4 – 0	4
ELE-712T	Advanced Power Electronics	C	4 – 0	4
ECE-718T	Digital Signal Processing	C	4 – 0	4
XXX-xxxX	Elective-VI	E		X
XXX-xxxX	Elective-VII	E		Y
ELE-713P	Switchgear & Protection Lab	C	0 – 2	1
ELE-714P	Preliminary Project Work	C	0 – 4	2
ELE-715P	Practical Training	C		2
	Total Credits		**12 - 6**	**17+X+Y**

8 th Semester

Course Code	Course Title	Type of Course	L – P	Credit
ELE-811T	Utilization of Electrical Energy	C	3 – 0	3
ELE-812T	Electrical Drives	C	4 – 0	4
XXX-xxxX	Elective-VIII	E		X
XXX-xxxX	Elective-IX	G		Y
ELE-813P	Project	C	0 – 18	10
ELE-814P	Electrical Drives Lab	C	**0 -- 2**	**1**
	Total Credits		**7 -- 20**	**18+X+Y**

ELE - 511T –Electrical Machines-II

L	P
4	0

UNIT I

The Rotating Magnetic Field (RMF), Magneto-motive force and flux distribution, Induced voltage, Production of torque, Leakage fluxes.

UNIT II

Three Phase Induction Motors, Principle of operation of an induction motor, Construction, Types, Slip, Equivalent circuit, Torque/Speed characteristics, Losses and Efficiency, Crawling and Cogging, Induction motor tests, Starting, Speed Control.

UNIT III

Double Field Revolving Theory, Types of 1-phase induction motors, Equivalent circuit of 1-phase induction motors, Shaded-pole Motor, Stepper Motor, Universal Motor.

UNIT IV

Constructional features, Types and working principle of alternators, EMF equation, Windings, Pitch Factor and Distribution Factor, Leakage reactance, Armature reaction, Equivalent circuit, Phasor diagram, Short Circuit Ratio (SCR), Voltage Regulation and its determination, Two- axis theory for salient type machines.

UNIT V

Construction, Principle of operation, Starting, Effect of load on synchronous motor, Effect of varying excitation, Equivalent circuit, Phasor diagram, 'V' and 'inverted V' curves, Hunting, Damper windings , Synchronous Condenser/Synchronous Phase Modifier.

Books Recommended:

1. Electric Machinery, by Fitzgerald, Kingsley, Umans, Tata Mcgraw-Hill.
2. Electric Machines, Nagrath and Kothari, Tata McGraw-Hill.
3. Electric Machines, Guru, Oxford University Press, 3rd Edition.
4. Electrical Machines and Transformers, George McPherson, John Wiley.
5. Electric Machinery Fundamentals, Chapman, Tata McGraw-Hill,
6. Electric Machinery by Dr. P.S. Bimbhra, Khanna Publishers.

ELE - 512T –Power Systems-I

L P
4 0

UNIT I

Introduction to Power System, Single line diagram, Impedance and Reactance diagram of a power system, Single Phase and Three Phase transmission, Overhead and Underground transmission System, Elements of AC distribution. Singly fed, Doubly fed and Ring main distributor. Per Unit (PU) Systems.

UNIT II

Mechanical design of overhead transmission line, Types of insulators and their applications, Voltage distribution over a string of insulators, String Efficiency & methods of its improvement.

UNIT III:

Classification of cables, Cable conductors, Insulating materials, Insulation Resistance, Electrostatic stress, Grading of cables, Capacitance calculation, Losses and current carrying capacity.

UNIT IV

Transmission line parameters, Types of overhead conductors with calculations of inductance and capacitance, Effect of earth on capacitance of a transmission line, Bundled conductors, Skin and Proximity effect, Corona, Interference of power lines with communication lines.

UNIT V

Modelling and performance analysis of short, Medium and Long transmission lines, ABCD parameters, Transposition of transmission conductors, Surge Impedance Loading (SIL), Ferranti effect.

Books Recommended:

1. Power System Analysis, J.J. Grainger and W.D Stevenson McGraw-Hill.
2. Electric Power Systems, C.L. Wadhwa, New Age International.
3. Power System Engineering, Nagrath and Kothari, Tata McGraw-Hill.
4. Transmission and Distribution of Electrical Energy, H.Cotton.

Department Of Electrical Engineering

ELE - 513T – Advanced Control System

L	P
4	0

UNIT I

Fields and Vector spaces; Linear independance and dependance; Basis and Dimension; Subspace; Representation using state variable methods; Similarity Transformation; Eigen values and Eigen vectors; Canonical forms; Conversion of State variable models to transfer functions and vice-versa;

UNIT II

Solution of state equations; Properties of state transition matrix- computation of state transition matrix by Laplace transformation and Cayley-Hamilton theorem; Concepts of Controllability and Observability.

UNIT III

Control System design using State variable methods Introduction, State variable feedback structure; Pole-placement design using state feedback; Limitations of State Feedback; State feedback with Integral control, Observer-based state feedback control;

UNIT IV

Introduction to Discrete-time control systems; Basic Discrete-time signals; State space representation of Discrete-time systems; Difference equation models; The z transform; The Pulse transfer function; s-Plane to z-Plane mapping, Stability on the z-plane and the Jury Stability criteria; Mathematical modelling of Impulse sampling and data hold.

UNIT V

Nonlinear Control Systems Non-linear Systems: Types of non-linearities, phenomena related to non-linear systems. Analysis of non-linear systems: linearization, phase portraits, describing function method and feedback linearisation. Stability: Lyapunov's stability theorems for continuous time systems.

Books Recommended:

1. M.Gopal, Digital Control and State Variable Methods.
2. Stefani R., Savant C., Shahian B., Hostetter G., Design of Feedback Control Systems.
3. Discrete-time systems, K. Ogata.
4. Optimal Control Systems, D.S. Naidu.
5. Applied nonlinear control, Jean-Jacques Slotine, Weiping Li.

ELE – 514T- Microprocessors

L	P
4	0

UNIT 1

Evolution of microprocessor technology from historical and future perspective, 8085 pin-out diagram, functions of different pins, data bus, address bus, multiplexing and demultiplexing of address/data lines, control bus, control and status signal.

UNIT 2

Internal architecture (ALU, Registers Array, timing and control unit), flags, basic interfacing devices (buffers, tri-state devices, decoders, encoders, latches), Memories (ROM, RAM and other types)

UNIT 3

Different addressing modes, instruction sets, arithmetic and logic operation, 8085 assembly language programming. (addition, subtraction, multiplication, Division), timing diagrams, Instruction cycle.

UNIT 4

Addressing techniques, memory mapped I/O and I/O mapped scheme, Partial and absolute address decoding, Basic interfacing concepts, interfacing input devices, interfacing output devices, 8085 Interrupts, stack and subroutines, counters and time delays.

UNIT 5

Interfacing peripheral devices, Multipurpose programmable device (8155), Interfacing of different devices, stepper motor, A/D and D/A convertor, Programmable peripheral Interface (8255), and its interfacing with 8085, Interfacing with LCD, 8259A programmable Interrupt controller, Direct Memory Access and DMA controller.

Books Recommended

1. Ramesh Gaonkar, Microprocessor Architecture, Programming and Application with 8085. PRI Publishing(India)
2. Gilmore, Microprocessor, TMH India.
3. K.L. Short, Microprocessor and Programming Logic.
4. M. Rafiquzzaman, Microprocessors: Theory and Applications (Intel and Motorola)

Department Of Electrical Engineering

MTH-511T – Numerical Analysis

L	P
4	0

UNIT I

Finite Difference: Difference Table and its usage. The difference operators and the operator 'E', Interpolation: Interpolation with equal intervals, Newton's advancing difference formula Newton's backward difference formula Interpolation with unequal intervals Newton's divided difference formula Lagrange's interpolation formula.

Central Differences: The central difference operator δ and the over-raging operator μ, Relations between the operators, Gauss forward and backward interpolation formula, Sterling's, Bessel's, Laplace and Everett's formulae.

UNIT II

Inverse interpolation: Inverse interpolation by (i) Lagrange's Method (ii) Methods of successive 'E' approximation (iii) Methods of elimination of third differences

Numerical solution of algebraic and Transcendental Equations: Graphic Method, Regula-Falsi method, Balzano's Process of bisection of intervals, Newton-Raphson Method and its geometrical significance.

UNIT III

Numerical Integration: Numerical Integration, General Quadrature Formula, Simpson's One-third and Three-Eighth rules, Weddles' rule, Hardy's rule, Trapezoidal rule.

Numerical Differentiation : Numerical differentiation of a function. Differential co-efficient of a function in terms of its differences. Applications.

UNIT IV

Difference Equations: Linear-homogeneous and Non-homogenoeus difference equations of order 'n' with constant co-efficient, and their solution, Method of undetermined co-efficients.

UNIT V

Numerical Solution of ordinary differential equations: Numerical solution of ordinary differential equations, Picard's method. Taylors series method, Euler's method, Runge-Kutta Method.

Books Recommended:

1. Numerical Methods for Scientists and Engineering, M.K. Jain, S.R. Iyengar & R.K. Jain, Wiley Eastern Ltd.
2. Mathematical Numerical Analysis by S.C. Scarborough, Oxford and IBH Publishing Company.
3. Introductory methods in Numerical Analysis by S.S. Sastry, Prentice Hall of India.
4. Numerical Solution of Differential equations, M.K. Jain.

Department Of Electrical Engineering

ELE – 515P – Electrical Machines-II Lab

L	P
0	2

List of Experiments:

1. To study the different parts of an Induction motor.
2. To determine the equivalent–circuit parameters of a 3-phaseInduction motor by (i) No load test (ii) Blocked rotor test.
3. To determine the Torque / speed characteristics of a 3-phase Induction motor.
4. To determine the equivalent circuit parameters of a 1-phase Induction motor by (i) No load test (ii) Blocked rotor test.
5. To Study of the construction of a synchronous machine.
6. To obtain the OCC and SCC of a synchronous machine by Synchronous Impedance method.
7. To find voltage regulation of an alternator by actual loading.
8. To obtain the 'V' curves and 'inverted V' curves of a synchronous motor.

Department Of Electrical Engineering

ELE – 516P – Power System-I Lab

L	P
0	2

List of Experiments:

1. To study different types of insulators.
2. To study potential distribution across different units of a string of insulators with and without guard ring.
3. To study different parts of a power cable.
4. To measure the insulation resistance of a cable.
5. To determine the charging current of a cable.
6. To study different types of overhead conductors.
7. To determine ABCD parameters of a transmission line.
8. To determine voltage regulation and efficiency of a transmission line.
9. Study of Ferranti effect.

Department Of Electrical Engineering

ELE- 517P - Microprocessors Lab

L 0 P 2

List of Experiments:

1. To write a program to add two single byte numbers.
2. To write a program to subtract one 8-bit number from another 8-bit number.
3. To write a program to multiply two single byte numbers.
4. To write a program to divide one number by another.
5. Write a program to introduce a time delay using subroutine.
6. Write a program to find the greatest of three numbers
7. To write a program to read data from an input device and send its complement to output.
8. To write a program to rotate a stepper motor both in clockwise and anti-clockwise direction
9. To design and interface a circuit to read data from analog to digital convertor, using 8255A in the memory-mapped I/O.
10. To design and interface a circuit to convert digital data into analog signal, using 8255A in the memory-mapped I/O.

Department Of Electrical Engineering

6th Semester

Course Code	Course Title	Type of Course	L – P	Credit
ELE-611T	Power Systems-II	C	4 – 0	4
ELE-612T	Power Electronics	C	4 – 0	4
ELE-613T	Renewable Energy Sources	C	4 – 0	4
ECE-618T	Communication Systems	C	4 – 0	4
XXX- xxxX	Elective-IV	E		X
XXX-xxxX	Elective-V	E		Y
ELE-614P	Power System-II Lab	C	0 – 2	1
ELE-615P	Power Electronics Lab	C	0 – 2	1
	Total Credits		**16 - 4**	**18+X+Y**

ELE - 611T – Power Systems-II

L	P
4	0

UNIT I

Transients in simple circuits, Three-phase short circuit on an alternator, Re-striking Voltage after removal of short circuit, Travelling waves on transmission lines: open-end line, Short-circuited line, Line terminated through a resistance.

UNIT II

Faults, Types of faults: Symmetrical & Unsymmetrical, Analysis of Symmetrical faults, Symmetrical components of a three phase system, Evaluation of components, Three-phase power in terms of symmetrical components, Sequence impedances.

UNIT III

Introduction, Sequence network equations, Calculation of fault currents for unsymmetrical faults: Single Line to Ground, Line-to-Line, Double Line to Ground faults and for symmetrical 3-phase balanced faults, current limiting reactors.

UNIT IV

Power System Stability, Transient and Steady State stability, Power Angle Equation, Swing Equation, Equal Area Criterion of Stability, Critical clearing angle, Factors affecting transient stability. Active and Reactive power control.

UNIT V

Load flow analysis: Introduction, Bus classifications, Nodal admittance matrix (YBUS), Development of load flow equations, Load flow solution using Gauss-Seidel and Newton-Raphson method, Approximation to N-R method.

Books Recommended:

- Power System Analysis by J.J. Grainger and W.D Stevenson.
- Electric Power Systems by B.M. Weedy and Cory.
- Power Systems Engineering by Nagrath and Kothari.
- Electrical Power Systems by C.L. Wadhwa.

ELE - 612T – Power Electronics

L P
4 0

UNIT I

Goals and objectives of power electronics, Characteristics and Specification of switches - Ideal characteristics, Characteristics of Practical Devices, Switch specifications, Figures of merit, Power Semiconductor devices, basic theory of operation (Power Diodes, BJTs, Power MOSFETs, IGBTs, GTOs) SCR: Characteristics, Two-transistor model , protection, Firing Circuits

UNIT II

AC-DC Converters AC-DC uncontrolled converters-Single phase Half wave Rectifiers, Concept of freewheeling, Single phase Full wave rectifiers, Three phase bridge rectifiers, Effect of source impedance.

UNIT III

AC-DC controlled converters-Single phase controlled converters (Semi-converters, full converters), Analysis for different types of load, Three phase controlled converters (Semi- converters, full converters), Analysis for different types of load.

UNIT IV

DC-DC converters: Introduction, Buck, Boost and Buck-Boost chopper configurations, Continuous and Discontinuous conduction mode.

Inverters: Introduction, Principle of operation and classification (VSI and CSI), Single phase inverters, Sinusoidal Pulse Width Modulation (SPWM) in VSI.

UNIT V

AC Voltage Controllers Introduction-Principle of AC voltage control (On-Off control, Phase control) Single-Phase controllers (Analysis for different types of load)-evaluation of performance parameters cycloconverter (1-phase)

Books Recommended:

1. Power Electronics: Converters, Applications, and Design, 3rd Edition. Mohan, Ned, Undeland, Robbins, John Wiley.
2. Power Electronics: Circuits, Devices and Applications, 3rd Edition. M. H. Rashid, Prentice Hall.
3. Power Electronics, 3rd Edition, Lander Cyril W, McGraw-Hill.
4. Power Electronics, Dr. P.S. Bimbhra, Khanna Publisher
5. NPTEL Lectures in Power Electronics.

ELE-613T - Renewable Energy Sources

L	P
4	0

UNIT I

Conventional & Non-conventional Energy resources, Energy problem, Energy & Environment, Need for renewable energy, Relevant energy conversion systems & Technologies, Electricity generation, Rural Energy.

UNIT II

Wind Energy: Principles of Power Generation from wind, site selection, wind speed & power duration curves, wind power system components, Wind-Diesel Hybrid systems & recent developments.

UNIT III

Solar Energy: Solar cell, principle and operation. Solar module & array, solar radiation, solar collectors – flat plate & concentrating collectors, solar water heaters & solar thermal power plants. solar wind Diesel system – operation & design. Miscellaneous Applications

UNIT IV

Electric Power Generation from Tidal, OTEC & Geothermal energy. Simple power plant based on Tidal / OTEC / Geothermal.
Direct Energy Conversion techniques, MHD & Thermo-Electric power generation.

UNIT V

Energy conservation, Energy conservation in Transport sector, rural energy, urban energy, Industrial energy, power generation & distribution, Energy efficient buildings, Energy audit, Typical case studies.

Books Recommended

1. Non-Conventional Energy Resources, R.K Singal, Dhanpat Rai Publications.
2. Energy Technology, S. Rao, B.B Parlekar, Khanna Publications.
3. Wind & Solar Power System, CRC Press.
4. Principle of Energy Conversion, Culp, McGraw Hill Publications.

ECE- 618T - Communication Systems

L	P
4	0

UNIT I

Amplitude modulation (AM): definition, AM modulation index, Spectrum of AM signal, Power analysis of AM signal, Standard AM generation, Detection using envelop detector. DSB/SC-AM, Generation & detection of SSB-SC modulation, Vestigial Side band A M signal (Brief ideas).

UNIT II

Frequency modulation (FM): Basic definition, Frequency modulation index, Carson Bandwidth of FM signal, Narrow band and broad band FM signal. Generation of FM, Detection of FM, pre-emphasis, de-emphasis, FM threshold effect

UNIT III

Elements of digital communication systems, advantages of digital communication systems, Elements of PCM : Sampling, Quantization and Coding, Quantization error (proof not required), Differential PCM systems(DPCM), Delta modulation, its drawbacks, adaptive delta modulation, comparison of PCM and DM systems. Digital Modulation techniques, ASK, FSK, PSK, DPSK, DEPSK, QPSK, M-ary PSK, ASK, FSK.

UNIT IV

Frequency division multiplexing (FDM), Tuned radio frequency receiver, Heterodyne receiver, Image frequency, Pulse modulation Techniques-Pulse Amplitude modulation (PAM), Pulse Position Modulation (PPM) Pulse Width Modulation (PWM).

UNIT V

Definition of noise, Sources of noise, Noise power, White noise, Band limited white noise, signal to noise ratio, SNR of base band communication system, SSB, DSB/SC, Standard-AM, SNR of FM, Noise figure, Relative performance.

Books Recommended:

1. Principles of communication system, Taub and Schilling, Mcgraw Hill, 3rd Ed.
2. Communication system; Analog and Digital, Sanjay Sharma
3. Modern Analog and Digital Communication system by Lathi
4. Communication System by Simon Hykin
5. Electronic Communications, Roody- Coolan, PHI

Department Of Electrical Engineering

ELE – 614P – Power System-II Lab

L	P
0	2

1. To measure positive, negative and zero sequence reactance of synchronous machine
2. Measurement of positive, negative and zero sequence impedance and currents.
3. Measurement of earth resistance.
4. To Study The Single Line To Ground Fault
5. To Study Line To Line Fault
6. Use of MATLAB/SIMULINK for Power System Analysis.

ELE – 615P – Power Electronics Lab

L	P
0	2

1. V-I static Characteristics of Thyristors.
2. Switching characteristics of various power electronic devices.
3. Various triggering Methods and Protection Circuits of SCR.
4. Different types of diode rectifiers and controlled rectifiers (Comparison and analysis for different types of loads).
5. Realization of the above using MATLAB/SIMULINK and SimPowerSystem software.
6. DC chopper circuits.
7. Operation of VSI and CSI
8. Operation of AC voltage controllers (Analysis for different types of loads).
9. Speed control of DC motor.

Department Of Electrical Engineering

7th Semester

Course Code	Course Title	Type of Course	L – P	Credit
ELE-711T	Switchgear & Protection	C	4 – 0	4
ELE-712T	Advanced Power Electronics	C	4 – 0	4
ECE-718T	Digital Signal Processing	C	4 – 0	4
XXX-xxxX	Elective-VI	E		X
XXX-xxxX	Elective-VII	E		Y
ELE-713P	Switchgear & Protection Lab	C	0 – 2	1
ELE-714P	Advanced Power Electronics Lab	C	0 – 2	1
ELE-715P	Preliminary Project Work	C	0 – 4	2
ELE-716P	Practical Training	C		2
	Total Credits		**12 - 8**	**18+X+Y**

ELE - 711T – Switchgear and Protection

L	P
4	0

UNIT I

Function of protective relaying, fundamental principles, primary and backup relaying, functional characteristics. Operating principles and characteristics of the following electromechanical relays: Current, voltage, directional, current balance, voltage balance, differential relays, and distance relays.

UNIT II

Short- circuit protection of stator windings, protection against turn-to-turn fault, stator ground-fault protection, stator open circuit protection, Overheating protection, Overvoltage protection, Loss of excitation protection, rotor overheating protection, Short circuit protection, over current and earth-fault protection differential protection. Buchholz relay, protection of parallel transformer banks, etc.

UNIT III

Protection of feeders, time limit fuse, over current protection for radial feeders, protection of parallel feeders, differential protection for parallel feeders, protection of ring mains, differential pillot wire protection, Circulating current protection, protection for bus-bars, differential protection, for bus bars, protection for double bus-bar system, transmission line protection, using over -current relays and distance relays. Setting of over-current and distance relays, coordination of relays. Phase fault and earth fault protection.

UNIT IV

Types of circuit breakers , basic principle of operation, phenomena of arc, initiation of arc, maintenance of arc, arc extinction, arc voltage and current waveforms in AC circuit breaking, re-striking and recovery voltages, de-ionization and current chopping, ratings of circuit breakers.

UNIT V

Fusing element, classification of fuses, current carrying capacity of fuses, high rupturing capacity (H.R.C.) cartridge fuses, characteristics of H.R.C. fuses, selection of HRC fuses.

Books Recommended:

1. Art and Science of Protective Relaying by Mason.
2. Protective relaying, Principles and Applications by J. L Black Burn
3. Computer Relaying for Power Systems, by A.G. Phadke and J.S Thorp.
4. Power System Protection and Switchgear by B. Ravindranath and M. Chander.

ELE – 712T – Advanced Power Electronics

L	P
4	0

Unit-1

Switched -Mode Power Supplies (SMPS), Advantages of Switching Power Supplies over Linear Power Supplies.

Unit-2

Non-Isolated DC-DC Converters: DC-DC Buck Converter, DC-DC Boost Converter, DC-DC Buck Boost Converter, DC-DC Cuk Converter.

Unit-3

Isolated DC-DC Converters; DC-DC Flyback Converter, DC-DC Forward Converter, DC-DC Push-Pull Converter, DC-DC Half Bridge Converter, DC-DC Full Bridge Converter.

Unit-4

Design aspects of Magnetics for DC-DC Converters, PWM Techniques for DC-DC Converter.

Unit-5

Uninterruptible Power Supply (UPS): Off Line UPS, On- Line UPS, Rating of Battery Bank, Calculation of Back-up-time. Introduction to AC-DC Improved Power Quality Converters.

Books Recommended:

1. Power Electronics Converters, Applications, and Design by Mohan, Undeland, Robbins Wiley Indian Edition.
2. Power Electronics by M. H. Rashid
3. Power Electronics and Motor Drives: Advances and Trends by Bimal K. Bose Academic Press
4. FACTS Controllers by Hingorani
5. IEEE Transactions on Power Electronics & Industrial Electronics

ECE - 718T – Digital Signal Processing

L	P
4	0

UNIT I

Basic elements of digital signal Processing –Concept of frequency in continuous time and discrete time signals – Sampling theorem –Discrete time signals. Discrete time systems –Analysis of Linear time invariant systems –Z transform –Convolution.

UNIT II

Introduction to DFT – Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms – Use of FFT algorithms in Linear Filtering and correlation.

UNIT III

Structure of IIR – System Design of Discrete time IIR filter from continuous time filter – IIR filter design by Impulse Invariance.Bilinear transformation – Approximation derivatives – Design of IIR filter in the Frequency domain.

UNIT IV

Symmetric & Anti-symmetric FIR filters – Linear phase filter – Windowing technique –

Rectangular, Kaiser Windows – Frequency sampling techniques – Structure for FIR systems.

UNIT V

Quantization noise – derivation for quantization noise power – Fixed point and binary floating point number representation – comparison – over flow error – truncation error – co-efficient quantization error - limit cycle oscillation – signal scaling – analytical model of sample and hold operations – Application of DSP – Model of Speech Wave Form – Vo-coder.

Books Recommended:

1. A.V Oppenheim and R. W Schafer: Discrete Time Signal Processing.
2. John G. Proakis and D.G Manolavis: Digital Signal Processing Principles, Algorthins and Applications.
3. J.R Johnson : Introduction To Digital Signal Processing.
4. L.R Rabinder and B. Gold :Theory and Application of Digital Signal Processing.

ELE – 713P – Switchgear and Protection Lab

L	P
0	2

1. To study I.D.M. T. Over current relay (electro mechanical type)
2. To study Percentage Differential Relay
3. To study the instantaneous relay and determine the pick up and reset values.
4. Operating quantity versus polarizing quantity characteristic of a directional attracted armature relay.
5. To study the earth fault relay and determine the characteristics.
6. Characteristics of inverse time over current relays.
7. Time graded protection using inverse time O/C relays
8. Characteristics of fuses of different relays.
9. Study of circuit breakers.
10. Study of differential protection scheme.
11. Study of an oil circuit breaker.

Department Of Electrical Engineering

8th Semester

Course Code	Course Title	Type of Course	L – P	Credit
ELE-811T	Utilization of Electrical Energy	C	3 – 0	3
ELE-812T	Electrical Drives	C	4 – 0	4
XXX-xxxX	Elective-VIII	E		X
XXX-xxxX	Elective-IX	G		Y
ELE-813P	Project	C	0 – 18	10
ELE-814P	Electrical Drives Lab	C	**0 -- 2**	**1**
	Total Credits		**7- 20**	**18+X+Y**

ELE – 811T – Utilization of Electrical Energy

L P
3 0

UNIT I

Electric Traction: Introduction, requirements of an ideal traction, systems of traction, speed time curve, tractive effort, co-efficient of adhesion, selection of traction motors, method of speed control, energy saving by series parallel control, ac traction equipment. Braking methods used in Traction Motor.

UNIT II

Electric and Hybrid Vehicles: Configuration and performance of electrical vehicles, traction motor characteristics, tractive effort, transmission requirement, vehicle performance and energy consumption

UNIT III

Illumination: Laws of illumination, lighting calculation, factory lighting, flood lighting, street lighting, different types of lamps-incandescent, fluorescent, vapour, CFL and LED lamps and their working, comparison, Glare and its remedy

UNIT IV

Heating and Welding: Advantages and methods of electric of heating, resistance ovens, induction heating, dielectric heating, the arc furnace, heating of building. Electric welding, resistance and arc welding

Book s Recommended:

1. Utilization Of Electric Energy, E Openshaw Taylor 12th Impression, 2009, Universities Press
2. Modern Electric, Hybrid Electric and Fuel Cell Vehicles, E. Gay, Mehrdad, Ehsani, Yimin Gao, Sabastien. Ali Emadi, CRC Press.
3. Art & utilization of Electric Energy, H. Partab.
4. Utilization of Electric Power & Electric Traction J.B Gupta

ELE – 812T – Electrical Drives

L P

4 0

UNIT I

Definition of Electric Drive, Structure and Elements of an Electric Drive, classification of Electric Drives Advantages of Electrical Drives, Types of Loads, Quadrant Diagrams, Four quadrant operation, Power requirement of different loads, Drive specifications.

UNIT II

Multi-Quadrant operation of separately-excited D.C Motor with regenerative braking, Transfer functions of separately excited D.C Motor, Single-phase converter-fed separately excited D.C Motor Drives, Mathematical Analysis and Torque/speed characteristics, performance evaluation (in Continuous Conduction Mode and Discontinuous Conduction Mode), Methods of improving the performance of DC Motor Drives, Three-phase converter fed DC Motor Drives (in Continuous Conduction Mode and Discontinuous Conduction Mode),

UNIT III

Motoring and regeneration operation of chopper-fed separately-excited DC Motor Drive, Chopper-fed series motor drive, Dynamic braking, Composite braking, Two quadrant and Four quadrant operation of chopper-fed DC Motor Drives

UNIT IV

3-phase AC voltage controller-fed Induction Motor drive, voltage source inverter (VSI) and current source inverter (CSI) variable frequency drives, comparison of VSI and CSI drives, Cyclo-converter fed Induction Motor drive, static rotor resistance control of 3-phase slip ring Induction Motor.

UNIT V

Control of synchronous Motor: Self-controlled synchronous motor, vector controlled synchronous motor, Permanent Magnet Synchronous Motor Drive, Brushless DC Motor Drive, Switched Reluctance Motor (SRM) Drive.

Books Recommended:

1. An Introduction to Electrical Drives by G.K. Dubey.
2. Power Semi-conductor controlled Drives by G.K. Dubey
3. Power Electronic Control of A.C Motors by Murphy & Turnbull
4. Power Electronics and A.C Drives by B.K. Bose

Department Of Electrical Engineering

ELE – 814P – Electrical Drives Lab

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1. Operation of 3- phase Full-Converter on R & R-L load.

2. Performance & speed control of D.C. drive using 3-phase full Converter.

3. Performance & Operation of a four quadrant Chopper on D.C. Drive

4. Performance & Operation of a 3-phase A.C. Voltage controller on motor load.

5. Single Phase IGBT based PWM Inverter on R & R-L load

6. Operation of 3-phase IGBT based PWM Inverter on R & R-L load.

7. Performance & speed control of 3 phase slip ring Induction motor by Static Rotor Resistance controller.

8. Simulation of various drives using MATLAB/SIMULINK