New Scheme

Institute of Information and Communication Technologies MUET, Jamshoro
Department of Electrical Engineering

Proposed/Revised courses for M.E in Electrical Power Engineering
Effective from 23ELP Onwards February, 2023

1st Semester			2nd Semester			3rd Semester		
S #	**Subject Name**	**CH/ Marks**	**S #**	**Subject Name**	**CH/ Marks**	**S #**	**Subject Name**	**CH/ Marks**
1.	Power Quality (ELP611)	2/50	1.	Power Electronics and Motor Drives (ELP651)	2/50	1.	FACTS and HVDC (ELP705)	2/50
2.	Electrical Power Transmission and Distribution (ELP615)	2/50	2.	Power System Stability (ELP660)	2/50	2.	Power Engineering Laboratory (ELP720)	1/50
3.	Power System Operation and Control (ELP625)	2/50	3.	Advanced High Voltage Engineering (ELP670)	2/50	3.	Power System Planning and Management (ELP730)	2/50
4.	Clean Energy Technologies (ELP635)	2/50	4.	Energy Management (ELP680)	2/50	4.	Thesis (ELP799)	6
5.	Power System Analysis (ELP640)	2/50	5.	Power System Protection (ELP690)	2/50	5.	Advance Electrical Machine Design (ELP748)	2/50

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO
INSTITUTE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
DEPARTMENT OF ELECTRICAL ENGINEERING

Title of Subject	:	**Power Quality (ELP611)**
Discipline	:	Electrical Power Engineering
Semester	:	1st Semester C.Hs: 02
Effective	:	23rd ELP-Batch and onwards
Marks	:	50
Assesment	:	Sessional 10% Mid Semester Exam 30% Final Semster Exam 60%
Minimum Contact Hrs	:	28

Aims: To provide adequate knowledge and develop expertise for the analysis, monitoring and control of power quality problems

Objectives :

Upon successful Completion of this course the student will be able to:

- Understand the issues concerning the power quality such as; harmonics, voltage sags, notches, swellings, surges, transients, voltage regulation & frequency regulation.
- familiar with power quality measuring devices
- Describe Various Equipment used for Power Monitoring.

Contents :

Power Quality Concepts

Power quality evaluation Procedure, General classes of power quality problems, Transients, Long-Duration Voltage Variations, Short-Duration Voltage Variations, Voltage Imbalance,Waveform Distortion,Voltage Fluctuation, Power Frequency Variations, Power Quality Terms

Voltage Sags and Intruptions

Sources of Sags and Interruptions, Estimating Voltage Sag Performance, Fundamental Principles of Protection, Solutions at the End-User Level, Evaluating the Economics of Different Ride-Through Alternatives, Motor-Starting Sags,Utility System Fault-Clearing Issues.

Harmonics

Harmonic Distortion, Voltage versus Current Distortion,Harmonics versus, Transients,Harmonic Indexes, Harmonic Sources from Commercial Loads, Harmonic Sources from Industrial Loads, Locating Harmonic Sources, System Response Characteristics, Adverse effects of Harmonic Distortion, Interharmonics, Harmonic Distortion Evaluations, Principles for Controlling Harmonics, Harmonic Studies, Devices for Controlling Harmonic Distortion, Standards of Harmonics

Power Quality Monitoring

Monitoring Considerations,Historical Perspective of Power Quality Measuring Instruments Power Quality Measurement Equipment,Assessment of Power Quality Measurement Data, Power Quality Monitoring Standards

Cost of Poor Power Quality

Exploring power quality cost, Studies on cost of poor power quality, power quality solutions

Books Recommended (Latest available editions) :

Hand book of power quality	Angelo Baggini
Power quality	C.Shankaran
Power system quality assessment	J.Arrillaga, N.R. Watson S.Chen

Approval:	:	Board of Studies, Deptt. of Electrical Engg.	Res. No. 2.2	Dated: 14-10-2022
		Board of Faculty:	Res. No. 20.3	Dated: 22-02-2023
		Advanced Studies and Research Board	Res. No. 191.13 (a)	Dated: 07-03-2023
		Academic Council	Res. No.	Dated:

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DEPARTMENT OF ELECTRICAL ENGINEERING

Title of Subject	:	**Electrical Power Transmission and Distribution (ELP615)**
Discipline	:	Electrical Power Engineering
Semester	:	1st Semester C.Hs: 02
Effective	:	23rd ELP-Batch and onwards
Marks	:	50
Assesment	:	Sessional 10% Mid Semester Exam 30% Final Semster Exam 60%
Minimum Contact Hrs	:	28

Aims

To provide adequate knowledge and understanding of Electrical Power Transmission System its types, design analysis and performance as a part of electric network. This course also gives clear understanding of Planning, design and operation of Electrical power distribution system.

Objectives :

Upon successful Completion of this course the student will be able to:

- Understand the various concepts of transmission system
- Evaluate line parameters such as resistance, inductance and capacitance for single phase and three phase lines.
- Describe the constructional features of underground cable, their types, ratings and their application.

Understand the techniques in planning and automation of distribution systems.
Operate optimally the distribution networks

Contents :

Introduction
Transmission system planning, Complex power in balanced three phase transmission lines. Power flow in transmission lines.

Performance Analysis of Transmission system
Transmission line constants, Bundled conductors, Parallel lines, , Steady state power limit and voltage regulation in Short transmission lines. Medium transmission line, A, B, C & D constants.

Nominal π and nominal T circuits. Analysis of Long transmission lines, Line and load compensation, series and shunt compensation. Environmental effects of overhead lines.

Undergorund Cables
Types of underground cables, Cable installation techniques, Electric stress, dielectric constant, charging current, insulation resistance, skin effect and proximity effect, current carrying capcity of cables.

Distribution System Planning
Importance of distribution system planning, load forecasting. Factors affecting distribution system planning, planning methods, computer applications, distribution automation and control, Distribution system in Pakistan, Planning constraints in Pakistan

Distribution Substation
Distribution substation, Substation bus schemes. Rating of Distribution substation, limitation of service area. Square and hexagonal service area. Distribution transformer, distribution transformer efficiency, parallel operation of transformers, vector groups

Design Considerations for Primary and Secondary Distribution Systems
Primary distribution feeders, Primary feeder voltage level and loading, Design considerations for Radial feeders, Economic design of secondary lines, voltage fluctuation. Voltage regulation, Distribution system voltage control, line drop compensator.

Books Recommended (Latest available editions) :

Electrical Power Transmission System Engineering	Turan Gonen
Elements of Power system	Stevensen Jr.
Power system Analysis	Ashfaque Hussain

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DEPARTMENT OF ELECTRICAL ENGINEERING

Title of Subject	:	**Power System Operation and Control (ELP625)**
Discipline	:	Electrical Power Engineering
Semester	:	1st Semester C.Hs: 02
Effective	:	23rd ELP-Batch and onwards
Marks	:	50
Assesment	:	Sessional 10% Mid Semester Exam 30% Final Semster Exam 60%
Minimum Contact Hrs	:	28

Aims : To develop the skills of student and provide adequate knowledge about the concepts of automated power system control. The course will equip student with the understanding of SCADA and various other application functions used in the modern power system.

Objectives :
Upon successful Completion of this course the student will be able to:
Describe the objectives of power system control and various power system operation modes
Describe SCADA and its functions
Understand the concept of Active and reactive power control
Understand power system security Economic dispatch and automated generation control.

Contents :

Introduction
Structure of Power System control, SCADA system, Power control systems in Pakistan.

Active power and frequency control
Fundamentals of Turbine speed governing system, Governor with speed-droop characteristics, Load sharing between parallel operating generators, Control of generating unit power output

Economic Dispatch and Optimization
Optimization Fundamentals, classification of optimization problems, Maintenance optimization, Thermal system economic dispatch with and without network losses, Hydrothermal scheduling Economic of Multi-area interconnection, concept of wheeling, introduction of unit commitment.

Automatic Generation Control
Fundamentals of Automatic generation control (AGC), Automatic generation control in an isolated power systems and in two-area systems, AGC in systems with more than two areas, Performance of AGC under normal and abnormal conditions, Implementation of AGC,

Reactive power and voltage control
Fundamental concepts, Production and absorption of reactive power, Methods of voltage control

Books Recommended (Latest available editions) :

Power System Stability and control	P.Kundur
Power Generation, Operation, and Control	A. J. Woods B. F. Wollenberg
Optimization of power system operation	Jizhong Zhu

Approval :

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Title of Subject	:	**Clean Energy Technologies (ELP635)**
Discipline	:	Electrical Power Engineering
Semester	:	1st Semester C.Hs: 02
Effective	:	23rd ELP-Batch and onwards
Marks	:	50
Assesment	:	Sessional 10% Mid Semester Exam 30% Final Semster Exam 60%
Minimum Contact Hrs	:	28

Aims : To impart knowledge about conversion of different kinds of energy into electrical energy, physical and engineering aspects and arrangement of different components in a power station where this energy conversion takes place.

Objectives : On completion of the above course the student will be able to:

- Understand the environmental issues with convention energy sources
- Know about the renewable energy conversion techniques.
- Familiar with synchronization of small power plants with national grid system

Contents :

- Energy sources and environmental impacts
- Basic energy concepts; sustainability problems
- Solar power (solar thermal and photovoltaics)
- Wind energy resources, wind turbines, aerodynamics, components and operational characteristics
- Biomass resources, energy conversion processes including gasification and pyrolysis
- Fuel cells operation, characteristics and electrochemistry
- Hydel power, Tidal power, wave energy technology, geothermal energy, hydrogen energy.
- Advanced Power Generation Systems
- Combine heat & power (CHP)
- intergrated coal gasification technology (ICGT)
- Consideration for synchronizing of small power plants (wind, solar) to national grid system
- Energy Efficenecy and optimization Advanced and existing power systems
- Relative cost of various Renewable Energy power plants.
- Renewable Energy Resources available in Pakistan,

Books : Recommended (Latest available editions)

Principles of Energy conversion	AU club
Wind and Solar Power Systems	Mukund R. Patel
Fundamentals of renewable energy processes	Aldo V. Da Rosa

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Title of Subject	:	**Power System Analysis (ELP640)**
Discipline	:	Electrical Power Engineering
Semester	:	1st Semester C.Hs: 02
Effective	:	23rd ELP-Batch and onwards
Marks	:	50
Assessment	:	Sessional 10% Mid Semester Exam 30% Final Semester Exam 60%
Minimum Contact Hrs	:	28

Aims : This subject aims to provide skills and knowledge to the students on power systems analysis

Objectives :

Upon successful Completion of this course the student will be able to:

- Analyse various symmetrical as well as electrical faults and calculate fault current levels for various systems.
- Understand and compare various iterative methods of load flow analysis for determining various node voltages and power flows in lines..

Contents :

Introduction
Types of faults, Occurrence and seniority of faults, Effect of faults on system components.

Symmetrical Fault Analysis
Equivalent circuit of synchronous machines, transformer and transmission lines. Percentage method, Short circuit kVA calculations, Reactors, Bus Impedance matrix, Symmetrical fault analysis using bus impedance matrix, Computer applications for symmetrical fault analysis

Unsymmetrical faults
Symmetrical components, Sequence impedance of synchronous machines, Sequence networks of large systems. Unsymmetrical fault analysis, Effect of neutral grounding on fault level.

Power Flow Analysis
Network model formulation, Formation of Bus Admitance matrix, Bus Classifications, Power flow problem, Applications of power flow studies, Methods for power flow analysis.

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Books Recommended (Latest available editions) :

Elements of Power System	Stevensen Jr.
Power Systems	Hadi Saadat
Modern power system Analysis	D.P Kothari

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Title of Subject	:	**Power Electronics and Motor Drives (ELP651)**
Discipline	:	Electrical Power Engineering
Semester	:	2nd Semester C.Hs: 02
Effective	:	23rd ELP-Batch and onwards
Marks	:	50
Assessment	:	Sessional 10% Mid Semester Exam 30% Final Semester Exam 60%
Minimum Contact Hrs	:	28

Aims: To provide adequate Knowledge and clear understanding about the power electronic converters and their applications.

Objectives :

Upon successful Completion of this course the student will be able to:

- have a clear understanding and knowledge about the modern semiconductor devices and their usage in power converters.
- analyze, model and design control strategies of various converters topologies
- Describe principle of operation, characteristics of power electronic converter-based motors

Contents :

Solid- State Devices

Latest development in the area of Power Electronics covering modern devices, converter topologies & control strategies.

Power Electronic Converters

Controlled rectifiers, single phase and three phase inverters, AC voltage controllers, DC-DC Converters, switch mode converters, Cycloconverters, Matrix converters
Power Factor analysis of power electronic converters, Applications of power electronic conver methods for Power Electronic converters

Solid State Drives

Closed loop control of solid-state drives, Thyristor starting & speed control of Induction motors and Direct current motors, Inverter fed induction motor drives, Cyclo-converter controlled AC drives, Brushless excitation of synchronous machines. Effects of non-sinosoidal supply on motors operation

Books Recommended (Latest available editions) :

Power Electronics Hand Book	Muhammad H. Rashid
Fundamentals of Power Electronics	Robert W Erickson, Dragan- Maksimovic
Power Semiconductors Drives	S. B. Dewan
Power Semiconductors Drives	G. K. Dubey

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Title of Subject	:	**Power System Stability (ELP660)**
Discipline	:	Electrical Power Engineering
Semester	:	2nd Semester C.Hs: 02
Effective	:	23rd ELP-Batch and onwards
Marks	:	50
Assessment	:	Sessional 10% Mid Semester Exam 30% Final Semester Exam 60%
Minimum Contact Hrs	:	28

Aims : This subject aims to provide skills and knowledge to the students on power systems stability.

Objectives :

Upon successful Completion of this course the student will be able to:

- Under stand the concept of power system stability.
- Describe the small signal, transient and voltage stability
- Use methods to improve the stability of power system

Contents :

Introduction to Power System stability problems

Basic concept and definition, power versus angle relationship, classification of stability, swing equation

Small-Signal Stability

Fundamental concepts of stability of dynamic systems, Eigen properties of state matrix, Small signal stability of single machine infinite bus system. Methods to improve small-signal stability

Transient Stability

An elementary view of transient stability, Equal area criterion, transient stability phenomenon in response to a short circuit fault, Factors influencing transient stability, Methods to improve transient stability

Voltage Stability

Basic concepts related to voltage stability, Voltage collapse.

Books Recommended (Latest available editions)	:	Power System Stability and control	P. Kundur
		Power System control and stability	P.M Anderson and A.A. Fouad

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Title of Subject	:	**Advanced High Voltage Engineering (ELP670)**
Discipline	:	Electrical Power Engineering
Semester	:	2nd Semester C.Hs: 02
Effective	:	23rd ELP-Batch and onwards
Marks	:	50
Assesment	:	Sessional 10% Mid Semester Exam 30% Final Semster Exam 60%
Minimum Contact Hrs	:	28

Aims: To develop the skills of student and provide adequate knowledge about the concepts of high voltage engineering.

Objectives :

- Upon successful Completion of this course the student will be able to:
- Describe reasons of increasing transmission voltage level from time to time
- Differentiate between different voltage levels
- Understand the various aspects of high voltage generation and measurements
- Learn the operation of high voltage power supplies for ac, dc, and impulse voltages
- Learn high voltage measurement techniques and interfacing with low voltage instrumentation.

Contents :

Generation of High Voltages
Introduction to High Voltage Engineering, Review of generation of high voltage: A.C., D.C. and impulse, Design of multi-stage impulse generator, Special features of high voltage generating equipment, Study of wave shaping circuits for generating lightning and switching impulses

High Voltages Measurements
Voltage measurements by sphere gaps. Potential dividers for ac and dc voltage measurements. Potential dividers for impulse voltage measurements. Sources of errors in HV measurements. Dielectric loss and capacitance measurements, Partial-discharge measurements, Non-destructive measurements Bridge methods- Transformer arm ratio bridge and Schearing bridge methods

Insulation Breakdown
Breakdown in gases, liquid and solids, breakdown under impulse voltage, Dynamic properties of dielectrics, , insulation testing techniques and application, Prediction of deterioration and ageing in insulation, Preventive measures of avoiding total breakdown of dielectrics, Effect of various parameters on the dielectric strength of insulation system

Books Recommended (Latest available editions) :

High Voltage Engineering- Fundamentals,	E. Kuffel, W. S. Zaengl, Kuffel, J.
High Voltage- Measurements, Testing and Design	T. J. Gallagher A. J. Pearmain
High Voltage Engineering- Theory and Practice,	M. Khalifa, Marcel Decker

Approval: :

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Title of Subject	:	**Energy Management (ELP680)**
Discipline	:	Electrical Power Engineering
Semester	:	2nd Semester C.Hs: 02
Effective	:	23rd ELP-Batch and onwards
Marks	:	50
Assessment	:	Sessional 10% Mid Semester Exam 30% Final Semester Exam 60%
Minimum Contact Hrs	:	28

Aims

The module/course is aimed to emphasis on the energy management especially demand side electrical power management techniques, issues and framework required appreciate the significance of energy related matters.

Objectives :

Upon successful Completion of this course the student will be able to:

- Describe Electrical Power Management from utility perspective
- Describe benefits and potential of demand side management
- Understand Benefits of energy management form customer perspective

Contents :

Energy Resource Management, Supply Side Management, Potential Benefits, Depletion of Traditional Fuels, Energy Efficiency and Conservation, Economic Appraisal of Conventional/Non conventional Technology, Customer Perspective, Integrated Network System, Rationale and Feasibility of Energy Management, Role of Electrical Engineer as Energy Managers.

Demand Side Management (DSM), the utility perspective. Systems of electricity supply and demand, the load duration curve (SSM, DSM). Definition, Background of DSM, Benefits and potential of DSM, Current trends in DSM, DSM in Pakistan.

Energy Management, the customer perspective. The customer perspective of DSM, Integrated energy management approaches. The process of energy management in industry, TARRIFF and billing techniques, Energy Audits, Identification of Potential of Energy Savings, Rationale and Feasibility of Energy Management, Role of electrical engineer as energy managers.

End-use of electricity. Motor Loads, Lighting System, HVAC, Furnaces and Heat Treatment System, Cooking Appliances, Welding and arcing, Inductive Loads, battery charging, electro chemical and electrometatturgical applications

Energy Efficient System. Energy management system and Demand leveling, P.F. correction, Variable speed drives. Intelligent Lighting System, Thermal Insulation's.

Monitoring and metering. Energy monitoring equipment, Data Loggers for the measurement of Load, light, temperature. The concept of Smart meter.

Books Recommended (Latest available editions) :

Energy Management Handbook	Wayne C Turner and Steve Doty
Guide to energy management,	Barney L. Capehart, Wayne C.Turner, and William J. Kennedy
Handbook of energy audits,	Albert Thumann, P.E., C.E.M.

Approval: :

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Title of Subject	:	**Power System Protection (ELP690)**
Discipline	:	Electrical Power Engineering
Semester	:	2nd Semester C.Hs: 02
Effective	:	23rd ELP-Batch and onwards
Marks	:	50
Assessment	:	Sessional 10% Mid Semester Exam 30% Final Semester Exam 60%
Minimum Contact Hrs	:	28

Aims To provide adequate Knowledge and design Power system protection schemes to ensure safe and reliable operation of the power system..

Objectives :

Upon successful Completion of this course the student will be able to:

- Understand the function and operation of the protective system elements.
- Select, apply and operate protection systems.

Contents :

Elements of protection systems
Zones of protection. Types, construction, operation and selection of circuit breakers. Types, characteristics and selection of fuses. Reactors and bus bar arrangement. Neutral and system grounding. Lightening arreators.

Protective Relays
Different types and characteristics of protective relays, Solid state relays, Microprocessor based relays

Protection Schemes
Principle and applications of over-current protection. Protection schemes for distance protection. Unit protection.

Equipment Protection
Protection of alternators, Transformers, bus bars, feeders and the transmission lines. Protection of Motors.

Books Recommended (Latest available editions)	:	Power System Protection and Switchgear	Badri Ram
		Network Protection and Automation,	Alstom
		Protective Relaying,	J.L. Blackburn,

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Title of Subject	:	**FACTS and HVDC (ELP705)**
Discipline	:	Electrical Power Engineering
Semester	:	3rd Semester C.Hs: 02
Effective	:	23rd ELP-Batch and onwards
Marks	:	50
Assessment	:	Sessional 10% Mid Semester Exam 30% Final Semester Exam 60%
Minimum Contact Hrs	:	28

Aims : This subject aims to provide knowledge to the students on the concepts and technology of flexible ac transmission systems and HVDC transmission.

Objectives : On completion of the above course the student will be able to:

- Understand the basic concepts, principles and operation of fast high power electronic controllers known as Flexible AC Transmission Systems (FACTS)
- Understand how to enhance power system stability, minimize transmission losses and effectively increase transmission capacity by using FACTS controllers
- Know the components, issues and merits of HVDC transmission to overcome some of demerits of A/C transmission..

Contents :

FACTS concepts and general system considerations
Power flow in AC systems, Constraints of maximum transmission line loading, Transmission line compensation, Definition of FACTS, Benefits of FACTS,Classification of FACTS Controllers, concept of voltage and current source converters

Static shunt compensators
Operation and control of TCR, TSC, Principle of operation and applications of SVC and STATCOM- Comparison between SVC and STATCOM.

Static series compensation
Principle operation and applications of TCSC, TSSC and SSSC

Combined compensators
Introduction to unified power flow controller (UPFC) , Circuit Arrangement, Operation and control of UPFC- Applications of UPFC – Basic operating principlecharacteristics and applications of interline power flow controller (IPFC)-

HVDC Transmission
Components of HVDC . Types of HVDC links, Comparison of power transmission capacity of high voltage a.c and d.c transmission systems. Economics of HVDC, Issues with HVDC transmission.

Books Recommended (Latest available editions) :

Understanding FACTS — Narain G. Hingorani Laszlo Gyugyi
ThyristorBased FACTS Controllers for Electrical Transmission Systems R.M. Mathur R.K. Varma
Power System Stability and control — P.Kundur
FACTS Controllers in Power Transmission and Distribution — K. R. Padiyar

Approval: :

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Title of Subject	:	**Power Engineering Laboratory (ELP720)**
Discipline	:	Electrical Power Engineering
Semester	:	3rd Semester C.Hs: 01
Effective	:	23rd ELP-Batch and onwards
Marks	:	Practical 50
Assesment	:	Lab Evaluation work 40% Final Semester Exam 60%
Minimum Contact Hrs	:	42

Aims — The aim of this course is to develop the experimental skills of student and provide practical knowledge about electrical systems

Objectives :

Upon successful Completion of this course the student will be able to:

- Evaluate the performance of electrical machines and power electronic converters Familiar with protective schemes for power systems.
- Understand the concepts of high voltage engineering
- Understand the processes of reneable energy sources

Contents :

Characteristics of rotating machines, transformers, and power utilization equipment.Protective schemes for power systems.Measuring instruments.Data acquisation Performance of power electronic converters.Breakdown of gases, liquids and solids.Reneable energy sources: wind, solar cell, biomass, tidal, fuel cell.

Books Recommended (Latest available editions) : Laboratory Manuals

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Title of Subject	:	**Power System Planning and Management (ELP730)**
Discipline	:	Electrical Power Engineering
Semester	:	3rd Semester C.Hs: 02
Effective	:	23rd ELP-Batch and onwards
Marks	:	50
Assessment	:	Sessional 10% Mid Semester Exam 30% Final Semester Exam 60%
Minimum Contact Hrs	:	28

Aims: This module/course focuses on role of power planning and management for the sustainable development of energy and power system network.

Objectives :

Upon successful Completion of this course the student will be able to:

- Understand the concept of reliability
  Familiar with Energy policy and sustainable development
- Understand Environmental impact assessment of power system
- Understand Financial and investment planning of power system

Contents :

Energy resources development, Sustainable Development, Strategy in Sustainable Development, Guiding Engineering Principles of Sustainable Development, Energy conservation, Regulation of power systems, Study of NEPRA and its performance, Privatization of power plants and transmission system, Domestic and foreign investment in the power sector of Pakistan. Environmental assessment of power plants and high tension transmission lines. Extension and renovation of power transmission and distribution systems, Management of large power systems, Application of IT in planning, design, execution and operation of power systems, Accounting and Auditing, Financial Management, Investment planning and calculation of financial and economic returns, Power tariffs, Project management, Power project negotiating, tendering and contracting, Feasibility studies for power generation and transmission, Human resources development and personal welfare, Application of safety standards in power systems, Research and development in power sector.

Books Recommended (Latest available editions) :

Concepts in Reliability EngineeringL.S. Srinath
Guide to energy services companies, Cary Bullock and George Caraghiaur
Electric Power Planning for Regulated and Deregulated Markets Arthur Mazer

Approval:	:	Board of Studies, Deptt. of Electrical Engg.	Res. No. 2.2	Dated: 14-10-2022
		Board of Faculty:	Res. No. 20.3	Dated: 22-02-2023
		Advanced Studies and Research Board	Res. No. 191.13 (a)	Dated: 07-03-2023
		Academic Council	Res. No.	Dated:

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO
INSTITUTE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
DEPARTMENT OF ELECTRICAL ENGINEERING

Title of Subject	:	**Advance Electrical Machine Design (ELP748)**
Discipline	:	Electrical Power Engineering
Term	:	3rd Semester
Effective	:	23rd ELP-Batch Onwards
Marks	:	50
Assessment	:	Sessional 10% Mid Semester Exam 30% Final Semester 60%
Credit Hours	:	02
Minim Contact hrs	:	28

Aims : To produce clear understanding of Electrical machine design principles and requirements of safety before, during and after operation and accident, The subject teacher must train electrical engineering students in the complete process of design, from drawing table to manufacturing and utilization of the electrical machines and equipment.

Objectives : The student must learn all techniques related to electrical machine design

- To open and re-assemble machines.
- To design electrical machines.
- To develop model of different designs of electrical machines through simulations

(The students will have to submit case studies on machines for sessional evaluation.

THE DESIGN CONSIDERATIONS
Basic consideration, Specific loads and output equations, Limitations, Design and constructional features of rotating machine, Basic principles of electrical machines and Basic machine forms

SELECTION OF MATERIALS FOR ELECTRICAL MACHINES
Electrical conducting materials, Magnetic materials, Insulting materials, Classes of insulating materials

HEATING, COOLING AND VENTILATION OF ELECTRICAL MACHINES
Modes of heat transfer, The heat flow problems, Temperature rise-time relation, Duty cycles, Enclosures, Cooling and ventilation of rotating electrical machine, Limits of temperature rise

TRANSFORMER

Transformer types, Standard conductors, Cooling, Output equation, Design of core section, Design of insulation and Design of tanks with tubes

DESIGN OF ROTATING MACHINES

1. Three phase and single-phase Induction motors: Design, Output equation, Calculation of man dimensions, Specifications, Output equation, Stator design and Rotor design
2. Switched Reluctance Machines: Construction, working, phase, Design of different phase machine, converters with one switch and two switches per phase

MECHANICAL DESIGN

Design of shaft, Bearings, mechanical strength of rotors and Design of fan

Books Recommended :

- M.G. Say Pitman, Alternating Current Machines, , Latest Edition
- S. Rao Khanna, Testing Commissioning Operation and Maintenance of Electrical Equipment, Latest Edition
- Electronic control of Switched Reluctance Machines, TJ Miller

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