GODAVARI INSTITUTE OF ENGINEERING & TECHNOLOGY

Department of ELECTRICAL & ELECTRONICS ENGINEERING

COURSE STRUCTURE

B. Tech. ELECTRICAL & ELECTRONICS ENGINEERING

IV YEAR **I SEMESTER**

S. No.	Subject Code	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
			L	T	P		Int.	Ext.	Total
1	14120701	Utilization of Electrical Energy*	3	1	-	3	30	70	100
2	14124702	Principles of Signal	3	1	-	3	30	70	100
3	14120703	Power System Operation & Control	3	1	-	3	30	70	100
4		**Elective-I**	3	1	-	3	30	70	100
	14120764a	High Voltage Engineering							
	14124764b	Electronic Instrumentation and Automation system							
	14120764c	Renewable Energy Sources and Systems							
	14124764d	VLSI Design							
5		**Elective – II**	3	1	-	3	30	70	100
	14120765a	Electrical Machine Design							
	14120765b	Electrical Distribution							
	14123765c	Optimization Techniques							
	14124765d	Embedded Systems							
6	14120711	Power Systems Lab			3	2	50	50	100
7	14124712	Microprocessors & Microcontrollers and its applications Lab	-	-	3	2	50	50	100
8	14120713	Electrical Simulation Lab	-	-	3	2	50	50	100
9	14120731	Summer Internship	-	-	4	3	100	-	100
		Total	**15**	**5**	**13**	**24**	**400**	**500**	**900**

L- LECTURE T- TUTORIAL P – PRACTICAL Int. – INTERNAL Ext. – EXTERNAL C –CREDITS

IV YEAR **II SEMESTER**

S. No.	Subject Code	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
			L	T	P		Int.	Ext.	Total
1	14120801	Energy Audit, Conservation & Management*	3	1	-	3	30	70	100
2		**Elective – III**	3	1	-	3	30	70	100
	14120862a	Advanced Control Systems							
	14120862b	Special Electrical Machines							
	14120862c	Extra High Voltage transmission							
3		**Elective – IV**	3	1	-	3	30	70	100
	14120863a	Electric Power Quality							
	14120863b	FACTS: Flexible Alternating Current Transmission Systems							
	14120863c	Smart Grid							
4		**Elective – V**	3	1	-	3	30	70	100
	14125864a	OOPS Through JAVA							
	14125864b	DBMS							
	14125864c	UNIX and Shell Programming							
	14125864d	Artificial Intelligence							
5	14120841	Project	-	-	-	9	60	140	200
		Total	**12**	**4**	**-**	**21**	**180**	**420**	**600**

L- LECTURE T- TUTORIAL P – PRACTICAL Int. – INTERNAL Ext. – EXTERNAL C – CREDITS

IV YEAR – I SEMESTER	T	P	C
	3+1	0	3
Sub Code:14120701	**UTILIZATION OF ELECTRICAL ENERGY**		

Course Objective	Course Outcome
• To acquaint with the different types of heating and welding techniques.	• Able to identify most appropriate heating or welding techniques for suitable applications.
• To study the basic principles of illumination and its measurement.	• Able to understand various level of illuminosity produced by different illuminating sources.
• To understand different types of lightning system including design.	• Able to estimate the illumination levels produced by various sources and recommend the most efficient illuminating sources and should be able to design different lighting systems by taking inputs and constraints in view.
• To understand the operating principles and characteristics of traction motors with respect to speed, temperature ,loading conditions.	• Able to identify a suitable motor for electric drives and industrial applications
• To understand the basic principle of electric traction including speed–time curves of different traction services.	• Able to determine the speed/time characteristics of different types of traction motors.
• To understand the method of calculation of various traction system for braking, acceleration and other related parameters, including demand side management of energy.	• Able to estimate energy consumption levels at various modes of operation.

UNIT – I

Electric Heating: Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating.

Electric Welding: Electric welding–Resistance and arc welding–Electric welding equipment– Comparison between AC and DC Welding

UNIT – II

Illumination fundamentals: Introduction, terms used in illumination–Laws of illumination–Polar curves– Integrating sphere–Lux meter–Sources of light

UNIT – III

Various Illumination Methods: Discharge lamps, MV and SV lamps – Comparison between tungsten filament lamps and fluorescent tubes–Basic principles of light control– Types and design of lighting and flood lighting–LED lighting.

UNIT – IV

Selection of Motors: Choice of motor, type of electric drives, starting and running characteristics– Speed control–Temperature rise–Applications of electric drives–Types of industrial loads–continuous– Intermittent and variable loads–Load equalization.

UNIT – V

Electric Traction – I: System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor– Mechanics of train movement–Speed–time curves for different services – Trapezoidal and quadrilateral speed time curves.

UNIT – VI

Electric Traction – II: Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation–Adhesive weight and braking retardation adhesive weight and coefficient of adhesion– Principles of energy efficient motors.

Text Books:

1. Utilization of Electric Energy – by E. Openshaw Taylor, Orient Longman.
2. Art & Science of Utilization of electrical Energy – by Partab, DhanpatRai & Sons.

Reference Books:

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
2. Generation, Distribution and Utilization of electrical Energy – by C.L. Wadhwa, New Age International (P) Limited, Publishers, 1997.

IV YEAR – I SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14124702	**PRINCIPLES OF SIGNAL PROCESSING**		

Course Objective: The student will be able to

- **Know the basics of signals and systems.**
- **Understand the applications of Fourier transform and Laplace transform.**
- **Use convolution, Z-transforms and inverse Z-transforms.**
- **Define and use discrete Fourier transform and fast Fourier transform.**
- **Understand simple finite impulse response filter.**
- **Learn to program a DSP processor to filter signals.**

UNIT – I

Objective: To study the different types of signals, properties of systems, trigonometric and exponential Fourier series.

Introduction to Signals and Systems: Classification of signals, singularity functions – Impulse, step, ramp functions, Sampling, aliasing, impulse response, Concept of orthogonality in signals, Trigonometric and exponential Fourier series, representation of periodic functions by Fourier series , LTI systems, convolution, difference equations.

UNIT – II

Objective: To learn the concepts of Fourier and Laplace transforms.

Transforms and their applications to signals and systems – Fourier transform definition, properties of Fourier transform. Laplace transform and Frequency domain analysis.

UNIT – III

Objective: To study the basic concepts of discrete time signals and systems and also Z-transforms.

Discrete Time Signals & Systems: Discrete time signals, representation, operations on sequences, discrete time systems and classification, Linear Convolution.
Z-Transforms: ROC, properties of Z-Transforms, Inverse Z-Transforms.

UNIT – IV

Objective: To study the applications of Fourier transforms to the discrete time systems and fast Fourier transforms.

Discrete Fourier Transform (DFT): Discrete-Time Fourier Transform (DTFT), Discrete- Fourier Transform (DFT), properties, computation of DFT.
Fast Fourier Transform: Fast Fourier Transforms (FFT), Radix-2 decimation-in-time and decimation-in -frequency algorithms, Inverse FFT.

UNIT-V
Objective: To study the realization of digital filters and their design.

Design of Digital Filter : Design of IIR filters from analog filters, Butterworth filters, Chebyshev filters, Impulse invariant, Bilinear Transform, frequency transformations, Filter structures, design examples.

Design of FIR filters: Design of IIR filters, Fourier series method, window function technique, Filter structures, design examples comparison between IIR and FIR filters.

UNIT-VI
Objective: To study the architecture of digital signal processors.

Introduction to digital signal processor :TMS320C5X introduction, architecture, pipeling, addressing modes, bus structure, memory access schemes,onchip peripherals, applications of DSP in electrical engineering: motor speed control

Text Book:

1. B.P. Lathi, "Signals & Systems and Communication" - BSP ISBN: 8178000164
2.John G. Proakis, Dimitris G. Manolakis,, "Digital signal processing, principles, Algorithms and applications", Pearson Education/PHI, 4th ed., 2007
3.Digital signal processors – Architecture, programming and applications, B. Venkataramani, M. Bhaskar, TATA McGraw Hill, 2002

References:

1.Sanjay K.Mitra- Digital signal processing- A computer based approach, TMH.
2. Tarun Rawat, "Signals and Systems", Oxford publications *ISBN*: 9780198066798
3. Oppenheim, Willsky & Young; "Signals and Systems", PHI, EEE, New Delhi ISBN: 978-81-203-1246-3

IV YEAR – I SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14120703	**POWER SYSTEM OPERATION AND CONTROL**		

Course Objective	Course Outcome
• To understand optimal dispatch of generation with and without losses	• Able to compute optimal scheduling of Generators.
• To study the optimal scheduling of hydro thermal systems.	• Able to understand hydrothermal scheduling
• To study the optimal unit commitment problem	• Able to Understand the unit commitment problem.
• To study the load frequency control for single area system	• Able to understand importance of the frequency.
• To study the PID controllers for single area system and two area system.	• Able to Understand importance of PID controllers in single area and two area systems.
• To understand the reactive power control and compensation of transmission lines.	• Able to understand reactive power control and line power compensation.

UNIT–I

Economic Operation of Power Systems: Optimal operation of Generators in Thermal power stations, – Heat rate curve– Cost Curve – Incremental fuel and Production costs – Input–output characteristics – Optimum generation allocation with line losses neglected – Optimum generation allocation including the effect of transmission line losses – Loss Coefficients – General transmission line loss formula.

UNIT–II

Hydro thermal Scheduling: Optimal scheduling of Hydrothermal System**:** Hydroelectric power plant models – Scheduling problems – Short term Hydrothermal scheduling problem.

UNIT–III

Unit Commitment: Optimal unit commitment problem – Need for unit commitment – Constraints in unit commitment – Cost function formulation – Solution methods – Priority ordering – Dynamic programming.

UNIT–IV

Load Frequency Control: Modeling of steam turbine – Generator – Mathematical modeling of speed governing system – Transfer function – Modeling of Hydro turbine – Necessity of keeping frequency constant – Definitions of Control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case – Load frequency control of two area system – Uncontrolled case and controlled case – Tie–line bias control.

UNIT–V

Load Frequency Controllers: Proportional plus Integral control of single area and its block diagram representation – Steady state response – Load Frequency Control and Economic dispatch control.

UNIT–VI

Reactive Power Control: Overview of Reactive Power control – Reactive Power compensation in transmission systems – Advantages and disadvantages of different types of compensating equipment for transmission systems – Load compensation – Specifications of load compensator – Uncompensated and compensated transmission lines**:** Shunt and series compensation – Need for FACTS controllers.

Text Books:

1. Electric Energy systems Theory – by O.I.Elgerd, Tata McGraw–hill Publishing Company Ltd., Second edition.
2. Power System stability & control, Prabha Kundur,TMH
3. Modern Power System Analysis – by I.J.Nagrath & D.P.Kothari Tata Mc Graw – Hill Publishing Company Ltd, 2nd edition.

Reference Books:

1. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma, THOMPSON, 3rd Edition.
2. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
3. Power System Analysis by Hadi Saadat – TMH Edition.

IV YEAR – I SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14120764a	**HIGH VOLTAGE ENGINEERING (ELECTIVE – I)**		

Course Objective	Course Outcome
• To understand electric field distribution and computation in different configuration of electrode systems.	• To be acquainted with the performance of high voltages with regard to different configurations of electrode systems.
• To understand HV breakdown phenomena in gases, liquids and solids dielectric materials.	• To be able to understand theory of breakdown and withstand phenomena of all types of dielectric materials.
• To acquaint with the generating principle of operation and design of HVDC, AC and Impulse voltages and impulse currents.	• To acquaint with the techniques of generation of AC,DC and Impulse voltages.
• To understand various techniques of AC, DC and Impulse measurement of high voltages and currents.	• To be able to apply knowledge for measurement of high voltage and high current AC, DC and Impulse.
• To understand the insulating characteristics of dielectric materials.	• To be in a position to measure dielectric property of material used for HV equipment.
• To understand the various testing techniques of HV equipments.	• To know the techniques of testing various equipment's used in HV engineering.

UNIT–I

Introduction to High Voltage Technology: Electric Field Stresses – Uniform and non–uniform field configuration of electrodes – Estimation and control of electric Stress – Numerical methods for electric field computation.

UNIT–II

Break down phenomenon in gaseous, liquid and solid insulation: Gases as insulating media – Collision process – Ionization process – Townsend's criteria of breakdown in gases – Paschen's law – Liquid as Insulator – Pure and commercial liquids – Breakdown in pure and commercial liquid – Intrinsic breakdown – Electromechanical breakdown – Thermal breakdown –Breakdown of solid dielectrics in practice – Breakdown in composite dielectrics used in practice.

UNIT–III

Generation of High voltages and High currents: Generation of high DC voltages – Generation of high alternating voltages – Generation of impulse voltages – Generation of impulse currents – Tripping and control of impulse generators.

UNIT–IV

Measurement of high voltages and High currents: Measurement of high AC, DC and Impulse voltages – Voltages and measurement of high currents – Direct, alternating and Impulse.

UNIT–V

Non–destructive testing of material and electrical apparatus: Measurement of DC resistivity – Measurement of dielectric constant and loss factor – Partial discharge measurements.

UNIT–VI

High voltage testing of electrical apparatus: Testing of insulators and bushings – Testing of isolators and circuit breakers– Testing of cables – Testing of transformers – Testing of surge arresters – Radio interference measurements.

Text Books:

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition.
2. High Voltage Engineering : Fundamentals by E.Kuffel, W.S. Zaengl, J. Kuffel by Elsevier, 2nd Edition.
3. High Voltage Engineering and Technology by Ryan, IET Publishers.

Reference Books:

1. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 1997.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New. Age International (P) Limited, 1995.

IV YEAR – I SEMESTER	T	P	C
	3+1	0	3
Sub Code:14124764b	**ELECTRONIC INSTRUMENTATION AND AUTOMATION SYSTEM**		

Course objective*:* Students will able:

- **To study various types of signals and their representation**
- **To study various types of of transducers: electrical , mechanical, electro mechanical and optical etc**
- **To study and measure the various types of non electrical quantities**
- **To analyze the structure of automation system.**
- **To learn the concepts of special purpose DAC and different types of automation system.**
- **To study different applications of automation system.**

UNIT–I

Objective: To Study various types of signals and their representation

Signals and their representation

Measuring Systems, Performance Characteristics, – Static characteristics – Dynamic Characteristics – Errors in Measurement – Gross Errors – Systematic Errors – Statistical analysis of random errors – Signal and their representation – Standard test, periodic, aperiodic, modulated signal – Sampled data pulse modulation and pulse code modulation.

UNIT–II:

Objective: To Study various types of transducers, electrical, mechanical, electromechanical and optical etc.,

Transducers

Definition of transducers – Classification of transducers – Advantages of Electrical transducers – Characteristics and choice of transducers – Principle operation of resistor, inductor, LVDT and capacitor transducers – LVDT Applications, Strain gauge and its principle of operation – Gauge factor, Thermistors – Thermocouples – Synchros – Piezo electric transducers – Photo diodes, MEMS-nano sensor digital transducers.

UNIT–III

Objective: To study and measure various types of Non-electrical quantities.

Measurement of Non–Electrical Quantities

Measurement of strain – Gauge Sensitivity – Displacement – Velocity – Angular Velocity – Acceleration – Force – Torque – Measurement of Temperature, Pressure, Vacuum, Flow, Liquid level.

UNIT-IV
Objective: To analyze the structure of automation system.

Automation system structure
Definition, sub-systems, data acquisition control unit(DAC),data analysis, decision making and control execution, control actuation, final control elements, control strategies, stand alone and communicability.

UNIT–V
Objective: To learn the concepts of special purpose DAC and different types of automation system.

Special purpose DAC
PID, PLC, loop controller, remote terminal unit.
Types of automation system
Need, centralized control system, distributed control system, network control system, supervisory control and data acquisition system(SCADA),evolution, similarities with DCS and NCS, automation system functionalities.

UNIT–VI
Objective: To study different applications of automation system.

Practical automation system case study
Traffic signal automation with PLC, engine, speed automation with loop controller, electrical sub-station automation with DCS, power plant automation with DCS, railway traction power supply automation with MCS.

Text Books:

1. Electronic Instrumentation–by H.S.Kalsi Tata McGraw–Hill Edition, 1995.
2. Process control instrumentation technical, CD JHONSON
3. Instrument engineering Hand book-vol1, vol2, BG LIPTAK.

Reference Books:

1. Overview of industrial process Automation, K.L.S.Sharma, IIIT Bangalore.
2. Fundamentals of industrial control, D.E.Coggan.
3. Understanding distributed processor systems for control- SM Herb, ISA

IV YEAR – I SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14120764c	**RENEWABLE ENERGY SOURCES AND SYSTEMS**		

Course Objective	Course Outcome
• To study the solar radiation data, extra terrestrial radiation, radiation on earth's surface.	• Analyze solar radiation data, extraterrestrial radiation, radiation on earth's surface.
• To study solar photo voltaic systems.	• Design solar photo voltaic systems.
• To study solar thermal collections.	• Design solar thermal collections.
• To study maximum power point techniques in solar pv and wind.	• Develop maximum power point techniques in solar PV and wind
• To study wind energy conversion systems, Betz coefficient, tip speed ratio.	• Able to wind energy conversion systems, Betz coefficient, tip speed ratio.
• To study basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.	• Basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.

UNIT–I

Fundamentals of Solar Energy Systems

Energy conservation principle – Energy scenario (world and India) – Solar radiation**:** Outside earth's atmosphere – Earth surface – Analysis of solar radiation data – Geometry – Radiation on tilted surfaces – Numerical problems.

UNIT–II

Solar Photovoltaic Systems: Balance of systems – IV characteristics – System design**:** storage sizing – PV system sizing – Maximum power point techniques**:** Perturb and observe (P&O) technique – Hill climbing technique

UNIT–III

Solar Thermal Systems: Liquid flat plate collections**:** Performance analysis – Transmissivity – Absorptivity product collector efficiency factor – Collector heat removal factor – Numerical problems. Introduction to solar air heaters – Concentrating collectors and solar pond.

UNIT–IV

Wind Energy: Wind patterns – Types of turbines – Kinetic energy of wind – Betz coefficient – Tip–speed ratio – Efficiency – Power output of wind turbine – Selection of generator(synchronous, induction) – Maximum power point tracking.

UNIT–V

Hydro and Tidal power systems: Hydro systems**:** Basic working principle –Large, small, micro – measurement of head and flow – Energy equation – Types of turbines – Numerical problems. Tidal power – Basics – Kinetic energy equation – Numerical problems – Wave power – Basics – Kinetic energy equation.

UNIT–VI

Biomass, fuel cells and geothermal systems: Biomass Energy**:** Fuel classification – Pyrolysis – Direct combustion of heat– Different digesters and sizing.
Fuel cell**:** Classification – Efficiency – VI characteristics.
Geothermal**:** Classification – Dry rock and acquifer – Energy analysis.

Text Books:

1. Solar Energy**:** Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, TMH, New Delhi, 3rd Edition.
2. Renewable Energy Resources, John Twidell and Tony Weir, Taylor and Francis -second edition, 2013.
3. Energy Science**:** Principles, Technologies and Impacts, John Andrews and Nick Jelly, Oxford.

Reference Books:

1. Renewable Energy- Edited by Godfrey Boyle-oxford university, press, 3rd edition, 2013.
2. Handbook of renewable technology Ahmed and Zobaa, Ramesh C Bansal, World scientific, Singapore.
3. Renewable Energy Technologies /Ramesh & Kumar /Narosa.
4. Renewable energy technologies – A practical guide for beginners – Chetong Singh Solanki, PHI. Non conventional energy source –B.H. Khan- TMH-2nd edition.

IV YEAR – I SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14124764d	**VLSI DESIGN**		

Course Objective: *The student will be introduced to*

- *Use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnects*

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- *Learn the various fabrication steps of IC and come across basic electrical properties of MOSFET.*
- *Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect and to verify the functionality, timing, power and parasitic effects.*
- *The concepts and techniques of modern integrated circuit design and testing (CMOS VLSI).*
- *Design static CMOS combinational and sequential logic at the transistor level, including mask layout.*

UNIT –I

Objective: To learn the various fabrication steps of IC

Introduction

Introduction to IC technology – The IC era – MOS and related VLSI technology – Basic MOS transistors – Enhancement and depletion modes of transistor action – IC production process – MOS and CMOS fabrication process – BiCMOS technology – Comparison b/w CMOS and bipolar technologies.

UNIT – II

Objective: To learn basic electrical properties of MOSFET.

Basic electrical properties of MOS and BiCMOS circuits

I_{ds}–V_{ds} relationships – Aspects of MOS transistor threshold voltage – MOS Trans–conductance and output conductance – MOS Transistor – Figure of merit – The pMOS transistor – The nMOS inverter – Determination of pull– up to pull–down ratio for nMOS inverter driven by another nMOS inverter for an nMOS inverter driven through one or more pass Transistors – Alternative forms of pull up – The CMOS Inverter MOS transistor Circuit model – Bi–CMOS Inverters.

UNIT – III

Objective: To Apply CMOS technology specific layout rules in the placement and routing of transistors and interconnections.

MOS and BiCOMS circuit design processes

MOS layers – Stick diagrams – Design rules and layout – General observation on the design rules, 2μm double metal, double poly – CMOS/BiCMOS rules, 1.2μm Double metal, Double poly CMOS rules – Layout diagrams of NAND and NOR gates and CMOS inverter – Symbolic Diagrams – Translation to Mask Form.

UNIT – IV

Objective: To understand the basic circuit concepts MOS circuits.

Basic circuit concepts

Sheet resistance – Sheet resistance concept applied to MOS transistor and inverters – Area capacitance of layers – Standard unit of capacitance – Some area capacitance calculations – The delay unit – Inverter delays – Driving large capacitive loads – Propagations Delays – Wiring Capacitance – Fan–in and Fan–out characteristics – Choice of layers – Transistor switches – Realization of gates using nMOS, pMOS and CMOS technologies.

UNIT – V

Objective: To understand the scaling factors of MOS circuits.

Scaling of MOS circuit

Scaling models and scaling factors – Scaling factors for device parameters – Limitations of scaling – Limits due to sub threshold currents – Limits on logic level and supply voltage due to noise – Limits due to current density – Some architectural Issues – Introduction to switch logic and gate logic.

UNIT – VI

Objective: To understand the concepts of VHDL modeling.

Digital design using HDL

Digital system design process – VLSI Circuit Design Process – Hardware simulation – Hardware Synthesis – History of VHDL – VHDL requirements– Levels of abstraction – Elements of VHDL – Packages – Libraries and bindings – Objects and classes – Variable assignments – Sequential statements – Usage of subprograms – Comparison of VHDL and verilog HDL.

VHDL Modelling

Simulation – Logic Synthesis – Inside a logic synthesizer – Constraints – Technology libraries – VHDL and logic synthesis – Functional gate – Level verification – Place and route – Post layout timing simulation – Static timing– Major net list formats for design representation – VHDL synthesis – Programming approach.

Text Books:

1. Essentials of VLSI Circuits and Systems–Kamran Eshraghian, Douglas and A.Pucknell and Sholeh Eshraghian, Prentice–Hall of India Private Limited, 2005 Edition.
2. VLSI Design–K. Lal Kishor and V.S.V.Prabhakar, I.K. International Publishing House Private Limited, 2009 First Edition.
3. VLSI Design–A.Shanthi and A.Kavitha, New Age International Private Limited, 2006 First Edition.

References Books:

1. VLSI Design by Debaprasad Das, Oxford University Press, 2010.
2. VLSI Design by A. Albert Raj & T. Latha, PHI Learning Private Limited, 2010.
3. NPTEL online courses.
4. MOOCS online courses by jntuk.

IV YEAR – I SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14120765a	**ELECTRICAL MACHINE DESIGN**		

Course Objective	Course Outcome
• To study the basic components of Electrical Machines	• Able to learn the design concepts of Electrical Machine
• To understand the concept of Armature winding both AC & DC	• Able to understand the Concept of Armature Windings.
• To understand the basic components of design of DC Machines	• Understand the Design parameters of DC Machine
• To understand the basic components of design of Transformer	• Able to understand the Design aspects of transformers.
• To understand the basic components of design of Induction motors.	• Able to understand the stator and rotor design aspects of induction motors.
• To understand the basic components of design of Synchronous Machine.	• Know the main dimensions of the synchronous machines design.

UNIT –I

Introduction to Electrical Machine Design: Design concepts, factors, Material Selection, Manufacturing techniques. Review of basic Principles, Heating & Cooling Techniques.

UNIT –II

Armature Windings (DC & AC): Single layer winding, two layer winding, lap and wave windings, concept of pole pitch, emf generation -full pitch coil, fractional pitch coil and concentrated winding.

UNIT –III

DC Machines: Constructional details – Output equation - Choice of specific electric and magnetic loadings – Separation of D and L for rotating machines. Estimation of number of conductors / turns- Coils – armature Slots – Conductor dimension – Slot dimension. Choice of number of poles – Length of air gap – Design of field system, Interpoles, Commutator and Brushes.

UNIT –IV

Transformers:Construction **–** Comparison of Core and Shell type, Single and Three phase transformer comparison. Core and Yoke Design – cross section, construction, cooling of transformers, Number of tubes. Transformer windings, Coil design, Output equation, determination of number of turns and length of mean turn of winding, Resistance, Leakage reactance, no load current calculation, losses and efficiency.

UNIT –V

Induction Machines: Principles of operation, choice of specific electric and magnetic loadings, Stator Design (Frames), output equation, choice of conductor rating, stator winding, stator slots. Squirrel cage rotor design - air gap length, rotor slots and rotor bars. Design of wound rotor - rotor slots, windings, short circuit (blocked rotor currents).

UNIT –VI

Synchronous Machines: Constructional features – short circuit ratio– Output equation – Specific loadings – Main dimensions– Stator design – Design of Salient Pole field coil.

TEXT BOOKS:

1. "Electrical Machine Design", Sawhney, Dhanpath Rai&Co

REFERENCE BOOKS:

1. "Performance and Design of DC Machines", Clayton & Hancock, ELBS.
2. "Performance and Design of AC Machines", M.G.Say; Pitman, ELBS.

IV YEAR – I SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14120765b	**ELECTRICAL DISTRIBUTION SYSTEMS**		

Course Objective	Course Outcome
• To study different factors of Distribution system	• Able to understand the various factors of distribution system
• To study and design the substations and distribution systems.	• Able to design the substation and feeders.
• To study the determination of voltage drop and power loss.	• Able to determine the voltage drop and power loss
• To study the distribution system protection and its coordination.	• Able to understand the protection and its coordination.
• To study the effect of compensation on p.f improvement.	• Able to understand the effect of compensation on p.f improvement.
• To study the effect of voltage control on distribution system.	• Able to understand the effect of voltage, current distribution system performance.

UNIT – I

General Concepts: Introduction to distribution systems, Load modeling and characteristics – Coincidence factor – Contribution factor loss factor – Relationship between the load factor and loss factor – Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

UNIT – II

Substations: Location of substations**:** Rating of distribution substation – Service area within primary feeders – Benefits derived through optimal location of substations.

Distribution Feeders: Design Considerations of distribution feeders**:** Radial and loop types of primary feeders – Voltage levels – Feeder loading – Basic design practice of the secondary distribution system.

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UNIT – III

System Analysis: Voltage drop and power–loss calculations**:** Derivation for voltage drop and power loss in lines – Manual methods of solution for radial networks – Three phase balanced primary lines.

UNIT – IV

Protection: Objectives of distribution system protection – Types of common faults and procedure for fault calculations – Protective devices**:** Principle of operation of fuses – Circuit reclosures – Line sectionalizes and circuit breakers.

Coordination: Coordination of protective devices**:** General coordination procedure, fuse-fuse, recloser-fuse, circuit breaker-fuse, circuit breaker-recloser, recloser-recloser.

UNIT – V

Compensation for Power Factor Improvement: Capacitive compensation for power–factor control – Different types of power capacitors – shunt and series capacitors – Effect of shunt capacitors (Fixed and switched) – Power factor correction – Capacitor allocation – Economic justification – Procedure to determine the best capacitor location.

UNIT – VI

Voltage Control

Voltage Control**:** Equipment for voltage control – Effect of series capacitors– Effect of AVB/AVR –Line drop compensation.

Text Book:

1. "Electric Power Distribution system, Engineering" – by TuranGonen, McGraw–hill Book Company.

Reference Books:

1. Electrical Distribution Systems by Dale R.Patrick and Stephen W.Fardo, CRC press
2. Electric Power Distribution – by A.S. Pabla, Tata McGraw–hill Publishing company, 4th edition, 1997.
3. Electrical Power Distribution Systems by V.Kamaraju, Right Publishers.

	T	P	C
IV YEAR – I SEMESTER	3+1	0	3
Sub Code: 14123765c	**OPTIMIZATION TECHNIQUES**		

UNIT – I

Learning Objective: To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.

Introduction and Classical Optimization Techniques

Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

Outcomes: Able to state and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.

UNIT – II

Learning Objective: To state single variable and multi variable optimization problems, without and with constraints.

Classical Optimization Techniques

Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints– Kuhn – Tucker conditions.

Outcomes: Able to apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.

UNIT – III

Learning Objective: To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.

Linear Programming

Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm - Duality in Linear Programming – Dual Simplex method.

Outcomes: Able to formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.

UNIT – IV

Learning Objective: To state transportation and assignment problem as a linear programming problem to determine optimality conditions by using Simplex method.

Transportation Problem

Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems – Special cases in transportation problem.

Outcomes: Able to solve transportation and assignment problem by using Linear programming Simplex method.

UNIT – V

Learning Objective: To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.

Nonlinear Programming:

Unconstrained cases - One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method - Univariate method, Powell's method and steepest descent method.

Constrained cases - Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem.

Outcomes: Able to apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions.

UNIT – VI

Learning Objective: To explain Dynamic programming technique as a powerful tool for making a sequence of interrelated decisions.

Dynamic Programming

Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

Outcomes: Able to Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.

Text Books:

1. "Engineering optimization: Theory and practice"-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. "Introductory Operations Research" by H.S. Kasene & K.D. Kumar, Springer (India), Pvt. LTd.

Reference Books:

1. "Optimization Methods in Operations Research and systems Analysis" – by K.V. Mital and C. Mohan, New Age International(P) Limited, Publishers, 3rd edition, 1996.
2. Operations Research – by Dr. S.D.Sharma, Kedarnath, Ramnath & Co
3. "Operations Research : An Introduction" – by H.A.Taha,PHI pvt. Ltd., 6th edition
4. Linear Programming–by G. Hadley.

IV YEAR – I SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14124765d	**EMBEDDED SYSTEMS**		

COURSE OBJECTIVES: The student will

- **Understand the basics in typical embedded system**
- **Understand the concepts of communication devices and basics integrated circuit design**
- **Understand concepts of firmware design approaches, ISR concept and interrupt servicing mechanism.**
- **Understand the basics of operating system and concept of choosing aqn RTOS**
- **Understand concepts of integrated development environment, Compiler, debugger**
- **Understand concepts of software utility tools, quality assurance and tedting of the design.**

UNIT I

Objective: To understand the building blocks of typical embedded sysyem and different memory technology and memory types.

INTRODUCTION:

Embedded systems-, Definition, History, Classification, Application areas and purpose of embedded system, the typical embedded system – Core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, PCB and passive components. Characteristics, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system.

UNIT II

Objective: To learn about communication devices and basics integrated circuit design

Embedded Hardware Design:

Analog and digital electronic components, I/O types and examples, Serial communication devices, parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

UNIT III

Objective: To learn concept of firmware design approaches, ISR concept and interrupt servicing mechanism.

Embedded Firmware Design:

Embedded Firmware Design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

UNIT IV

Objective: To understand the basics of operating system, task scheduling and learn how to choose an RTOS.

Real Time Oprating System:

Operating, system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Threads, Processes and Scheduling, Task Scheduling, Communication, Synchronization, Device Drivers, How to choose anRTOS.

Hardware Software Co-Design:

Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade offs, Intergration of Hardware and Firmware, ICE.

UNIT V

Objective: To learn about the integrated development environment, the concepts of compiler and also the debugging tools.

Embedded system development:

The integrated development environment, Types of files generated on cross-compilation, Deassembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and Tools.

UNIT VI

Objective: To learn about the software utility tool, quality assurance and testing of the design, testing on host machine and simulators.

Embedded system Implementation and Testing:

The main software utility tool, CAD and te hardware, Translation toos-Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools.

TEXT BOOKS:

1. Embedded systems Architecture by Tammy Noergaard, Elsevier Publications,2005
2. Embedded system Design, Frank Vahid, Tony Givargis, John Wiley publication

REFERENCE BOOKS:

1. Embedded Systems, Raj Kamal-Tata McGraw Hill Education Private Limited, Second Edition, 2008
2. Embedding system building blocks By Labrosses, CMP publishe.

WEB REFERENCES

1. NPTEL online courses.
2. MOOCS online courses nt JNTUK.rs.
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IV YEAR – I SEMESTER	T	P	C
	0	3	2
Sub Code: 14120711	**POWER SYSTEMS LAB**		

Learning Objectives:
To impart the practical knowledge of functioning of various power system components and determination of various parameters and simulation of load flows, transient stability, LFC and Economic dispatch.

Any 10 of the Following experiments are to be conducted:

1. Determination of ABCD parameters of Transmission network.
2. Determination of Sequence impedances of 3 phase Transformer.
3. Determination of Sequence impedances of 3 phase Alternator by Fault Analysis.
4. Determination of Sequence impedances of 3 phase Alternator by Direct method.
5. Power Angle Characteristics of 3phase Alternator with infinite bus bars.
6. Dielectric strength of Transformer oil.
7. Calibration of Tong Tester.
8. Comparison of different Load flow methods.
9. Economic load dispatch without considering losses
10. Economic load dispatch considering losses
11. Transient Stability Analysis
12. Load frequency control without controller
13. Load frequency control with controller

IV YEAR – I SEMESTER	T	P	C
	0	3	2
Sub Code: 14124712	**MICROPROCESSORS AND MICROCONTROLLERS AND APPLICATIONSLAB**		

Learning Objectives:

- To study programming based on 8086 microprocessor and 8051 microcontroller.
- To study 8056 microprocessor based ALP using arithmetic, logical and shift operations.
- To study modular and Dos/Bios programming using 8086 micro processor.
- To study to interface 8086 with I/O and other devices.
- To study parallel and serial communication using 8051 micro controller.

Any 8 of the following experiments are to be conducted :

I. Microprocessor 8086 :

Introduction to MASM/TASM.

1. Arithmetic operation – Multi byte addition and subtraction, multiplication and division – Signed and unsigned arithmetic operation, ASCII – Arithmetic operation.

2. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.

3. By using string operation and Instruction prefix**:** Move block, Reverse string Sorting, Inserting, Deleting, Length of the string, String comparison.

4. Modular Program: Procedure, Near and Far implementation, Recursion.

5. Dos/BIOS programming: Reading keyboard (Buffered with and without echo) – Display characters, Strings.

6. Interfacing 8255–PPI

7. Programs using special instructions like swap, bit/byte, set/reset etc.

8. Programs based on short, page, absolute addressing.

9. Interfacing 8259 – Interrupt Controller.

10. Interfacing 8279 – Keyboard Display.

11. Stepper motor control using 8253/8255.

Any 2 of the following experiments are to be conducted:

Microcontroller 8051

12.Reading and Writing on a parallel port.

13.Timer in different modes.

14.Serial communication implementation.

15.Understanding three memory areas of 00 – FF (Programs using above areas). Using external interrupts.

IV YEAR – I SEMESTER	T	P	C
	0	3	2
Sub Code: 14120713	**ELECTRICAL SIMULATION LAB**		

Learning objectives:

- To simulate controls & machine models.
- To simulate power system models and to study the power system analysis.
- To simulate power electronics circuits

Any 10 of the following experiments are to be conducted:

Control & Machines :

1. Simulation of transient response of RLC circuits
   a. Response to Impulse input
   b. Response to step input
   c. Response to sinusoidal input
2. Plotting of Bode plots, root locus and nyquist plots for the transfer functions of systems up to 5^{th} order.
3. Integrator & Differentiator circuits using op–amp.
4. Simulation of D.C separately excited motor using transfer function approach

Power systems:

5. Analysis of three phase circuit representing the generator transmission line and load.
6. Power system load flow using Newton–Raphson technique.
7. Modeling of transformer and simulation of lossy transmission line
8. Transient analysis of single machine connected to infinite bus (SMIB).

Power electronics:

9. Simulation of three phase full converter
10. Simulation of Boost and Buck converters
11. Simulation of single phase inverter with PWM control
12. Simulation of single–phase full converter using RLE loads and single phase AC voltage controller using RL loads.

Learning outcomes:

- Able to simulate controls & machine models
- Able to simulate transmission line models
- Able to perform transient analysis of RLC circuit and single machine connected to infinite bus (SMIB).
- Able to find load flow solution for a transmission network with Newton–Rampson method.
- Able to simulate power electronics circuits

IV YEAR – I SEMESTER	T	P	C
	-	4	3
Sub Code: 14120731	**SUMMER INTERNSHIP**		

IV YEAR – II SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14120801	**ENERGY AUDIT, CONSERVATION & MANAGEMENT**		

Course Objectives	Course Outcomes
• The student will be able to understand energy efficiency, scope, conservation and technologies.	• Able to Explain energy efficiency, conservation and various technologies
• The student will be able to design energy efficient lighting systems	• Able to Design energy efficient lighting systems.
• The student will be able to estimate/calculate power factor of systems and propose suitable compensation techniques.	• Calculate power factor of systems and propose suitable compensation techniques.
• The student will be able to understand energy conservation in HVAC systems	• To explain energy conservation in HVAC systems.
• The student will be able to calculate life cycle costing analysis and return on investment on energy efficient technologies	• Calculate life cycle costing analysis and return on investment on energy efficient technologies.
• The student will be able to understand economic aspects	• Able to formulate simple playback and net present worth method.

Unit–I

Basic Principles of Energy Audit and management

Energy audit – Definitions – Concept – Types of audit – Energy index – Cost index – Pie charts – Sankey diagrams – Load profiles – Energy conservation schemes and energy saving potential – Numerical problems – Principles of energy management – Initiating, planning, controlling, promoting, monitoring, reporting – Energy manager – Qualities and functions – Language – Questionnaire – Check list for top management.

Unit–II

Lighting

Modification of existing systems – Replacement of existing systems – Priorities**:** Definition of terms and units – Luminous efficiency – Polar curve – Calculation of illumination level – Illumination of inclined surface to beam – Luminance or brightness – Types of lamps – Types of lighting – Electric lighting fittings (luminaries) – Flood lighting – White light LED and conducting Polymers – Energy conservation measures.

Unit–III

Power Factor and energy instruments: Power factor – Methods of improvement – Location of capacitors – Power factor with non linear loads – Effect of harmonics on Power factor – Numerical problems. Energy Instruments – Watt–hour meter – Data loggers– Thermocouples – Pyrometers – Lux meters – Tong testers – Power analyzer.

Unit–IV

Space Heating and Ventilation: Ventilation – Air–Conditioning (HVAC) and Water Heating**:** Introduction – Heating of buildings – Transfer of Heat–Space heating methods – Ventilation and air–conditioning – Insulation–Cooling load – Electric water heating systems – Energy conservation methods.

Unit–V

Economic Aspects and Analysis: Economics Analysis – Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis – Energy efficient motors (basic concepts).

Unit–VI

Computation of Economic Aspects: Calculation of simple payback method – Net present worth method – Power factor correction – Lighting – Applications of life cycle costing analysis – Return on investment.

Text Books:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012
2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd–2nd edition, 1995

Reference Books:

1. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi.
2. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1st edition, 1998.
3. Energy management hand book by W.C.Turner, John wiley and sons.
4. Energy management and conservation –k v Sharma and pvenkata seshaiah-I K International Publishing House pvt.ltd,2011.
5. http://www.energymanagertraining.com/download/Gazette_of_IndiaP artIISecI-37_25-08-2010.pdf

IV YEAR – II SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14120862a	**ADVANCED CONTROL SYSTEMS (ELECTIVE – III)**		

Course Objectives	Course Outcomes
• The student will be able to review of the state space representation of a control system**:** Formulation of different models from the signal flow graph, diagonalization.	• State space representation of control system and formulation of different state models are reviewed
• The student will be able to introduce the concept of controllability and observability. Design by pole placement technique.	• Able to design of control system using the pole placement technique is given after introducing the concept of controllability and observability.
• The student will be able to Analysis of a nonlinear system using Describing function approach and Phase plane analysis.	• Able to analyse of nonlinear system using the describing function technique and phase plane analysis.
• The student will be able to Know the Lypanov's method of stability analysis of a system.	• Able to analyse the stability analysis using lypnov method.
• The student will be able to Formulation of Euler Laugrange equation for the optimization of typical functionals and solutions.	• Minimization of functionals using calculus of variation studied
• The student will be able to Formulation of linear quadratic optimal regulator (LQR) problem by parameter adjustment and solving riccatti equation	• Able to formulate andsolve the LQR problem and riccatti equation.

UNIT – I

State space analysis: State Space Representation – Solution of state equation – State transition matrix, –Canonical forms – Controllable canonical form – Observable canonical form, Jordan Canonical Form.

UNIT – II

Controllability, observability and design of pole placement: Tests for controllability and observability for continuous time systems – Time varying case – Minimum energy control – Time invariant case – Principle of duality – Controllability and
observability form Jordan canonical form and other canonical forms – Effect of state feedback on controllability and observability – Design of state feedback control through pole placement.

UNIT – III

Describing function analysis: Introduction to nonlinear systems, Types of nonlinearities, describing functions, Introduction to phase–plane analysis.

UNIT–IV

Stability analysis: Stability in the sense of Lyapunov – Lyapunov's stability and Lypanov's instability theorems – Direct method of Lypanov for the linear and nonlinear continuous time autonomous systems.

UNIT–V

Calculus of variations: Minimization of functional of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints – Euler lagrangine equation.

UNIT –VI

Optimal control: Linear quadratic optimal regulator (LQR) problem formulation – Optimal regulator design by parameter adjustment (Lyapunov method) – Optimal regulator design by continuous time algebraic riccatti equation (CARE) - Optimal controller design using LQG framework.

Text Books:

- Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3rd edition, 1998
- Automatic Control Systems by B.C. Kuo, Prentice Hall Publication

Reference Books:

1. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition, 1996
2. Control Systems Engineering by I.J. Nagarath and M.Gopal, New Age International (P) Ltd.
3. Digital Control and State Variable Methods – by M. Gopal, Tata Mc Graw– Hill Companies, 1997.
4. Systems and Control by Stainslaw H. Zak , Oxford Press, 2003.

   Optimal control theory: an Introduction by Donald E.Kirk by Dover publications

IV YEAR – II SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14120862b	**SPECIAL ELECTRICAL MACHINES**		

Course Objectives	Course Outcomes
• The student will be able to know the theory of operation and control of switched reluctance motor. •	• Able to explain theory of operation and control of switched reluctance motor.
• The student will be able to explain the performance and control of stepper motors, and their applications. •	• Able to explain the performance and control of stepper motors, and their applications
• The student will be able to describe the operation and characteristics of permanent magnet dc motor. •	• Able to describe the operation and characteristics of permanent magnet dc motor.
• The student will be able to distinguish between brush dc motor and brush less dc motor**.** •	• Able to distinguish between brush dc motor and brush less dc motor**.**
• The student will be able to explain the theory of travelling magnetic field and applications of linear motors.	• Able to explain the theory of travelling magnetic field and applications of linear motors.
• The student will be able to understand the significance of electrical motors for traction drives.	• Able to understand the significance of electrical motors for traction drives.

UNIT I

Electric Motors for traction drives:AC motors– DC motors –Single sided linear induction motor for traction drives – Comparison of AC and DC traction

UNIT II

Stepper Motors: Construction – Principle of operation – Theory of torque production – Hybrid stepping motor –Variable reluctance stepping motor – Open loop and closed loop control.

UNIT III

Switched Reluctance Motor: Principle of operation – Design of stator and rotor pole arc – Power converter for switched reluctance motor – Control of switched reluctance motor.

UNIT IV

Permanent Magnet DC Motors: Construction – Principle of working – Torque equation and equivalent circuits – Performance characteristics – Moving coil motors.

UNIT V

Permanent Magnet Brushless DC (BLDC) Motor: Construction – Principle of operation – Theory of brushless DC motor as variable speed synchronous motor – Sensor less and sensor based control of BLDC motors

UNIT VI

Linear motors: Linear induction motor: Construction– principle of operation– applications. Linear synchronous motor: Construction – principle of operation– applications.

Text Books:

1. Special electrical Machines, K.Venkata Ratnam, University press, 2009, New Delhi.
2. Brushless Permanent magnet and reluctance motor drives, Clarenden press, T.J.E. Miller, 1989, Oxford.
3. Special electrical machines, E.G. Janardhanan, PHI learning private limited, 2014.

Refernce Books:

1. Fractional and Sub fractional HP electric motors- Cyril G. Veinott - TMH Intrrnational 1987

IV YEAR – II SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14120862c	**EXTRA HIGH VOLTAGE TRANSMISSION**		

Course Objectives	Course Outcomes
• The student will be able to review of the state space representation of a control system**:** Formulation of different models from the signal flow graph, diagonalization.	• State space representation of control system and formulation of different state models are reviewed
• The student will be able to introduce the concept of controllability and observability. Design by pole placement technique. •	• Able to design of control system using the pole placement technique is given after introducing the concept of controllability and observability.
• The student will be able to Analysis of a nonlinear system using Describing function approach and Phase plane analysis.	• Able to analyse of nonlinear system using the describing function technique and phase plane analysis.
• The student will be able to Know the Lypanov's method of stability analysis of a system. •	• Able to analyse the stability analysis using lypnov method.
• The student will be able to Formulation of Euler Laugrange equation for the optimization of typical functionals and solutions. •	• Minimization of functionals using calculus of variation studied
• The student will be able to Formulation of linear quadratic optimal regulator (LQR) problem by parameter adjustment and solving riccatti equation	• Able to formulate and solve the LQR problem and riccatti equation.

UNIT – I

Introductionof EHVAC Transmission: Necessity of EHV AC transmission – advantages and problems–power handling capacity and line losses mechanical considerations – resistance of conductors – properties of bundled conductors – bundle spacing and bundle radius- Examples

UNIT – II

Voltage gradients of conductors: Electrostatics – field of sphere gap – field of line changes and properties – charge – potential relations for multi-conductors – surface voltage gradient on conductors – distribution of voltage gradient on subconductors of bundle – Examples.

UNIT – III

Corona effects – I: Power loss and audible noise (AN) – corona loss formulae – charge voltage diagram – generation, characteristics - limits and measurements of AN – relation between 1-phase and 3-phase AN levels – Examples.

UNIT – IV

Corona effects – II: Radio interference (RI) - corona pulses generation, properties, limits – frequency spectrum – modes of propagation – excitation function – measurement of RI, RIV and excitation functions – Examples.

UNIT – V

Basic Concepts of DC Transmission Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for VDC Systems – Comparison of AC &DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission.

UNIT – VI

Harmonics and Filters : Generation of Harmonics –Characteristics harmonics, calculation of AC Harmonics, NonCharacteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics. Types of AC filters, Design of Single tuned filters –Design of High pass filters.

TEXT BOOKS:

1. EHVAC Transmission Engineering by R. D. Begamudre, New Age International (p) Ltd.
2. HVDC Transmission – J.Arrillaga.
3. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons.

REFERENCE BOOKS:

1. HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar, New Age International (P) Limited, and Publishers.
2. EHVAC and HVDC Transmission Engineering and Practice – S.Rao.
3. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications
4. HVAC and DC Transmission by S. Rao.

IV YEAR – II SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14120863a	**ELECTRIC POWER QUALITY (ELECTIVE – IV)**		

Course Objectives	Course Outcomes
• The student will be able to review of the state space representation of a control system**:** Formulation of different models from the signal flow graph, diagonalization.	• State space representation of control system and formulation of different state models are reviewed
• The student will be able to introduce the concept of controllability and observability. Design by pole placement technique.	• Able to design of control system using the pole placement technique is given after introducing the concept of controllability and observability.
• The student will be able to Analysis of a nonlinear system using Describing function approach and Phase plane analysis.	• Able to analyse of nonlinear system using the describing function technique and phase plane analysis.
• The student will be able to Know the Lypanov's method of stability analysis of a system.	• Able to analyse the stability analysis using lypnov method.
• The student will be able to Formulation of Euler Laugrange equation for the optimization of typical functionals and solutions. •	• Minimization of functionals using calculus of variation studied
• The student will be able to Formulation of linear quadratic optimal regulator (LQR) problem by parameter adjustment and solving riccatti equation	• Able to formulate andsolve the LQR problem and riccatti equation.

UNIT–I

Introduction: Overview of power quality – Concern about the power quality – General classes of power quality and voltage quality problems – Transients – Long– duration voltage variations – Short–duration voltage variations – Voltage unbalance – Waveform distortion – Voltage fluctuation – Power frequency variations.

UNIT–II

Voltage imperfections in power systems: Power quality terms – Voltage sags – Voltage swells and interruptions –Sources of voltage sag, swell and interruptions – Nonlinear loads – IEEE and IEC standards. Source of transient over voltages – Principles of over voltage protection – Devices for over voltage protection – Utility capacitor switching transients.

UNIT–III

Voltage Regulation and power factor improvement: Principles of regulating the voltage – Device for voltage regulation – Utility voltage regulator application – Capacitor for voltage regulation – End–user capacitor application – Regulating utility voltage with distributed resources – Flicker – Power factor penalty – Static VAR compensations for power factor improvement.

UNIT– IV

Harmonic distortion and solutions: Voltage distortion vs. Current distortion – Harmonics vs. Transients – Harmonic indices – Sources of harmonics – Effect of harmonic distortion – Impact of capacitors, transformers, motors and meters – Point of common coupling – Passive and active filtering – Numerical problems.

UNIT–V

Distributed Generation and Power Quality: Resurgence of distributed generation – DG technologies – Interface to the utility system – Power quality issues and operating conflicts – DG on low voltage distribution networks.

UNIT–VI

PQ Monitoring and Instrumentation: Power quality monitoring and considerations – Historical perspective of PQ measuring instruments – PQ measurement equipment – Assessment of PQ measuring data – Application of intelligent systems – PQ monitoring standards.

Textbooks:

1. Electrical Power Systems Quality, Dugan R C, McGranaghan M F, Santoso S, and Beaty H W, Second Edition, McGraw–Hill, 2012, 3rd edition.
2. Electric power quality problems –M.H.J. Bollen IEEE series-Wiley india publications, 2011.
3. Power Quality Primer, Kennedy B W, First Edition, McGraw–Hill, 2000.

Reference Books:

1. Understanding Power Quality Problems: Voltage Sags and Interruptions, Bollen M HJ, First Edition, IEEE Press; 2000.
2. Power System Harmonics, Arrillaga J and Watson N R, Second Edition, John Wiley & Sons, 2003.
3. Electric Power Quality control Techniques, W. E. Kazibwe and M. H. Sendaula, Van Nostrad Reinhold, New York.
4. Power Quality c.shankaran, CRC Press, 2001
5. Harmonics and Power Systems –Franciso C.DE LA Rosa–CRC Press (Taylor & Francis).

IV YEAR – II SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14120863b	**FLEXIBLE ALTERNATING CURRENT TRANSMISSION SYSTEMS (FACTS)**		

Course Objective: The student will be able to:

- Learn the basics of power flow control in transmission lines by using FACTS controllers
- Explain the operation and control of voltage source converter
- Discuss compensation methods to improve stability and reduce power oscillations in the transmission lines.
- Learn the method of shunt compensation by using static VAR compensators.
- learn the methods of compensation by using series compensators
- Explain the operation of two modern power electronic controllers (Unified Power Quality Conditioner and Interline Power Flow Controller).

UNIT–I

Introduction to FACTS: Power flow in an AC System – Loading capability limits – Dynamic stability considerations – Importance of controllable parameters – Basic types of FACTS controllers – Benefits from FACTS controllers – Requirements and characteristics of high power devices – Voltage and current rating – Losses and speed of switching – Parameter trade–off devices.

UNIT–II

Voltage source and Current source converters: Concept of voltage source converter(VSC) – Single phase bridge converter – Square–wave voltage harmonics for a single–phase bridge converter – Three–phase full wave bridge converte r– Three–phase current source converter – Comparison of current source converter with voltage source converter.

UNIT–III

Compensation methods: Objectives of shunt compensation – Mid–point voltage regulation for line segmentation – End of line voltage support to prevent voltage instability – Improvement of transient stability – Power oscillation damping.

Methods of controllable VAR generation

Variable impedance type static VAR generators – Thyristor Controlled Reactor (TCR) and Thyristor Switched Reactor (TSR).

UNIT–IV

Shunt Compensators: Thyristor Switched Capacitor(TSC)– Thyristor controlled Reactor(TCR). Static VAR compensator(SVC) and Static Compensator(STATCOM)**:** The regulation and slope transfer function and dynamic performance – Transient stability enhancement and power oscillation damping– Operating point control and summary of compensation control.

UNIT V

Series Compensators: Static series compensators**:** Concept of series capacitive compensation – Improvement of transient stability – Power oscillation damping – Functional requirements. GTO thyristor controlled Series Capacitor (GSC) – Thyristor Switched Series Capacitor (TSSC) and Thyristor Controlled Series Capacitor (TCSC).

UNIT–VI

Combined Controllers: Schematic and basic operating principles of unified power flow controller(UPFC) and Interline power flow controller(IPFC) – Application of these controllers on transmission lines.

Text Books:

1. "Understanding FACTS" N.G.Hingorani and L.Guygi, IEEE Press.Indian Edition is available:—Standard Publications, 2001.
2. "Flexible ac transmission system (FACTS)" Edited by Yong Hue Song and Allan T Johns, Institution of Electrical Engineers, London.

Reference Books :

1. Thyristor-based FACTS Controllers for Electrical Transmission Systems, by R.Mohan Mathur and Rajiv K.Varma, Wiley.

IV YEAR – II SEMESTER	T	P	C
	3+1	0	3
Sub Code: 14120863c	**SMART GRID**		

Course Objective: The student will be able to:

- Provide the students a systems perspective of modem electricity markets and a systems approach to address various issues faced by the electricity sector.
- Provide the students an in–depth knowledge of how electricity markets operate from short-term system dispatch to long-term asset investment.
- Present the student a vision of how smart grid will transform the current electricity grid to a reliable and sustainable modern energy system.

UNIT-I

The smart grid: Introduction, Ageing Assets and Lack of Circuit capacity, Thermal constraints, Operational constraints, security of supply, National Initiatives, Early smart grid initiatives, Active distribution networks, virtual power plant, Other Initiatives and Demonstrations, Overview of te Technologies Required for the smart grid.

Outcome: Know the concept on constraints, initiatives, distribution networks of smart grids and technology required for smart grids.

UNIT-II

Communication Technologies: Data communication: Introduction, Dedicated and shared communication channels, switching Techniques, Circuit Switching, Message Switching, Packet Switching, communication channels, wired communication, optical fiber, Radio communication, Cellular Mobile communication, Layered architecture and protocols, The ISO/OSI Model, TCP/IP

Communication Technologies: IEEE 802 Series, Mobiles Communications, Multi protocol Label Switching, Power line communication, Standards for information Exchange, Standards for smart meteting, Modbus, DNP3, IEC61850.

UNIT-III

Information Security for the Smart Grid: Introduction, Encryption and Decryption, Symmetric key encryption, Public key Encryption, Authentication, Authentication based on shared secret key, Authentication based on key distribution center, digital signature, Secret key signature, Public key signature, Message digest, Cyber Security standards, IEEE 1686: IEEE standard for substation intelligent Electronic Devices(IEDs) Cyber security capabilities, IEC 62351: power systems management and Association information exchange-data and communication security.

UNIT-IV

smart metering: Introduction, Smart metering- evolution of electricity metering, key components of smart metering, Smart meters: An Overview of the hardware used – signal acquisition, signal conditioning, analogue to digital conversion, computation, input/output and communication. Communication infrastructure and protocols for smart metering- Home area network, Neighborhood area network, data concentrator, meter management system, protocols for communication.

.**UNIT-V**

Demand side Integration- Services provided by DSI, Implementation of DSI, hardware support, Flexibility delivered by prosumers from the demand side, system support from DSI.

UNIT-VI

Transmission and Distribution Management Systems: Data sources, Energy management system, wide area Applications, Visualization Techniques, Data sources and Associated external systems, SCADA, customer information system, modeling and analysis Tools, distribution system modeling,

Topology analysis, load forecasting, power flow analysis, Fault calculations, state estimation, applications, system monitoring, operation, management Outage management system, Energy storage technologies, Batteries, flow battery, Fuel cell and Hydrogen Electrolyser, Fly wheels, superconducting Magnetic energy storage systems, super capacitors.

Text Books:

1. Smart grid, Janaka Ekanayake, Liyanage, Wu, Akihiko yokoyama, Jenkins, Wiley publications, 2012.

Reference Books:

1. Smart Grid: Fundamentals of Design and Analysis, James Momoh, Wiley, IEEE Presss., 2012.

IV YEAR – II SEMESTER	L+T	P	C
	3+1	-	3
Sub Code: 14125864a	**OOPs through JAVA (for ECE, EEE)**		

Course Objective:

Implementing programs for user inferface and application devlopment using core java principles.

Course Outcomes:

- *Understand the format and use of objects.*
- *Understand basic input/output methods and their use.*
- *Understand object inheritance and its use.*
- *Understanding of Thread concepts and I/O in Java.*
- *Understand development of JAVA applets vs. JAVA applications.*
- *Understand the use of various system libraries.*

Unit-I

Objective: Focus on object oriented concepts and java program structure and its installation.

Introduction to OOP: Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK1.6

Unit-II

Objective: Comprehension of java programming constructs, control structures in Java.

Programming Constructs: Variables, Primitive Datatypes, Identifiers- Naming Coventions, Keywords, Literals, Operators-Binary, Unary and ternary, Expressions, Precedence rules and Associativity, Flow of control-Branching, Conditional, loops.

Unit-III

Objective: Understanding the concept of classes and objects

Classes and Objects- classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments,

Unit-IV

Objective: Implementing Object oriented constructs such as various class hierarchies and interfaces

Inheritance: Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class, Interfaces & Packages

Unit-V

Objective: Implementing Thread concepts, I/O and exception handling in Java

Exceptions & Assertions - Introduction, Exception handling techniques-try... catch, throw, throws, finally block, user defined exception, Exception Encapsulation and Enrichment, Assertions, Multithreading- Using isAlive() and join(), Synchronization

Unit-VI

Objective: Being able to build dynamic user interfaces using applets in java.

Applets-Applet class, Applet structure, An Example Applet Program, Applet Life Cycle, paint (), update () and repaint ()

Text Books:

1. The Complete Refernce Java, 8ed, Herbert Schildt, TMH
2. Programming in JAVA, Sachin Malhotra, Saurabh choudhary, Oxford.
3. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
4. Object oriented programming with JAVA, Essentials and Applications, Raj Kumar Bhuyya, Selvi, Chu TMH.
5. Introduction to Java rogramming, 7th ed, Y Daniel Liang, Pearson.

Reference Books:

1. JAVA Programming, K. Rajkumar. Pearson.
2. Core JAVA, Black Book, Nageswara Rao, Wiley, Dream Tech
3. Core JAVA for Beginners, Rashmi Kanta Das, Vikas.
4. Object Oriented Programming through JAVA , P Radha Krishna, University Press.

IV YEAR – II SEMESTER	L+T	P	C
	3+1	-	3
Sub Code: 14125864b	**Database Management Systems**		

Course Objectives: ***Provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications. The logical design, physical design and implementation of relational databases are covered.***

Course Outcomes:

- *define a Database Management System*
- *give a description of the Database Management structure understand the applications of Databases*
- *know the advantages and disadvantages of the different models*
- *compare relational model with the Structured Query Language (SQL)*
- *know the constraints and controversies associated with relational database model. know the rules guiding transaction ACID*
- *understand the concept of data planning and Database design identify the various functions of Database Administrator*

Unit-I

Introduction: Data base System Applications, data base System VS file System, Advantages of a DBMS View of Data, Data Abstraction, instances and Schemas, data Models, the ER Model, Relational Model, Other Models

Unit-II

Database Languages: DDL, DML, DCL. Database Access for applications Programs, Storage Manager, the Query Processor, Transaction Management, data base System Structure, data base Users and Administrator

Unit-III

History of Data base Systems::Data base design and ER diagrams, Beyond ER Design Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Concept Design with the ER Model, and Conceptual Design for Large enterprises.

Unit- IV

Basic SQL Query: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, Set ,Comparison Operators, NULL values , Comparison using Null values, sub queries, grouping, aggregation, ordering, implementation of different types of joins, Simple Database schema, data types, table definitions, different types of DML and DDL operations

Unit-V

SQL and PL/SQL: Creating tables with relationship, implementation of key and integrity constraints, views. Introduction to PL/SQL, PL/SQL procedures, functions, triggers, cursors, exception handling, packages, varrays, table types. SQL constructs that grant access or revoke access from user or user groups.

Unit–VI

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form (BCNF), Lossless join and dependency preserving decomposition, Fourth normal form (4NF).

Text Books:

1. Database System Concepts 6e By Abraham Silberschatz, Henry Korth and S Sudarshan
2. Database Management Systems, 3/e Raghuram Krishnan, Johannes Gehrke, TMH

Reference Books:

1. Introduction to Database Systems, 8/e C J Date, PEA
2. The Database book principles & practice using Oracle/MySql Narain Gehani, University Press.
3. Oracle Database 11g. The complete reference (oracle press)

IV YEAR – II SEMESTER	L+T	P	C
	3+1	-	3
Sub Code: 14125864c	**Unix And Shell Programming**		

Course Objectives:

- *To provide a comprehensive introduction to Shell Programming.*
- *To have the fundamental skills required to write simple and complex Shell scripts to automate jobs and processes in the Unix environment.*

Course Outcomes:

- *Will be able to describe and use the UNIX operating system.*
- *Will be able to describe and use the fundamental UNIX system tools and utilities.*
- *We will able to describe and write shell scripts in order to perform basic shell programming.*
- *Will be able to describe and understand the UNIX file system.*

Unit-I

Introduction to Unix:- Architecture of Unix, Features of Unix, Unix Commands – PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip.

Unit-II

Objective: Understand the basic commands in UNIX

Unix Utilities:- Introduction to unix file system, vi editor, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text processing utilities and backup utilities, detailed commands to be covered are tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio.

Unit-III

Objective: Describe and understand the UNIX file system, Shell and Filters

File Management: File Structures, System Calls for File Management – create, open, close, read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown, Directory API – opendir, readdir, closedir, mkdir, rmdir, umask.

Introduction to Shells: Unix Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command- Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.

Filters : Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count characters, Words or Lines, Comparing Files.

Unit-IV

Objective: Understand the GREP, SED, AWK in UNIX.

Grep: Operation, grep Family, Searching for File Content.

Sed: Scripts, Operation, Addresses, commands, Applications, grep and sed.

awk: Execution, Fields and Records, Scripts, Operations, Patterns, Actions, Associative Arrays, String.

Functions, String Functions, Mathematical Functions, User – Defined Functions, Using System commands, in awk, Applications, awk and grep, sed and awk.

Unit-V

Objective: Describe and understand Interactive Korn Shell and Programming.

Interactive Korn Shell: Korn Shell Features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, Options, Startup Scripts, Command History, Command Execution Process.

Korn Shell Programming: Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

Unit-VI

Objective: Describe and understand Interactive C Shell and Programming.

Interactive C Shell: C shell features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, On-Off Variables, Startup and Shutdown Scripts, Command History, Command Execution Scripts.

C Shell Programming: Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

Text Books:

1. Unix and shell Programming Behrouz A. Forouzan, Richard F. Gilberg. Thomson.
2. Your Unix the ultimate guide, Sumitabha Das, TMH. 2nd Edition. 2007-2008 Page 34 of 95.

References Books:

1. Unix for programmers and users, 3rd edition, Graham Glass, King Ables, Pearson Education.
2. Unix programming environment, Kernighan and Pike, PHI. / Pearson Education.
3. The Complete Reference Unix, Rosen, Host, Klee, Farber, Rosinski, Second Edition, TMH.

IV YEAR – II SEMESTER	L+T	P	C
	3+1	-	3
Sub Code: 14125864d	**Artificial Intelligence Techniques**		

Course Objectives:

- *To study various methods of AI*
- *To study the models and architecture of artificial neural networks.*
- *To study the ANN paradigms.*
- *To study the fuzzy sets and operations.*
- *To study the fuzzy logic systems.*
- *To study the applications of AI.*

Course Outcomes:

- *The role of neural networks in engineering, artificial intelligence, and cognitive modeling*
- *Feed-forward neural networks of increasing complexity, gradient descent learning and extensions, learning and generalization theory be able to evaluate whether neural networks are appropriate to a particular application.*

Unit-I

Objective: Understand the Basic concepts and Introduction to Artificial Intelligence Techniques.
Introduction to AI techniques: Introduction to artificial intelligence systems– Humans and Computers – Knowledge representation – Learning process – Learning tasks – Methods of AI techniques.

Unit-II

Objective: Understand the Basic concepts and Introduction of Neural Networks.
Neural Networks: Organization of the Brain – Biological Neuron – Biological and Artificial neuron Models, MC Culloch-pitts neuron model, Activation functions, Learning rules, neural network architectures- Single-layer feed-forward networks: – Perceptron, Learning algorithm for perceptron- limitations of Perceptron model

Unit-III

Objective: Understand the ANN Paradigm with Hopfield Networks.

ANN paradigm: Multi-layer feed-forward network (based on Back propagation algorithm) – Radial-basis n function networks- Recurrent networks (Hopfield networks).

Unit- IV

Objective: Describe and Understand of Classical and Fuzzy Sets.

Classical and Fuzzy Sets: Introduction to classical sets – properties – Operations and relations – Fuzzy sets – Membership – Uncertainty – Operations – Properties – Fuzzy relations – Cardinalities – Membership functions.

Unit-V

Objective: Understand and simulate the fuzzy logic system concepts.

Fuzzy Logic System Components: Fuzzification – Membership value assign men – Development of rule base and decision making system – Defuzzification to crisp sets – Defuzzification methods – Basic hybrid system.

Unit-VI

Objective: Understand the Applications of AI Techniques in ac and dc motors.

Application of AI Techniques: Load forecasting – Load flow studies – Economic load dispatch – Load frequency control – Reactive power control – Speed control of dc and ac motors.

Text Books:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by S.Rajasekaran and G.A. Vijayalakshmi Pai – PHI Publication.
2. Fuzzy logic with fuzzy applications- by T.J. Ross, TMH.

Reference Books:

1. Introduction to Artificial Neural Systems – Jacek M. Zurada, Jaico Publishing House, 1997.
2. Fundamentals of Neural Networks Architectures, Algorithms and Applications - by laurene Fausett, Pearson.
3. Neural Networks, Algorithms, Applications and programming Techniques by James A. Freeman, David M. Skapura.
4. Introduction to Neural Networks using MATLAB 6.0 by S N Sivanandam, S Sumathi, S N Deepa TMGH

IV YEAR – II SEMESTER	T	P	C
	-	-	9
Sub Code: 14120841	**Project**		

LIST OF ELECTIVES

Elective-I:

- High Voltage Engineering
- Electronic Instrumentation and Automation system
- Renewable Energy Sources and Systems
- VLSI Design

Elective-II:

- Electrical Machine Design
- Electrical Distribution Systems
- Optimization Techniques
- Embedded Systems

Elective-III:

- Advanced Control Systems.
- Special Electrical Machines
- Extra High Voltage transmission

Elective-IV:

- Electric Power Quality
- FACTS: Flexible Alternating Current Transmission Systems
- Smart Grid

Elective-V:

- OOPS through JAVA
- DBMS
- UNIX and Shell Programming
- Artificial Intelligence Techniques