KURUKSHETRA UNIVERSITYKURUKSHETRA
Bachelor of Technology (ElectricalEngineering)
Scheme of Studies/Examination SemesterVII
(w.e.f.session 2021-22)

SN	Course No.	Subject	L:T:P	H/Wk	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	HSMC-401A	Principles of Management	3:0:0	3	3	75	25	0	100	3
2	--	Program Elective-IV	3:0:0	3	3	75	25	0	100	3
3	--	Program Elective-V	3:0:0	3	3	75	25	0	100	3
4	--	Open Elective-III	3:0:0	3	3	75	25	0	100	3
	--	Open Elective-IV	3:0:0	3	3	75	25	0	100	3
5	EE-401LA	Project Stage-I	0:0:6	6	3	-	40	60	100	3
6	#EE-403A	Industrial Training-II	2:0:0	2	-	-	100	-	100	3
		Total		**23**	**18**	**375**	**165**	**60**	**600**	

****Program Elective-IV**	EEP-405A	HVDC Transmission System
	**EENP-401A	Industrial Electrical System
****Program Elective- V**	**EENP-403A	Digital Control System
	**EENP-405A	High Voltage Engineering
****Open Elective-III**	EEO-401A	Utilization of Electric Energy
	EEO-415A	Transducers and their Applications
****Open Elective-IV**	EEO-419A	Biomedical Instrumentation
	EEO-421A	Fluid Machinery

Note: 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-403A is a mandatory credit-less course in which the students will be evaluated for the industrial training undergone after 6th semester and students will be required to get passing marks to qualify.

****: Subject common with B.Tech. Electrical& Electronics Engg .7th Sem.**

KURUKSHETRA UNIVERSITY KURUKSHETRA
BachelorofTechnology (Electrical Engineering) Scheme of Studies/Examination Semester VIII (w.e.f.Session 2021-22)

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	--	Program Elective-VI	3:0:0	3	3	75	25	0	100	3
3	--	Open Elective-V	3:0:0	3	3	75	25	0	100	3
4	--	Open Elective-VI	3:0:0	3	3	75	25	0	100	3
5	EE-402LA	Project Stage-II	0:0:12	12	6	-	40	60	100	3
		Total		**21**	**15**	**225**	**115**	**60**	**400**	

Program Elective-VI	EEP-402A	Electrical & Hybrid Vehicles
	**EENP-402A	Power Quality & FACTS
	**EENP-404A	Control System Design
	EEP-408A	Wind and Solar Energy System
Open Elective-V	EEO-410A	Power Plant Engineering
	EEO-412A	PLC and their application
Open Elective-VI	**EENO-406A	Embedded System
	**EENO-412A	Automobile Engineering
	EEO-418A	Biomedical Signal & Image Processing

Note: 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.

****Subject common with B.Tech. 8th sem Electrical & Electronics Engg.**

Total Credits = 160

HSMC-401A	Principles of Management						
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 technique used in signal and image processing						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To develop ability to critically analyze and evaluate a variety of management practices in the contemporary context						
CO2	To understand and apply a variety of management and organizational theories in practice						
CO3	To develop ability to critically analyze and evaluate a variety of management practices in the contemporary context						
CO4	To be able to mirror existing practices or to generate their own innovative management competencies, required for today's complex and global workplace						

UNIT-1

Introduction: Definition, roles and functions of a manager, management and its science and art perspectives, management challenges and the concepts like, competitive advantage, entrepreneurship and innovation. Early contributors and their contributions to the field of management. Corporate Social Responsibility. Planning, Organizing, Staffing and HRD functions, Leading and Controlling. Decision making under certainty, uncertainty and risk, creative process and innovation involved in decision making.

UNIT-2

Early Contributions and Ethics in Management: Scientific Management- contributions of Taylor, Gilbreths, Human Relations approach-contributions of Mayo, McGregor's Theory, Ouchi's Theory Z (3 Hrs.) Systems Approach, the Contingency Approach, the Mckinsey 7-S Framework Corporate Social responsibility- Managerial Ethics. (3 Hrs)

UNIT-3

Organizing for decision making: Nature of organizing, organization levels and span of control in management Organizational design and structure –departmentation, line and staff concepts (3 Hrs.) Limitations of decision making Evaluation and selecting from alternatives- programmed and non-programmed decisions - decision under certainty, uncertainty and risk-creative process and innovation (3 Hrs.)

UNIT-4

Staffing and related HRD Functions: definition, Empowerment, staff – delegation, decentralization and recentralization of authority – Effective Organizing and culture-responsive organizations –Global and entrepreneurial organizing (3 Hrs.) Manager inventory chart-matching person with the job-system approach to selection (3 Hrs.) Job design skills and personal characteristics needed in managers selection process, techniques and Instruments (3 Hrs.)

Text Books

1. Harold Koontz and Heinz Weihrich, *Essentials of Management*, Mc Graw Hil Companies , 10th edition, 2014
2. Draft, *New Era Managment*, Pearson Education , 11th edition, Cengage Learning
3. Ptere F. Drucker, *The Practice of Management*, Mc Graw Hill, New York.
4. Robbins and Coulter, Management,13th Edition, Pearson Education , 2016.

EEP-405A	HVDC Transmission Systems						
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 HVDC transmission system						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the advantages of dc transmission over ac transmission.						
CO2	Understand the operation of Line Commutated Converters and Voltage Source						
CO3	Understand the control strategies used in HVDC transmission system						
CO4	Understand the improvement of power system stability using an HVDC system						

UNIT 1

Comparison of AC and dc Transmission (Economics, Technical Performance and Reliability). Application of DC Transmission. Description of DC transmission system; planning for HVDC transmission; modern trends in DC transmission.

UNIT 2

Thyristor Valve & Analysis of HVDC Converters: Introduction; thryistor device; thyristor value; value tests; recent trends; pulse number; choice of converter configuration; simplified analysis of Graetz circuit; converter bridge characteristics; characteristics of twelve pulse converter; detailed analysis of converters.

UNIT 3

Converter and Hvdc System Control: General; principles of DC link control; converter control characteristics; system control hierarchy; firing angle control; current and extinction angle control; starting and stopping of dc link; power control; higher level controllers; telecommunication requirements.

UNIT 4

Smoothing Reactors, Reactive Power Sources and Filters in LCC HVdc systems DC line: Corona Effects. Insulators, Transient Over-voltages. dc line faults in LCC systems. dc line faults in VSC systems. dc breakers. Monopolar Operation. Ground Electrodes.

Suggested Books:

1. Padiyar, K.R., “HVDC Power Transmissions Systems”, New Age International, 2001
2. Rao,S., “EHV-AC, HVDC Transmission & Distribution Engineering”, Khanna Publishers, 1999
3. Tagare, D.M., “Reactive Power Management”, Tata McGraw Hill, 1996
4. Dubey, G.K., “Power Semi-conductor Controlled Drives”, Prentice Hall, 1999.
5. Arrillaga, J., “High Voltage D.C.Transmission”, Peter Peregrinus Ltd, 1996

EENP-401A	Industrial Electrical System						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To provide knowledge about various concepts of industrial electrical systems and their automation						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand residential and commercial electrical systems						
CO2	Understand various types of illumination systems and lighting schemes used for a residential and commercial premises						
CO3	Understand various concepts of industrial electrical systems						
CO4	Understand the concept related to industrial electrical system automation						

UNIT- I

Residential and Commercial Electrical Systems: Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components

UNIT- II

Illumination Systems: Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting

UNIT- III

Industrial Electrical Systems I : HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

UNIT IV

Industrial Electrical Systems II: DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks

Industrial Electrical System Automation: Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation

Text Books/References:

1. S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating &Costing”, Khanna publishers, 2008.

2. K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 2007.

3. S. Singh and R. D. Singh, “Electrical estimating and costing”, Dhanpat Rai and Co., 1997. Web site for IS Standards.

4. H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2008

EENP-403A	Digital Control System						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To enable students to design and analyze discrete time (digital) control system						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Represent discrete time systems under the form of z-domain transfer functions and state-space models. Also able to obtain the model of discrete-time systems by pulse transfer function						
CO2	Analyze stability, transient response and steady state behaviour of linear discrete time systems, analytically and numerically using tools such as MATLAB and Simulink						
CO3	Design sampled data control systems.						
CO4	Describe Discrete state space model and test controllability and observability of systems						

UNIT- I

Introduction to digital control: Introduction, Discrete time system representation, Mathematical modelling of sampling process, Data reconstruction.

Modelling discrete-time systems by pulse transfer function

Revisiting Z-transform, Mapping of s-plane to z-plane, Pulse transfer function, Pulse transfer function of closed loop system, Sampled signal flow graph

UNIT- II

Stability analysis of discrete time systems: Jury stability test, Stability analysis using bi-linear transformation, Time response of discrete systems, Transient and steady state responses, Time response parameters of a prototype second order system.

UNIT- III

Design of sampled data control systems: Root locus method, Controller design using root locus, Root locus-based controller design using MATLAB, Nyquist stability criteria, bode plot, Lead compensator design using Bode plot, Lag compensator design using Bode plot, Lag-lead compensator design in frequency domain.

UNIT IV

Discrete state space model: Introduction to state variable model, Various canonical forms, Characteristic equation, state transition matrix, Solution to discrete state equation. Controllability, observability and stability of discrete state space models: Controllability and observability, Stability, Lyapunov stability theorem.

Text Books/References:

1. B. C.Kuo, Digital Control Systems, Oxford University Press, 2nd Edition, Indian Edition, 2007.
2. K. Ogata, Discrete Time Control Systems,Prentice Hall, 2ne Edition, 1995.
3. M. Gopal, Digital Control and State Variable Methods, McGraw Hill, 2/e, 2003.
4. G. F. Franklin, J. D.Powell and M. L. Workman, Digital Control of Dynamic Systems, Addison Wesley, 1998, Pearson Education, 3rd Edition.
5. K. J.Astroms and B. Wittenmark, Computer Controlled Systems - Theory and Design, Prentice Hall, 3rd Edition, 1997.

EENP-405A	High Voltage Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To enable students to understand important concepts of high voltage engineering						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the concept of electrostatic field and effect of high electrostatic field over Gases, Liquid and solid dielectric						
CO2	Understand the concept of generation of high voltages and currents in the system						
CO3	Measure high voltages and currents in the system						
CO4	Perform Non-destructive and high voltage testing on various components of power system						

.UNIT I

Electrostatic Field and Field Stress Control: Electric field stresses, Numerical methods for Electric field computation, Finite Element Method, Charge simulation method.

Conduction and Break Down in Gases: Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law, break down in non-uniform field, and corona discharge

Break Down in Liquid Dielectrics: Conduction and breakdown in pure liquid and commercial liquid.

Break Down in Solid Dielectrics: Intrinsic breakdown, electromechanical breakdown of solid, dielectric and composite dielectrics.

UNIT II

Generation of High Voltages and Currents: Generation of high direct current voltages, generation of high alternating voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators..

UNIT III

Measurement of High Voltages and Currents: Measurement of high direct current voltages, measurement of high alternating and impulse Voltages measurement of high direct, alternating and impulse currents, Cathode Ray Oscillographs for impulse voltage and current measurements.

Insulation Coordination in Electric Power Systems: Principle of Isolation Coordination in High-Voltage & Extra-High Voltage Power System.

UNIT IV

Non-Destructive Testing: Measurement of direct current resistively, measurement of dielectric constant and loss factor, partial discharge measurements

High Voltage Testing: 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/References:

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering, Tata Mc-Graw Hill.
2. C. L. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.
3. E. Kuffel and W. S. Zacngal, High Voltage Engineering", Pergamon Press.
4. M. P. Chaurasia , "High Voltage Engineering", Khanna Publishers
5. R. S. Jha, "High Voltage Engineering", DhanpatRai& sons
6. M. Khalifa,' High Voltage Engineering Theory and Practice,' Marcel Dekker.
7. Subir Ray,' An Introduction to High Voltage Engineering' Prentice Hall of India

EEO-401A	UTILAZTION OF ELECTRICAL ENERGY						
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 used in Utiization of Electrical Energy						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the different terms of illumination and various lamps						
CO2	Analyze the different methods of Electrical heating and electrical welding						
CO3	Understand the laws of Electrolysis.						
CO4	Understand the basics of traction motors.						

UNIT 1

Illumination: Term used in illumination, Laws of illumination, sources of Light, arc lamp incandescent lamp, discharge lamp, sodium vapour, mercury vapour lamp, fluorescent tubes, lightening schemes, method of lightning calculation.

UNIT II

Electrical Heating: Advantages of Electrical Heating, various types of Electrical heating, Power frequency and High frequency heating, Degree of heating element, Equivalent circuit of arc furnace, Resistance heating, Arc heating, Induction heating, dielectric heating etc.

Electric Welding: All types of electrical welding, resistance welding, arc welding, electrical winding equipment, Comparison between AC & DC welding, types of electrodes, advantages of coated electrodes.

UNIT III

Electroplating: Basic principle, faraday's law of electrostatics, terms used, Application of electrolysis, factors governing electro deposition, power supply.

Refrigeration & Air Conditioning: Basic principle, various compression cycle & system its application, electric circuit of refrigerator, air conditioner.

UNIT IV

Traction Motors : Different system of electric traction, comparison between AC & DC system, block diagram of traction system ,Starting-Speed control and braking- Speed control and braking –Speed time curves,-Mechanics of Train movement-Tractive effort for acceleration – Power and energy output from driving axles -Specific energy output and consumption-Train resistance.

Suggested Books:

1. Dr.S.L.Uppal, Electrical Power ,Khanna Publishers, New Delhi,1980.
2. M.L.Soni,P.V.Gupta,U.S.Bhatnagar,A.Chakrabarti,A Text Book On Power System Engineering, Dhanpat Rai & Co,New Delhi1997-98
3. H.Pratap, Art and Science of Utilization of Electric Energy, Dhanpat Rai & Sons, New Delhi,1980.
5. G.C.Garg, Utilization of Electric Power and Electric Traction, Khanna publishers, New Delhi,1995.

EEO-415A	Transducer & Their Applications						
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 of transducers and their applications.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the different types of transducers						
CO2	Analyze the different methods of measurements of displacement						
CO3	Understand the different methods of measurements of pressure						
CO4	Understand the basics concepts of measurements of temperature						

UNIT - I

Definition of transducer. Advantages of an electrical signal as out-put. Basic requirements of transducers, Primary and Secondary Transducer, Analog or digital types of transducers. Resistive, inductive, capacitive, piezoelectric, photoelectric and Hall effect transducers.

UNIT-II

Measurement of Displacement - Potentiometric resistance type transducers, inductive type transducers, differential transformer (L.V.D.T), capacitive transducers, Hall effect devices, strain gage transducers. Measurement of Velocity - variable reluctance pick up, electromagnetic tachometers, photoelectric tachometer, toothed rotor tachometer generator.

Measurement of Flow: Venturi meter, orifice meter, nozzle meter, Pitot-static tube, rotameter, turbine flow meter, ultrasonic flow meter, electromagnetic flow meter, hot wire anemometer.

UNIT - III

Measurement of Pressure - Manometers, Force summing devices and electrical transducers Measurement of Force - Strain-gage load cells, pneumatic load cell, L VDT type force transducer.

Measurement of Torque - Torque meter, torsion meter, absorption dynamometers, inductive torque transducer, digital methods

UNIT - IV

Measurement of Temperature - Metallic resistance thermometers, semi conductor resistance sensors (Thermistors), thermo-electric sensors, pyrometers.

Measurement of Liquid Level: Resistive Method, Inductive method, capacitive method Sound Measurement: Microphone, Types of Microphones.

Measurement of Humidity: Resistive, capacitive, aluminium oxide & crystal hygrometers.

Suggested Books:

1. B.C. Nakra, K.K. Chaudhry, "Instrumentation Measurement and Analysis," . Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Thomas G. Beckwith etc. all, "Mechanical Measurements (International Student Edition), Addison-Wesley Longman, Inc. England.
3. A.K. Sawhney, " A Course in Electrical and Electronic Measurements and Instrumentation," Dhanpat Rai & Sons, Delhi-6.

EEO-419A	BIOMEDICAL INSTRUMENTATION						
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 technique used in biomedical instrumentation.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the basic concepts of bio potential.						
CO2	Analyze the different types of meters.						
CO3	Understand the different medical imaging technique.						
CO4	Understand the basics concepts of Electrode-electrolyte interface						

Unit 1

Cell resting potential and action potentials - Origin of bio potentials - characteristics – Frequency and amplitude ranges - ECG – Einthoven's triangle – 3 lead ECG system - EEG – 10- 20 electrode system - Origin and characteristics of EMG – EOG - ERG electrodes and transducers.

Unit 2

Diagnostic and Therapeutic Equipments: Blood pressure monitors – Electro-cardio scope - Pulse Oximeter - pH meter - Auto analyzer – Pacemakers – Defibrillator - Heart lung machine - Nerve and muscle stimulators - Dialysis machines - Surgical diathermy equipments – Nebulizer; inhalator - Aspirator – Humidifier - Ventilator and spirometry.

Unit 3

Medical imaging techniques: Basics of diagnostic radiology – Production - Nature and properties of X rays - X-ray machine - Block diagram - Digital radiography – CT - Basic Principle - Block diagram – Radioisotopes in medical diagnosis – Physics of radioactivity – Gamma Camera. Block diagram – SPECT Scanner – PET Scanner - Principles of NMR Imaging systems - Block diagram of NMR Imaging System .

Unit 4

Electrode-electrolyte interface – Electrode – skin interface - Half cell potential – Impedance - Polarization effects of electrode – Non-polarizable electrodes. Types of electrodes - Surface; needle and micro electrodes – ECG – EMG - EEG Electrodes. Physics of Ultrasound waves – Doppler effect – Medical Ultrasound Electrical safety: Physiological effects of electricity.

TEXT BOOKS:-

1. John G Webster, "Medical Instrumentation - Application and Design", 4th ed., John Wiley and Sons, 2007.
2. Leslie Cromwell, Fred. J. Weibell, Erich. A. Pfeiffer, "Biomedical Instrumentation & Measurements, 2nd ed., Pearson Education., 2001.
3. R S Khandpur, "Handbook of Biomedical Instrumentation", 1st ed., Tata McGraw Hill Publishing Company Limited, 2004.

EEO-421A	Fluid Machinery						
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 pumps and machinery used in hydraulic system.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Discuss the characteristics of centrifugal pump and reciprocating pumps.						
CO2	Calculate forces and work done by a jet on fixed or moving plate and curved plates.						
CO3	Know the working of turbines and select the type of turbine for an application						
CO4	Do the analysis of air compressors and select the suitable one for a specific application						

UNIT-1

Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat and curve),– Series of vanes - work done and efficiency Hydraulic Turbines : Impulse and Reaction Turbines – Degree of reaction – Pelton Wheel – Constructional features - Velocity triangles – Euler's equation – Speed ratio, jet ratio and work done , losses and efficiencies, design of Pelton wheel – Inward and outward flow reaction turbines- Francis Turbine – Constructional features – Velocity triangles, work done and efficiencies.

UNIT-2

Axial flow turbine (Kaplan) Constructional features – Velocity triangles- work done and efficiencies – Characteristic curves of turbines – theory of draft tubes – surge tanks – Cavitation in turbines – Governing of turbines – Specific speed of turbine , Type Number– Characteristic curves, scale Laws – Unit speed – Unit discharge and unit power.

UNIT-3

Rotary motion of liquids – free, forced and spiral vortex flows Rotodynamic pumps- centrifugal pump impeller types,-velocity triangles-manometric head- work, efficiency and losses, H-Q characteristic, typical flow system characteristics, operating point of a pump. Cavitation in centrifugal pumps- NPSH required and availableType number-Pumps in series and parallel operations.

UNIT-4

Positive displacement pumps- reciprocating pump – Single acting and double acting- slip, negative slip and work required and efficiencyindicator diagram- acceleration head - effect of acceleration and friction on indicator diagram – speed calculation- Air vessels and their purposes, saving in work done to air vessels multi cylinder pumps.

Text Books: 1. Som, Introduction to Fluid Mechanics and Fluid Machines ,McGraw Hill Education India 2011

2. Bansal R. K., A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications,2005.

3. Cengel Y. A. and J. M. Cimbala, Fluid Mechanics, Tata McGraw Hill, 2013

4. Yahya S. M, Fans, Blower and Compressor, Tata McGraw Hill, 2005.

EEP-402A	Electrical & Hybrid Vehicles						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To provide knowledge of Electrical and hybrid vehicles to the students.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To learn about Electrical and Hybrid Vehicles.						
CO2	Understand about types of machinery used in Electric propulsion unit						
CO3	Understand about various methods of energy storage in Electric and hybrid vehicles						
CO4	Learn about sizing methodology of drive system and energy management strategies used in electric and hybrid vehicles						

UNIT 1

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles.

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

UNIT 2

Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT 3

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT 4

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Text / Reference Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004

EENP-402A	Power Quality and FACTS						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To enable students to understand the Power Quality related issues, their solutions and details of FACTS devices.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.						
CO2	Understand the working principles of FACTS devices and their operating Characteristics.						
CO3	Understand the basic concepts of power quality.						
CO4	Understand the working principles of devices to improve power quality.						

UNIT 1

Power Quality Problems & Monitoring: Overview and Definitions of power quality, sources of pollution, international power quality standards, and regulations.

UNIT 2

Power Quality Problems : Surges, voltage sag and swell, over voltage under voltage, outage voltage, and phase angle imbalance, electric noise, harmonics, frequency deviation monitoring,

UNIT 3

Power System Harmonics: Harmonic analysis, harmonic sources – the static converters, transformer magnetization and non-linear machines, are furnaces, fluorescent lighting. Harmonic effect within the power system, interference with communication harmonic measurements, Harmonic Mitigation Techniques

UNIT 4

FACT Systems: Introduction – Terms & definition, Fact Controllers, Type of FACT devices i.e. SSC, SVC, TSC, SSS, TCSC, UPFC, Basic relationship for power flow control.

Introduction to Custom Power Devices-Network Reconfiguration devices; Load compensation and voltage regulation using DSTATCOM; protecting sensitive loads using DVR; Unified power Quality Conditioner. (UPQC), uninterruptible power suppliers

Text/References

1. N. G. Hingorani and L. Gyugyi, “Understanding FACTS: Concepts and Technology of FACTS Systems”, Wiley-IEEE Press, 1999.
2. K. R. Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd. 2007.
3. T. J. E. Miller, “Reactive Power Control in Electric Systems”, John Wiley and Sons, New York, 1983.
4. R. C. Dugan, “Electrical Power Systems Quality”, McGraw Hill Education, 2012.

EENP-404A	Control System Design						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	The course is useful for the students to get an idea of ideal practices in the field of control systems design. Students will get in touch with recent trends in the field of modern control engineering. Here importance of designing the control systems is emphasized.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Define fundamental control system design specifications and basic principles of controller design						
CO2	Design modern controllers based on the state space techniques and recognize the importance of observability and controllability for system design.						
CO3	Understand concept of optimal control and robust control techniques.						
CO4	Understand concept of Lyapunov's stability Criteria and optimal control						

UNIT 1

Design of Feedback Control Systems : Introduction, Approaches to System Design, Cascade Compensation Networks, Phase-Lead Design Using the Bode Diagram, Phase-Lead Design Using the Root Locus, System Design Using Integration Networks, Phase-Lag Design Using the Root Locus, Phase-Lag Design Using the Bode Diagram, Design on the Bode Diagram Using Analytical Methods, Systems with a Pre-filter, Design for Deadbeat Response; Design Examples.

UNIT 2

Design of State Variable Feedback Systems: Introduction, State space representation of physical systems, State space models of some common systems like R-L-C networks, DC motor, inverted pendulum etc., Controllable Canonical Form, Observable Canonical Form, Diagonal Canonical Form, State transition matrix, Solution of state equations, Controllability and Observability, Full-State Feedback Control Design; Observer Design; Integrated Full-State Feedback and Observer; Tracking Reference Inputs; Internal Model Design; Design Examples

UNIT 3

Introduction to Robust Control and optimal control : Robust control system and system sensitivities to parameter perturbations, analysis of robustness, systems with uncertain parameters, considerations in design of robust control system, robust PID controller.

UNIT 4

Lyapunov's stability and optimal control: Positive/negative definite, positive/negative semi-definite functions, Lyapunav stability criteria, introduction to optimal control, Riccatti Equation, Linear Quadratic Regulator, Design Examples.

Text books / References:

1. Modern Control Engineering by K. Ogata, PHI.
2. Discrete Time Control Systems by K. Ogata, PHI.
3. Automatic Control Systems by B C Kuo, PHI.
4. Control Systems, Principles and Design by M. Gopal, MC Graw Hill, 2012.

EEP-408A	Wind and Solar Energy						
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 detailed knowledge of working of solar and wind power plants.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the current energy scenario across the country and the world .Students will also be able to get knowledge about various types of energy resources available.						
CO2	Get knowledge about various types of Solar energy systems.						
CO3	Understand the concepts related to wind energy generation.						
CO4	Design hybrid energy systems.						

UNIT 1

Introduction: Energy demand of world and country and gap analysis, Fossil fuel based systems, Impact of fossil fuel based systems, Non conventional energy – seasonal variations and availability, Renewable energy – sources and features, Hybrid energy systems. Distributed energy systems and dispersed generation (DG).

UNIT 2

Solar thermal systems: Solar radiation spectrum, Radiation measurement, Technologies, Applications, Heating, Cooling, Drying, Distillation, Power generation; Costing: Life cycle costing (LCC), Solar thermal system.

Solar Photovoltaic systems : Operating principle, Photovoltaic cell concepts ,Cell, module, array, Series and parallel connections, Maximum power point tracking, Applications ,Battery charging, Pumping , Lighting,Peltier cooling , Costing: Life cycle costing ,Solar PV system

UNIT 3

Wind Energy: Wind power and its sources, Wind patterns and wind data, Site selection, criterion, momentum theory, Types of wind mills, Characteristics of wind generators, performance and limitations of energy conversion systems, Load matching, Life cycle costing - Wind system LCC

UNIT4

Hybrid Energy Systems: Need for Hybrid Systems, Range and type of Hybrid systems, Case studies of Diesel-PV, Wind-PV, Microhydel-PV, electric and hybrid electric vehicles.

Text Books / References:

1. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd, New Delhi
2. Mittal K M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi
3. Ramesh R & Kumar K U, Renewable Energy Technologies, Narosa Publishing House, New Delhi
4. Wakil MM, Power Plant Technology, Mc Graw Hill Book Co, New Delhi

EEO-410A	Power Plant Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To enable students to understand the power plant engineering.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To provide an overview of power plants and the associated						
CO2	Understand the energy conversion issues						
CO3	Understand the principles of operation for different power plants						
CO4	Understand the principles power plant economics.						

Unit-1

Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment.

Unit-2

Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants.

Unit-3

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

Unit-4

Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems.

Text Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
3. Elliot T.C., Chen K and Swane kamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

EEO-412A	PLC and Their Application						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Program Objective (PO)	To enable students to understand the power plant engineering.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the Programmable Logic Controllers						
CO2	Explore the basic functions of PLC Programming						
CO3	Recognize the intermediate functions of PLC						
CO4	Identify the various advanced functions in PC Programming						

Paper Setter Note: 8questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections

UNIT 1

Introduction to PLC:- Definition: Evolution, Advantages/Disadvantages: system description; Internal operation of CPU and I/C modules, installation & testing.

Programs & Software:- General programming procedures, registers and Addresses, Relation of Digital Gate Logic to contact logic.

UNIT 2

Basic PC Functions:- Programming, On-Off inputs to produce on – off outputs: Timers, Counters: Auxiliary Commands &functions.

UNIT 3

Intermediate Functions:- Arithmetic functions, Number Comparison functions, The skip & master control relay functions, Data move systems.

Functions involving individual register bits:- Utilizing digital bits, the sequences functions, Matrix functions.

UNIT 4

Advanced Functions:- Controlling a robot with a PC; Analog PC operator , Immediate update, select continuously, ascending sort, transmit print, FIFO, LIFO,& Loop Control.

Suggested Books:

1. Webb: Programmable Controllers: Principles & Applications, Merril Publishing Co.Columbus, Ohio, 1988.
2. Simpson: Programmable Logic Controllers, Prentice Hall, Englewood Cliffs, 1994.
3. T.A.Hughes, Programmable Controllers, 3rd Edition, ISA Press.
4. Gary Danning, Introduction to Programmable Logic Controllers, Delmar Thomson Learning
5. Bela.G.Liptak, Instrument Engineer's Handbook, Vol:II-Process Control, 3rd Edition, ISA Press, 1995

EENO-406A	Embedded System						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	0	0	3	75	25	100	3
Program Objective (PO)	To introduce the students to concepts of embedded systems. To offer them a level of confidence in microcontroller based system design. To introduce them to the concepts of ARM architectures and RTOS.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand various concepts of embedded system						
CO2	Learn about 8051 Microcontroller						
CO3	Understand the operating system of Embedded system and also learn about higher embedded system						
CO4	Learn about communication basics and interfacing of various devices to the microcontroller						

UNIT 1

Introduction to embedded system: Embedded System, Embedded versus external memory devices, CISC and RISC processors, Harvard and Von Neumann Architecture, Application of Embedded System, Embedded operating system, Design Parameters of embedded and its Significance, Design life cycle, Hardware fundamentals, Digital circuit parameter, O.C and Tristate outputs, I/O sink and Source, Custom single purpose processor Optimization, FSMD, data path & FSM , General purpose Processor and ASIP'S

UNIT 2

8051 Microcontrollers: 8051 microcontrollers-Assembly language, Architecture of 8051, Registers, Addressing Modes, Instruction Set, I/O ports, memory organization, Programs showing use of I/O Pins, Interrupts, Interrupt Programming, Timer and counters, Serial Communication, Programming of serial communication.

UNIT 3

Introduction to operating system and basics of higher embedded system: Introduction to RTOS, Tasks, Data, Semaphores and shared data, Operating system services, Message queues, Mailboxes, Advanced processor (Only architecture), 80386, 80486, Introduction to ARM, features, architecture, instruction set

UNIT 4

Communication basics and interfacing of various devices the microcontroller: Microprocessor interfacing I/O addressing, direct memory access (DMA), Arbitration, multilevel bus architecture, serial protocol, parallel protocols and wireless protocol, Real world interfacing: LCD, Stepping motor, ADC, DAC, LED, Pushbuttons, Keyboard, Latch connection, PPI

Text / Reference Books:

1. Embedded system Design-Frank Vahid/ Tony Givargis. John Willey
2. Microcontroller (Theory and applications) Ajay V Deshmukh, Tata , McGraw-Hill
3. An Embedded Software Primer-David E.Simon, Pearson Education
4. The 8051 Microcontroller and embedded systems-Muhammad Ali Mazidi and Janice Gillispie.
5. Microcontrollers (Architecture, Implementation & Programming) Kenneth Hinz, Daniel Tabak, Tata McGraw-Hill
6. 8051 Microcontrollers & Embedded Systems 2nd edition Sampath Kr. Katson books

EENO-412A	Automobile Engineering						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time(Hrs)**
3	0	0	3	75	25	100	3
Program Objective (PO)	To make aware the students with the study of engineering which teaches manufacturing and mechanical-mechanisms as well operations of automobiles. It is an introduction to vehicle engineering which deals with motorcycles, cars, buses trucks etc. It includes branch study of mechanical, electronic, and safety elements. Some of the engineering attributes and disciplines that are of importance to the automotive engineer.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Students will be able to Develop a strong base for understanding future developments in the automobile industry						
CO2	Students will be able to Explain the working of various parts like engine, transmission, gear box etc.						
CO3	Students will be able to Describe how the brakes and the suspension systems operate						
CO4	Students will be able to Understand the steering geometry and emission control system.						

UNIT I

Introduction: Brief history of automobiles, Main components of an automobile, Brief description of each component. Brief description of constructional details and working of a four stroke I.C. Engine (S.I. Engines and C.I. Engines) including lately developed overhead cam shaft, Multi-cylinder engines, Introduction to recent developments in I.C. Engines- Direct injection systems, Multi-point fuel injection systems, Introduction, Brief description of different components of Transmission System.

Clutch: Introduction to Clutch and its different types, Principle of Friction Clutch, Clutch Lining and friction materials used in Friction Clutches, Torque transmitted, Brief description of Cone Clutch, Single Plate and Multiplate Clutches, Dry and wet clutches, Automatic clutch action, Centrifugal clutches, Electromagnetic clutches, Fluid Flywheel.

UNIT II

Gear Box: Gear Box Air resistance, gradient resistance and rolling resistance coming across a moving automobile, Tractive effort, Variation of tractive effort with speed, Performance curves (object and need of a gear box), Sliding mesh gear box, Control mechanism, Sliding type selector mechanism, Ball type selector mechanism, Steering column gear shift control, Constant mesh gear box, Synchromesh device, Automatic transmission in general, AP automatic gear box, Torque converter, Torque converter with direct drive, Lubrication of Gear Box.

Propeller Shaft: Functions and requirements of a propeller shaft, Universal joints, Constructional forms of universal joints, Flexible-ring joints, Rubber-bushed flexible joints. Constant-velocity joints. Differential : Principle of operation, Constructional details of a typical Differential unit, Traction control differentials, Multi-plate clutch type traction control device.

UNIT III

Brakes: Functions and methods of operation, Brake efficiency. Elementary theory of shoe brake, brake shoe adjustments, A modern rear-wheel brake, Disc brakes, Brake linkages, Leverage and adjustment of the brake linkage, Servo- and power operated brakes, Vacuum brake operation,' Hydraulic Brakes-constructional details and working, Direct action vacuum servos, Power-operated brakes, A dual power air brake system,

Suspension system: Suspension principles, Road irregularities and human susceptibility, Suspension system, Damping, Double tube damper, Single tube damper, Lever arm type damper, Springs-Leaf springs,

Coil and torsion springs, variable rate springs, Composite leaf springs, Rubber springs, Air springs, Adjustable and self-adjusting suspensions, Interconnected suspension system, Interconnected air and liquid suspensions, Independent suspension system, Different independent suspension layouts, McPherson strut type, Rear suspension-live axle, McPherson strut rear suspension.

UNIT IV

Steering Geometry: Castor, Camber, Kingpin inclination, Combined angle, Toe-in, Steering system-basic aims, Ackerman linkage, Steering linkages for independent suspension, Center point steering, Costarring or trailing action, Cornering power, Self-righting torque, Steering characteristics-over steer and under steer, Axle beam, Stub-axle construction, Steering column, Reversible and irreversible steering, Rack-and-pinion steering mechanism, Effect of toe-in on steering, Power steering, Vickers System. Recent trends in automobile engineering Multi fuel automobiles, Automobiles running on alternate sources of energy, Emission control through catalytic converter, Double catalytic converter, Aspects of pollution control in Automobiles.

Reference and Text Books:

1. The Motor Vehicle - By Newton, Steeds and Garretle Basic
2. Automobile Engineering - By Kirpal Singh
3. Automobile Engineering *' -By K.M. Gupta, Umesh Publications

EEO-418A	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.