

KURUKSHETRA UNIVERSITY KURUKSHETRA
Bachelor of Technology (Electrical Engineering)
Scheme of Studies/Examination Semester V (w.e.f. Session 2020-21 onwards)

S. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	*EE-301A	Power System – I	3:1:0	4	4	75	25	0	100	3
3	*EE-305A	Control Systems	3:1:0	4	4	75	25	0	100	3
4	EEP**	Program Elective-I	3:0:0	3	3	75	25	0	100	3
5	*EE-309A	Microprocessors	3:0:0	3	3	75	25	0	100	3
6	EEO**	Open Elective-I	3:0:0	3	3	75	25	0	100	3
7	*EE-313A	Power System Lab - I	0:0:2	2	1	-	40	60	100	3
8	*EE-315A	Microprocessors Lab	0:0:2	2	1	0	40	60	100	3
9	*EE-317A	Control Systems Lab	0:0:2	2	1	0	40	60	100	3
10	***EE-319A	Industrial Training-II	2:0:0	2	-	-	*100	-	*100	3
		Total		25	20	375	245	180	800	

**The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.

***EE-319A is a mandatory credit-less course in which the students will be evaluated for the industrial training undergone after 4th semester and students will be required to get passing marks to qualify.

**Program Elective-I	*EEP-307A	Electrical Machine Design
	EEP-311A	Electrical Drives
	EEP-315A	Power Management
	*EEP-329A	Digital Signal Processing
**Open Elective-I	EEO-321A	Electronic Device
	EEO-323A	Thermal and Fluid Engineering
	*EEO-325A	Computer Networks
	EEO-327A	Soft Computing

* Subjects Common with Vth Semester. B.Tech. [Electrical & Electronics Engg.] Scheme, K.U.K.

KURUKSHETRA UNIVERSITY KURUKSHETRA

Bachelor of Technology (Electrical Engineering)

Scheme of Studies/Examination Semester VI (w.e.f. Session 2020-21 onwards)

S. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs.)
						Major Test	Minor Test	Practical	Total	
1	*EE-302A	Power System – II	3:1:0	4	4	75	25	0	100	3
2	EEP**	Program Elective-II	3:1:0	4	4	75	25	0	100	3
3	EEP**	Program Elective-III	3:1:0	4	4	75	25	0	100	3
4	EEO**	Open Elective-II	3:0:0	3	3	75	25	0	100	3
5	*EE-310A	Electrical Measurements and Measuring Instrumentation	3:0:0	3	3	75	25	0	100	3
6	*EE-312A	Power Systems Lab – II	0:0:2	2	1	-	40	60	100	3
7	*EE-314A	Measurements and Instrumentation Lab	0:0:2	2	1	-	40	60	100	3
8	*EE-316A	Electronic Design Lab	0:0:4	4	2	-	40	60	100	3
9	HM 901A	Organizational Behavior	3:0:0	3	3	75	25	0	100	3
		Total		29	25	450	270	180	900	

* Subjects Common with VIth Semester. B.Tech. [Electrical & Electronics Engg.] Scheme, K.U.K.

** The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.

Note: All the students have to undergo 4 to 6 weeks Industrial Training after 6th semester which will be evaluated in 7th semester.

**Program Elective-II	EEP-304A	Power System Protection
	EEP-306A	Electrical Energy Conservation and Auditing
**Program Elective- III	*EEP-308A	Biomedical Signal & Image Processing
	EEP-318A	Computer Architecture
**Open Elective-II	EEO-320A	Electrical Materials
	EEO-322A	Strength of Materials

EE-301A Power System -I							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	1	0	4	75	25	100	3
Program Objective (PO)	To enable students to analyses power system networks, network parameters, modeling of transmission line						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the concepts of power systems.						
CO2	Understand the various power system components						
CO3	Understand various compensation techniques						
CO4	Determine methods of generation of overvoltage						

UNIT- I

Evolution of Power Systems: Typical power system, Modern trends in power system transmission. Underground and overhead system, Effects of increase in Voltage on transmission line efficiency, Radial and ring main system. Different types of distributors; Relative copper consumption in various systems. Conductor size and Kelvin's Law

UNIT- II

Transmission line modelling & compensation: Short, medium and long lines. Power Transfer, Voltage profile and Reactive Power. Characteristics of transmission lines. Surge Impedance Loading. Series and Shunt Compensation of transmission lines. Travelling-wave Equations

UNIT- III

Overhead Transmission Lines: Overhead Transmission Lines: Electrical and Magnetic Fields around conductors, Corona loss, Bundled conductors Parameters of lines. Capacitance and Inductance calculations for simple configurations. Skin effects, Proximity effect

UNIT IV

Generation of Over-voltages: Synchronous Machines: Steady-state performance characteristics. Operation when connected to infinite bus. Steady state, transient and sub-transient equivalent circuits.

Generation of Over-voltages: Lightning and Switching Surges. Protection against Over- voltages, Insulation Coordination. Propagation of Surges. Voltages produced by traveling surges

Text Books/References:

1. Power System analysis and Stability by S.S. Vadhwa
2. Electrical Power System by C.L. Wadhwa
3. Electrical Power System by Ashfaq Hussain
4. Elements of Power System Analysis by W.D. Stevenson
5. Electric Power System by B.M. Weddy
6. The transmission and Distribution of Electric energy by H. Cotton
7. Modern Power System Analysis by I.J. Nagrath and D.P. Kothari

EE-305A Control Systems							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	1	0	4	75	25	100	3
Program Objective (PO)	To enable students to analyses basic of control system, time and frequency domain analysis of various system						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the Mathematical models of physical systems						
CO2	Understand the concept of stability and its assessment for linear-time invariant systems						
CO3	Determine the state space variables and state equations						
CO4	Find the time and frequency response of system						

UNIT I

Control Systems: Basics & Components: Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

UNIT II

Time-Domain Analysis: Standard test signals, Time response of first and second order systems for standard test inputs, Application of initial and final value theorem, Design specifications for second-order systems based on the time-response, Concept of Stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique, Construction of Root-loci.

UNIT III

Frequency Domain Analysis and Stability: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

UNIT IV

State Space & Compensation Techniques: Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability.

Text/References:

1. Control System Engg. By Nagrath and Gopal.
2. Control System Engg. By K.Ogata.
3. Liner Control System by R.S. Chauhan, (Umesh Publications)
4. Feedback control system Analysis and Synthesis by D’Azzo and Houpias.
5. Control System by B.C. Kuo.

EE-309A	Microprocessors						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of microprocessors and programing						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Do assembly language programming						
CO2	Do interfacing design of peripherals like I/O, A/D, D/A, timer etc						
CO3	Develop systems using different microcontrollers						
CO4	Understand the architecture of 8051						

UNIT 1

Fundamentals of Microprocessors

Fundamentals of Microprocessor Architecture. 8-bit Microprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.

UNIT 2

The 8051 Architecture

Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

UNIT 3

Instruction Set and Programming

Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, and Subroutine instructions

UNIT 4

Memory and I/O Interfacing

Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, and memory devices. Application: LED, LCD and DC Motor interfacing

Text / References:

1. M. A. Mazidi, J. G. Mazidi and R. D. McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson Education, 2007.
2. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 2004.
3. R. Kamal, "Embedded System", McGraw Hill Education, 2009.
4. R. S. Gaonkar, "Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996

EEP-307A Electrical Machine Design							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of designing of various electrical machine						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the construction and performance characteristics of electrical machines.						
CO2	Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines						
CO3	Understand the principles of electrical machine design and carry out a basic design of an ac machine						
CO4	Use software tools to do design calculations						

UNIT 1

Introduction

Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT 2

Transformers

Sizing of a transformer, main dimensions, output equation for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

UNIT 3

Induction Motors

Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current

UNIT 4

DC MACHINES: Output equation, choice of specific loadings, choice of poles and speed, Design of core length, armature diameter, depth of armature core, air gap length, cross section of armature conductors, armature slots.

COMPUTER AIDED DESIGN: Computerization of design procedures, development of computer programs & performance predictions, optimization techniques & their application to design problems.

Text / References:

1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London.
3. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and

EEP-311A	Electrical Drives						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of designing of various electrical machine						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the characteristics of dc motors and induction motors.						
CO2	Understand the principles of speed-control of dc motors and induction motors						
CO3	Understand the power electronic converters used for dc motor and induction motor speed control						
CO4	Understand the concept of DC drive						

UNIT-I

Introduction: Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, example load torque-speed characteristics.

Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor

UNIT-II

Multi-quadrant DC drive: Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking. Control structure of DC drive, inner current loop and outer speed loop.

UNIT-III

Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation.

UNIT-IV

Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery.

Text / References:

1. G. K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989.
2. R. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control", Prentice Hall, 2001.
3. G. K. Dubey, "Fundamentals of Electrical Drives", CRC Press, 2002.
4. W. Leonhard, "Control of Electric Drives", Springer Science & Business Media, 2001.

EEP-315A Power Management							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of management of different power sectors						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To know about the present power scenario.						
CO2	Understand the concept of resources and project management						
CO3	Knowledge of Engineering and general layout of equipment's						
CO4	Understand the structure of power sector						

UNIT-I

Introduction: Power scenario; power development; planning; power resources; environment- power matters plan; pre-feasibility and feasibility studies; state relations for power etc; electricity industry structure and safety regulations bill - state and central power boards / power corporations.

UNIT-II

Resources; geophysical study; Seismic considerations; environmental restraints; resettlement and rehabilitation. Procurement: Contracting and procurement; consulting services; types of contracts; project management; organization and economy management; organizational planning and time scheduling; project cost control.

UNIT-III

Engineering and general layout of equipments; generator; transformer and switch gear and control equipment; construction methods; operation and maintenance principle; maintenance organization and planning; availability; life cycle cost and future development; visits to sites.

UNIT-IV

Power Sector: Power sector structure in different states; regulatory regime in those states; power utilities in Haryana; grid management; power financing; visit to sites.

Power Station: Management of fuel; water resource electricity devind scenario; storage and handling; pricing; contract etc.; human resource management; visit to sites.

Suggested Books:

1. Subranmanyam,B. "Power Plant Engineering", Dhanpat Rai Pub., 1995
2. Sharma P.C., "Power Plant Engineering", Dhanpat Rai Pub., 1997
3. Decenzo, David A., Robbins, Stephen P. , " Human Resource Management", Prentice Hill of India, 2004.
4. Nag, P.K., "Power Plant Engg". Tata McGraw Hill, 2003.
5. Gill, A.B., "Power Plant Performance Management", British Electricity Authority, 1984.

EEP-329A Digital Signal Processing							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	1	0	4	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of discrete time signals and digital filters .						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Represent signals mathematically in continuous and discrete-time, and in the frequency domain.						
CO2	Analyse discrete-time systems using z-transform						
CO3	Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.						
CO4	Design digital filters for various applications						

UNIT-1

Discrete-time signals and systems

Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

UNIT-2

Z-transform

Z Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

UNIT-3

Discrete Fourier Transform

Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.

UNIT-4

Design of Digital filters

Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band-stop and High-pass filters.

Text/Reference Books:

1. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
2. A.V. Oppenheim and R. W. Schaffer, "Discrete Time Signal Processing", Prentice Hall, 1989.
3. J. G. Proakis and D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms And Applications", Prentice Hall, 1997.
4. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall, 1992.
5. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.

EEO-321A Electronic Device							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various electronics devices and amplifier						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the semiconductor physics						
CO2	Understand the concept of power amplifier						
CO3	Knowledge of feedback amplifier						
CO4	Understand the various optoelectronics device						

UNIT-1

Semiconductor physics: semiconductor materials, Energy band theory, Drift and diffusion current, Intrinsic and extrinsic semiconductor

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien Bridge), LC oscillators (Hartley, Colpitt, Clapp), Crystal Oscillator, Selection of Oscillator

UNIT-2

Power amplifiers: Introduction, Difference between voltage and power amplifier, Classification of power amplifier, Class A Power Amplifier, Class B and Class C power amplifier, Harmonic distortion in power amplifier, Class AB power amplifier

Push pull amplifier: Class A and Class B push pull amplifier

UNIT-3

Feedback amplifier: Introduction, Principle of feedback in amplifier, Advantages of negative feedback, Reduction in frequency distortion, nonlinear distortion and noise with negative feedback, Effect of Negative Feedback on input resistance, output impedance and on bandwidth, voltage series feedback, current series feedback, and current shunt feedback. Voltage shunts feedback.

UNIT-4

Optoelectronics devices: Introduction, photo electric effect, photo conductivity, photodetector, light dependent resistor, photodiode, photo transistor, photo conductive cell, photovoltaic or solar cell, IR emitters, Laser diode, optocoupler, Light emitting diode

Suggested Books:

1. Integrated Electronics; Miliman & Halkias; McGraw Hill.
2. Electronic circuit analysis and design (Second Ed.) D.A.V Neamen: TMH.
3. Electronic devices & circuit: J.B. Gupta, Katson Book
4. Electronics Circuits: Donald L. Schilling & Charles Belove, McGraw Hill.
5. Electronics Devices & Circuits: Boylested & Nashelsky, Pearson.

EEO-323A Thermal and Fluid Engineering							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of thermal and fluid engineering						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To learn about the application of mass and momentum conservation laws for fluid flows						
CO2	To understand the importance of dimensional analysis						
CO3	To learn about the application of mass and momentum conservation laws for fluid flows						
CO4	To understand the importance of dimensional analysis						

UNIT 1

Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.

UNIT 2

Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy; Various modes of energy, Internal energy and Enthalpy

UNIT 3

Definition of fluid, Newton's law of viscosity, units and dimensions, Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications

UNIT 4

Exact flow solutions in channels and ducts, Couette and Poiseuille flow, laminar flow through circular conduits and circular annuli- concept of boundary layer – measures of boundary layer thickness – Darcy Weisbach equation, friction factor, Moody's diagram

1. Moran, M. J. and Shapiro, H. N., 1999, *Fundamentals of Engineering Thermodynamics*, John Wiley and Sons.
2. Nag, P.K, 1995, *Engineering Thermodynamics*, Tata McGraw-Hill Publishing Co. Ltd.
3. M.M. Das ,Fluid mechanics and turbomachines. New Delhi, India: PHI Learning.
4. R.W. Fox, Introduction to fluid mechanics (7th ed.). New Delhi, India: Wiley-India.

EEO-325A Computer Networks							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various computer networks and their programming						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To develop an understanding of modern network architectures from a design and performance perspective						
CO2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).						
CO3	To provide an opportunity to do network programming						
CO4	To provide a WLAN measurement ideas.						

UNIT 1

Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

UNIT 2

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA

UNIT 3

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT 4

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Suggested reference books

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, UNITED States of America.

EEO-327A							
Soft Computing							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various computing techniques						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To develop an understanding of soft computing						
CO2	To introduce the student to the major concepts of neural network						
CO3	To understand the Fuzzy system						
CO4	To understand the concept of Genetic Algorithm						

UNIT 1

Soft Computing: Introduction of Soft Computing, Difference between hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing

UNIT 2

Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons, Back Propagation networks, Architecture of Back propagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications

UNIT 3

Fuzzy Systems: Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification.

UNIT 4

Genetic Algorithm: History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators-Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

Reference Books:

1. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S. Rajasekaran, G. A. Vijayalakshami, PHI
2. Genetic Algorithms: Search and Optimization, E. Goldberg.
3. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.

EE-313A	Power System Lab-I						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time(Hrs)
0	0	2	1	60	40	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various relays, insulators and transmission line modelling						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand various types of relay						
CO2	To study parallel operation of alternator						
CO3	To understand the concept of various insulators						
CO4	To understand the concept of transmission line modeling						

LIST OF EXPERIMENTS

1. Experiment to find out the dielectric strength of transformer oil.
- 2 Experiment to find zero sequence component of three phase line.
- 3 Draw the characteristics of thermal overload relay.
4. Experiment to study an IDMT over current relay & plot it's characteristic curves i.e. graph between current & time.
- 5 Experiment to study differential relay characteristics.
- 6 Experiment to measure the ABCD parameters of a given transmission line, also study Ferranti effect.
- 7 Experiment to study Parallel operation of two alternators.
- 8 Experiment to plot the power angle characteristics of given transmission line.
- 9 Experiment to find the string efficiency of a string insulator with/without guard rings.
- 10 Experiment to study the characteristics of transmission line for t-network & pie- network.
- 11 Testing of a current transformer & find Ratio Error & Phase angle error for various burdens.
- 12 To study various types of distance relay.
- 13 Experiment to study fault current using sequence impedance network.

NOTE: At least 10 experiments are to be performed with at least 8 from above list, remaining 2 may either be performed from the above list or designed & set by concerned institution as per the scope.

EE-315A	Microprocessors Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time(Hrs)
0	0	2	1	60	40	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of microprocessor kit, assembly language.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand the 8086 Trainer Kit						
CO2	To study the ramp, triangular waveform						
CO3	To understand the RAM location						
CO4	To generate the various waveform						

LIST OF EXPERIMENTS

1. a) Familiarization with 8086 Trainer Kit.
- b) Familiarization with Digital I/O, ADC and DAC Cards.
- c) Familiarization with Turbo Assembler and Debugger S/Ws.
2. Write a program to arrange block of data in
 - a) Ascending and b) Descending order.
3. i) Program for finding largest number from an array. ii) Program for finding smallest number from an array.
4. Write a program to find out any power of a number such that $Z = X^N$, Where N is programmable and X is unsigned number.
5. Write a program to generate :
 - (i) Sine wave form (ii) Ramp waveform (iii) Triangular waveform using DAC card.
6. Write a program to measure frequency/time period :
 - (i) Sine wave form (ii) Ramp waveform (iii) Triangular waveform using DAC card.
7. Copy a byte in TCON to register R2 using at least four different methods.
8. Store the no. 8DH in RAM location 30 H to 34 H.
9. Write a program load the unsigned no. found in internal RAM location 5H,26H& 27 H together and put the result in RAM locations 31H MSB and 30H LSB.
10. Find the address of first two internal RAM locations between 20H and 60H which contain consecutive nos. if so, set the carry to 1, and else clear the flag.

NOTE: At least 10 experiments are to be performed with at least 8 from above list, remaining 2 may either be performed from the above list or designed & set by concerned institution as per the scope.

EE-317A	Control Systems Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time(Hrs)
0	0	2	1	60	40	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various controller and compensation technique.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand the various simulator						
CO2	To study the various compensation technique						
CO3	To study the speed control of dc motor						
CO4	To study the various error detector.						

LIST OF EXPERIMENTS:

1. Experiment to study linear system simulator.
2. To study the stroboscope & measure the shaft speed
2. Experiment to study light intensity control using P & PI controller with provision for and transient speed control.
3. Experiment to study D.C motor speed control.
4. Experiment to study the stepper motor characteristics and its control through microprocessor kit.
5. Experiment to study Temperature control system.
6. Experiment to study Compensation design.
7. Experiment to study Digital control system.
8. Experiment to study Synchronos.
10. Experiment to study AC Position control system.
11. Experiment to study Potential Metric Error detector.

NOTE: At least 10 experiments are to be performed with at least 8 from above list, remaining 2 may either be performed from the above list or designed & set by concerned institution as per the scope.

EE-302A	Power System-II						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	1	0	4	75	25	100	3
Program Objective (PO)	To enable students to analyses power system networks, faults in power system, transient and bus impedance algorithm						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the concepts of per unit system						
CO2	Understand the various faults in power system						
CO3	Understand the transients in power system						
CO4	Determine methods of impedance matrix calculation.						

UNIT-I

Introduction: Characteristics & representation of components of a power system, synchronous machines, transformers, lines cables & loads. Single line diagram of a power system Flow of zero sequence current, zero sequence impedance diagrams of power system with different types of connections of three phase transformers.

Per unit system: Per unit method of representing quantities, Advantages and disadvantages of per unit system, determination of base impedance, per unit impedance of two winding transformer.

UNIT-II

Symmetrical faults: calculation of fault currents, use of current limiting reactors.

Unsymmetrical faults: Types of transformation in power system analysis, symmetrical components transformation, sequence impedance of power system elements, Sequence network of power system analysis of unsymmetrical short faults, Network analysis & its application to interconnected system.

UNIT-III

Transients in Power Systems: Transient electric phenomenon, lighting & switching surges, traveling waves, Surge impedance and velocity of propagation, reflection & refraction of waves, reflection & refraction of waves with different line termination, equivalent circuit for travelling wave studies, Bifurcated line, Travelling wave on a line terminated by inductance, capacitance

UNIT-IV

Bus Impedance and admittance matrices: Building algorithms for bus impedance matrix, modification of bus impedance matrix for change of reference bus and for network changes, formation of bus admittance matrix and modification of three-phase network elements, treatment under balanced and unbalanced excitation, transformation matrices, and unbalanced elements.

Reference Books:

1. Elements of Power System Analysis by W.D. Stevenson.
2. Electric Power System by B.M. Weddy.
3. The transmission & Distribution of Electric Energy by H. Cotton.
4. Power System & Protection by S.S. VADHERA

EEP-306A Electrical Energy Conservation and Auditing							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	1	0	4	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of energy conservation act, tariff and energy auditing.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Study the different energy conservation act						
CO2	Understand the various tariff and load management						
CO3	Understand the different types of energy auditing						
CO4	Study various types of motors.						

UNIT-I

Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

UNIT-II

Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity.

UNIT-III

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement. Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit.

UNIT-IV

Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers.

Suggested Books:

1. Albert : Plant Engineers & Managers Guide to Energy Conservation.
2. Wayne C. Turner Energy management handbook, John Wiley and Sons.
3. Guide to Energy Management, Cape Hart, Turner and Kennedy
4. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council
5. M.K.Lahiri : Saving of Electricity by System Management. M.K. Lahiri Publication
6. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)

EEP-304A	Power System Protection						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	1	0	4	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of different types of circuit breaker, Relay and different types of protection scheme.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Study the arc formation and interruption.						
CO2	Understand the various types of circuit breaker						
CO3	Understand the different types of relays						
CO4	Study various types of protection scheme.						

UNIT 1

Neutral grounding: Need for neutral grounding, various types of neutral grounding

Circuit Interruption: Circuit interruption, theory of arc formation and it's excitation in DC, AC circuits, restriking & recovery voltage, interruption of capacitive & inductive currents. Rupturing capacity & rating of circuit breakers. Resistance switching

UNIT 2

Circuit-Breakers: Classification of circuit-breakers, Oil circuit breaker, Air blast circuit breaker, SF6 circuit breaker, Vacuum circuit breaker, HVDC circuit breaker. Auto-restoring of high capacity & H.V. circuit breakers. Breaker operating mechanisms, Types of circuit breaker mountings and enclosure, comparison between different types of circuit breaker

UNIT 3

Protective System: features of good protective system, elements of relay, terms connected with relay, Electromagnetic attraction and induction relays, Overcurrent Relay, Differential relay, distance or impedance relay, static relays: Need, Essential components of static relay, comparison with electromagnetic relay

UNIT 4

Transformer Protection: Buchholz protection, Differential protection, restricted earth fault protection

Alternator protection: Stator and rotor protection, Merz Price Protection, Balance earth fault protection

Bus bar Protection: Differential overcurrent protection, Frame leakage protection

Transmission line protection: Time graded protection, Current graded protection, and Differential protection

Reference Books:-

1. Power System Protection & Switchgear, Ravinder Nath, New Age
2. Power System Protection & Switchgear, Badri Ram, MGH
3. Protection & Switchgear, Bhalja, Maheshwari, Oxford
4. Switch gear and protection, J.B. Gupta, Katson Books

EE-310A Electrical Measurements and Measuring Instrumentation							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various types of electrical measurements and measuring instruments.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To study the generalized instruments.						
CO2	To study the various types of measuring instruments						
CO3	Understand the concept of wattmeter and energy meter						
CO4	To study the different types of bridge.						

UNIT-1

MEASURING SYSTEM FUNDAMENTALS: Classification of instruments (Absolute & Secondary Instruments: indicating, recording & integrating instruments: based upon Principle of operation). Generalized instrument (Block diagram, description of blocks). Three forces in electromechanical indicating instrument (Deflecting, controlling & damping forces). Comparison between gravity & spring controls: comparison of damping methods & their suitability bearing supports, pivot-less supports (simple & taut-band). Scale information, instrument cases (covers).

UNIT – II

MEASURING INSTRUMENTS: Construction, operating principle, Torque equation, shape of scale, use as Ammeter or as Voltmeter (Extension of Ranges). Advantages & disadvantages, errors (both on AC/ DC) of PMMC types, electrodynamic type, moving iron type (attraction, repulsion & combined types). Hot wire type & Induction type, electrostatic type instruments. Introduction of Q meter

UNIT – III

WATTMETERS & ENERGY METERS: Construction, operating principle, torque equation, shape of scale, errors, Advantages & disadvantages of Electrodynamics & induction type watt meters; single phase induction type Energy meter, Compensation & creep in energy meter.

POWER FACTOR METERS: Construction, operating principle, torque equation, advantages & disadvantages of Single phase power factor meters (Electrodynamics & moving iron types)

UNIT – IV

LOW & HIGH RESISTANCE MEASUREMENTS: Kelvin's double bridge method, Difficulties in high resistance measurements, Measurement of high resistance by direct deflection, loss of charge method, Megaohm Bridge & meggar.

A. C. BRIDGES: General balance, Circuit & Phasor diagram, applications, advantages/disadvantages of: Maxwell's inductance, inductance-capacitance, Hays, Anderson, Owens, De-Sauty's, Schering & Weins Bridges.

REFERENCE BOOKS:

1. A Course in Elect. & Electronics Measurement & Instrumentation by A.K. Sawhney; Khanna Pub.
2. Electronics & Electrical Measurement & Instrumentation by J.B. Gupta, Kataria & Sons.
3. Electronics Instrumentation & Measurement technique, W.D. Copper & A.dHelfrick.
4. Measuring Systems by E.O. Doebelin; TMH.

EEP-318A Computer Architecture							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	1	0	4	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various types of electrical measurements and measuring instruments.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the concepts of microprocessors, their principles and practices.						
CO2	Write efficient programs in assembly language of the 8086 family of microprocessors						
CO3	Organize a modern computer system and be able to relate it to real examples						
CO4	To study the different types of memory organization						

UNIT-1

Introduction to computer organization

Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation and arithmetic, Control UNIT operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organization.

UNIT-2

Memory organization

System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management UNIT, Magnetic Hard disks, Optical Disks. Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling,

UNIT-3

Input – output Organization

Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus.

UNIT-4

16 and 32 microprocessors

80x86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86

Text/Refence Books

1. V. Carl, G. Zvonko and S. G. Zaky, “Computer organization”, McGraw Hill, 1978.
2. B. Brey and C. R. Sarma, “The Intel microprocessors”, Pearson Education, 2000.
3. J. L. Hennessy and D. A. Patterson, “Computer Architecture A Quantitative Approach”, Morgan Kauffman, 2011.
4. W. Stallings, “Computer organization”, PHI, 1987.

EEO-320A		Electrical Materials					
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various types of electrical engineering materials.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the concepts of conductors						
CO2	To study the various types of insulators						
CO3	Classify the different types of magnetic materials						
CO4	To study the different types of processes.						

UNIT-I

Conductors, Properties of conductors, ACSR, High resistivity materials and their properties, Alloys, Soldering and brazing materials, superconductivity, super conductor materials and their applications.

UNIT-II

Insulators, classifications of insulators, dielectrical materials, glass and ceramics, refractory materials and their uses, optical fibers, laser and opto-electronics materials, semiconductor materials, properties of semiconductor materials, thermosetting and thermoplast materials.

UNIT-III

Classification of material, Dia, Para, and Ferro magnetic materials-curie law and curie Weiss law (qualitative study).Ferromagnetism-Qualitative study of domain theory – Hysteresis phenomena. Hard and soft magnetic material and their applications. Ferrites, Structure and property.

UNIT-IV

Processes used in Plano technology e.g. Lapping, polishing, cleaning, masking, photolithography, diffusion, oxidation and metallization, welding, wire bonding, packaging and encapsulation, Heating-induction and dielectric, Electron beam welding and cutting, annealing, cold & Hot rolling.

REFERENCES :

1. SP Seth "A course in Electrical Engg. Material" (Dhanpat Rai & Sons).
2. Dekker, "Electrical Engg. Materials" (PHI).
3. PL Kapoor,"A text book of Electrical Engg. Material" (Khanna Publishers).

EEO-322A	Strength of Materials						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of calculation of strength of different types of geometry.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand the nature of stresses developed in simple geometries						
CO2	To calculate the elastic deformation occurring in various simple geometries						
CO3	To calculate the moment of inertia in various simple geometries						
CO4	To calculate the torsion and stress in various simple geometries						

UNIT-1

Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses- elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle.

UNIT-2

Beams and types transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads.

UNIT-3

Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems.

UNIT-4

Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs.

Text Books:

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
2. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
3. Ferdinand P. Beer, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGraw Hill Publishing Co. Ltd., New Delhi 2005.

HM-901A	Organizational Behavior						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various methods adopted in organizational behavior.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To study the structure of organization						
CO2	Understand the behavior of individual						
CO3	To study the group behavior in an organization.						
CO4	Understand the human resource management policies.						

UNIT-1

Introduction to organization, organization and managers, manager' roles and skills, behavior at work, introduction to organization behaviour, major behavioural science disciplines contributing to OB, challenges and opportunities managers have in applying OB concepts, OB model (including motivation models) and levels of OB model

UNIT-2

Introduction to individual behaviour, values, attitudes, job satisfaction, personality, perception and individual decision making, learning, motivation at work, managing emotions and stress (Meaning-Definition Stress and job performance relationship Approaches to stress management (Coping with stress))

UNIT-3

Introduction to group behaviour, foundations of group behaviour, concept of group and group dynamics, types of groups, formal and informal groups, theories of group formation, group norms, group cohesiveness, group decision making, inter group behaviour, concept of team vs. group, types of teams, building and managing effective teams, leadership theories and styles, power and politics, conflict and negotiation.

UNIT-4

Foundations of organization structure, organization design, organization culture, organization change, managing across cultures, human resource management policies and practices, diversity at work.

Books Recommended:

1. Robbins, S. P/ Judge, T. A/ Sanghi, S., Organizational Behavior, Pearson Publication
2. Aswathappa, K., Organisational Behaviour– Text and Problem, Himalaya Publication
3. Pardeshi, P. C., Organizational Behaviour & Principles & Practice Of Management, Nirali publication

EE-314A	Measurements and Instrumentation Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time(Hrs)
0	0	2	1	60	40	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of various types of instruments and measurement of resistance, inductance and capacitances						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand the different types of meters.						
CO2	To measure the low and high resistance						
CO3	To calculate the inductance and capacitance using bridge.						
CO4	To measure the energy and power .						

LIST OF EXPERIMENTS:

1. To identify the meters from the given lot w.r.t application.
2. To convert & calibrate a D'Arsonnal type galvanometer into a voltmeter & an ammeter.
3. To calibrate an energy meter with the help of a standard wattmeter & a stop watch
4. To measure power & p.f. in 3-phase circuit by 2-wattmeter method using P. T and C.T.
5. To measure capacitance by De Sauty's bridge.
6. To measure inductance by Maxwell's bridge.
7. To measure frequency by Wien's bridge.
8. To measure magnitude & phase angle of a voltage by rectangular type potentiometer.
9. To measure magnitude & phase angle of a voltage by polar type potentiometer.
10. To measure low resistance by Kelvin's Double bridge.
11. To measure high resistance by loss of charge method.
12. To measure R,L,C, by Q metre

Note: At least seven experiments should be performed from above list. Remaining three experiments may either be performed from above list or designed & set by concerned institution as per scope of syllabus.

EE-312A	Power System Lab -II						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time(Hrs)
0	0	2	1	60	40	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of programming in power system.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To develop the program for Y- bus and Z-bus						
CO2	To develop the program load flow analysis.						
CO3	To develop the program for different mathematical operation.						
CO4	To develop the program for Gauss Seidal method.						

List of Experiments:

- Develop a program to do the following mathematical operations:
 - Transpose of a matrix
 - Multiplication of two matrices
 - Addition & subtraction of two matrices.
- Write a program to formulate Y-Bus by non- singular transformation $Y_{Bus} = [A], T[= y] [A]$.
- Develop a program to solve a set of 4 simultaneous liner equations using Gaussian Elimination method.
- Develop a program to calculate Z bus of a given network using building algorithm. Assume that no mutual coupling is involved in between the different elements.
- The Gauss Seidel method to find the solution of following equations
$$X_1 + X_1X_2 + X_3 = 10$$

$$X_1 + X_2 + X_3 = 6$$

$$X_1 X_2 - X_3 = 2$$
- You have given with a 6 bus system. Apply load flow technique using Gauss Seidel method to solve up to two iterations.
- Develop a program to find Eigen Values for given Matrix.
- Develop a program to determine the bus impedance matrices for the given power system network.
- Develop a program to determine the admittance matrices for the given power system network.
- To conduct the load flow analysis of power system networks (not more than 6 bus) on any dedicated using Newton Raphson method.

Note: At least seven experiments should be performed from above list on any dedicated software platform. Remaining three experiments may either be performed from above list or designed & set by concerned institution as per scope of syllabus.

EE-316A	Electronic Design Lab						
Lecture	Tutorial	Practical	Credit	Practical	Minor Test	Total	Time(Hrs)
0	0	4	2	60	40	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of design of various types of electronics circuit.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To study the characteristics of different types diode.						
CO2	To plot the characteristics of different types of BJT.						
CO3	Design of half and full wave rectifier.						
CO4	Characteristics of special devices-UJT and SCR						

List of Experiments:

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances
2. Zener diode characteristics and its application as voltage regulator
3. Design, realization and performance evaluation of half wave rectifiers without filters and with LC & pi section filters
4. Design, realization and performance evaluation of full wave rectifiers without filters and with LC & pi section filters
5. Plotting the characteristics of BJT in Common Base configuration and measurement of h-parameters
6. Plotting the characteristics of BJT in Common Emitter configuration and measurement of h-parameters
7. Plotting the characteristics of JFET in CS configuration and measurement of Trans-conductance and Drain resistance
8. BJT biasing circuits
9. FET biasing circuits
10. Common Emitter BJT Amplifier and measurement of Gain, bandwidth, input and output impedances
11. Common Source FET Amplifier and measurement of Gain, bandwidth, input and output impedances
12. Emitter Follower / Source Follower circuits and measurement of Gain, bandwidth, input and output impedances
13. Characteristics of special devices-UJT and SCR

Note: At least seven experiments should be performed from above list on any dedicated software platform. Remaining three experiments may either be performed from above list or designed & set by concerned institution as per scope of syllabus.

Biomedical Signal & Image Processing							
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	75	25	100	3
Program Objective (PO)	To make students aware about the fundamentals and various techniques of biomedical image processing and to develop the algorithms for image analysis and diagnosis in medical imaging						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand image fundamentals and acquisition techniques						
CO2	To learn Image Enhancement in Spatial and Frequency domain						
CO3	To learn Morphological Image Processing and Image Segmentation.						
CO4	To learn image compression and representation.						

UNIT-I

Fundamentals of Digital Image: Image formation, visual perception, CCD & CMOS Image sensor, Image sampling: Two dimensional Sampling theory, Nonrectangular grid and Hexagonal sampling, Optimal sampling, Image quantization, Non uniform Quantization, Image formats. Types of pixel Operations, Types of neighborhoods, adjacency, connectivity, boundaries, regions, 2D- convolution, Color models.

UNIT-II

Image Enhancement in Spatial and Frequency domain: Basic gray level transformations, histogram processing, Smoothing operations, Edge Detection-derivative based operation, filtering in frequency domain, 2D-DFT, Smoothing frequency domain filters, Sharpening frequency domain filters, Homomorphic filtering.

UNIT-III

Morphological Image Processing: Dilation and Erosion, Opening and Closing, Hit-or-Miss transformation, Boundary Extraction, Region filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning.

Image Segmentation: Detection of discontinuities, Point-line- edge detection, Linear and Circular Hough Transform, Basic Global and Adaptive Thresholding, Region Based segmentation, K-Means Clustering

UNIT-IV

Image Compression: Fundamentals of Image compression models, Lossless compression: variable length coding, LZW coding, Arithmetic coding, Lossy compression: Wavelet and DCT coding, Predictive coding.

Representation and Description: Image features, Feature extraction, Chain code, Moments

Text Books:

1. Digital Image Processing, Gonzalez and Woods- Pearson Education
2. Digital Image Processing, S. Sridhar – Oxford University Press.
3. Fundamentals of Digital Image Processing, A.K. Jain .P.H.I.
4. Digital Image Processing, William Pratt- John Wiley.
5. Feature Extraction and Image Processing, Mark S. Nixon and Alberto S. Aguado.
6. Digital Image Processing and Analysis, Chanda Majumder- Printice Hall India.
7. Medical image processing, Geoff Dougherty editor, springer.