ABOUT THE INSTITUTE

Guru Nanak Dev Engineering College (GNDEC) was inaugurated by Dr. Rajendra Prasad, Honorable first President of Republic of India in the year 1956. GNDEC is a pioneer engineering college of Punjab having Government Aided Status.

Since 1997, the college is affiliated with I.K.Gujral Punjab Technical University (IKGPTU). The College courses are approved by All India Council for Technical Education, New Delhi.

This is the first Engineering College of Punjab, which was conferred Autonomous Status by University Grants Commission(UGC), New Delhi in 2012 under section 2(f) and 12(B) of UGC Act 1956.

The College undergraduate courses are accredited with National Board of Accreditation, New Delhi since 2004, now the same are accredited under Tier-I (Washington Accord).

The college is accredited with ‘A” Grade by NAAC, UGC. Tata Consultancy Services (TCS) has accredited this college twice for placement purpose. The college is also ISO 9001-2008 Certified.

VISION OF THE INSTITUTE

Realization of glimpses of a Golden India in the real (rural) India which lives and abounds in its villages. GNDEC will excel nationally and distinguish itself as a recognized pre-eminent leader to serve this 70% brotherhood through its socioeconomic upliftment by exposure of the have-nots to Engineering and Technology thereby grooming them as technically competent and intellectually-vital graduates through practically focused quality learning experience, and thus assuring productive careers for them.

MISSION OF THE INSTITUTE

1. **Upliftment of Rural students through technical education.**
2. **Respond to local society needs by developing selected "targeted research projects"**
3. **Quality training programs in need based modern technology.**
4. **To maintain state-of-the-art infrastructure in laboratories.**

Towards the accomplishment of the vision, GNDEC offers Seven UG programs (all accredited by NBA, Tier-I, Washington Accord) and Twenty Three PG Programs (Ten Full-Time and Thirteen Part-Time). The institute also offers MCA and MBA programs. GNDEC is also Q.I.P. centre for Ph.D. in Electrical, Mechanical and Civil Engineering. The institute is scaling up its post graduate and under graduation education and research through TEQIP-II.

ABOUT THE DEPARTMENT

The department of **Electrical Engineering** started with an initial intake of 30 students in UG Program in 1957. At present the intake in UG program is 90. In 1982, the department started a part-time PG Program (Electrical Engg.) with an intake of 13 students and in 1997, a full time PG program (Power Engg.) with an intake of 13 students. At present the intake to full time PG program is 25 students. The department is an authorized research centre of Punjab Technical University for Ph.D. and its course work. Keeping in view the graduate attributes of ethical practices and social responsibility, green and clean energy obligation, the department has taken the initiative of starting a 50 kW_p rooftop grid connected solar power plant in college premises. Also 150 kW_p rooftop grid connected solar power plant is in the process of installation.

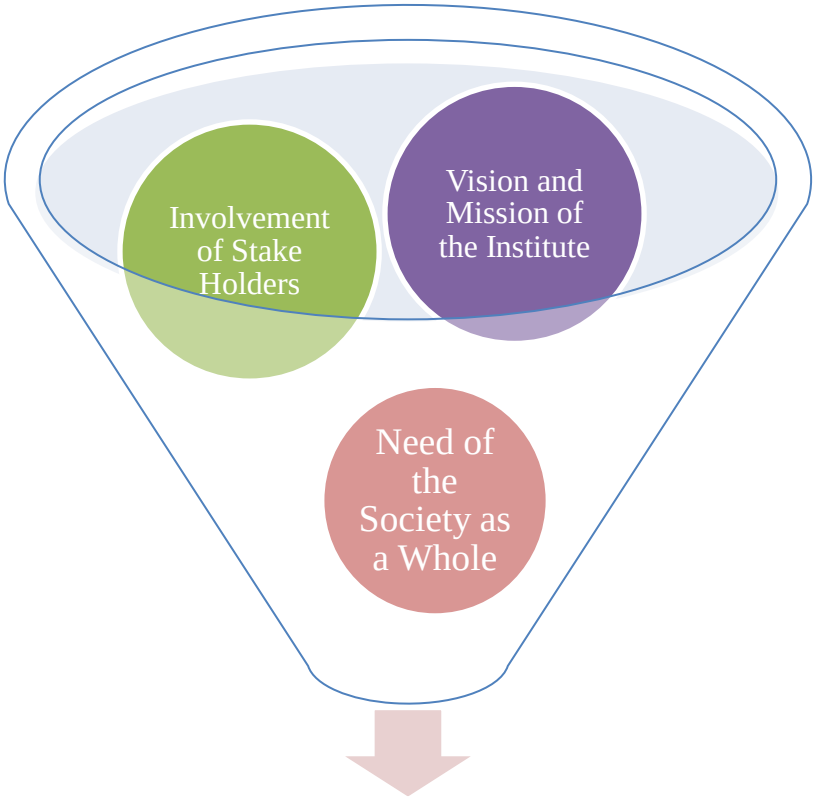
VISION OF THE DEPARTMENT

To impart knowledge, develop skills and prepare graduates in achieving global excellence in Electrical Engineering education, industry & research.

MISSION OF THE DEPARTMENT

a. To prepare engineering graduates with deep understanding of fundamentals of Electrical Engineering
b. To prepare professionals with good technical skills, positive attitude and ethical values
c. To collaborate with industry, research organizations and academia to encourage creativity and innovation.
d. To provide them a platform for developing new products and systems that can help industry and society as a whole.

PROCESS OF SETTING UP OF VISION AND MISSION OF THE DEPARTMENT



Vision and Mission of EE Department

PROGRAMME EDUCATIONAL OBJECTIVES

PEO 1	• Provide graduates with an outstanding education, research skills and knowledge to further their career aspirations
PEO 2	• Prepare students to excel in post graduate programs to succeed in industry, technical profession through rigorous education
PEO 3	• Prepare graduates for Ph.D. programs
PEO 4	• Inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, managerial skills, multidisciplinary approach and an ability to relate engineering issues to broader social context

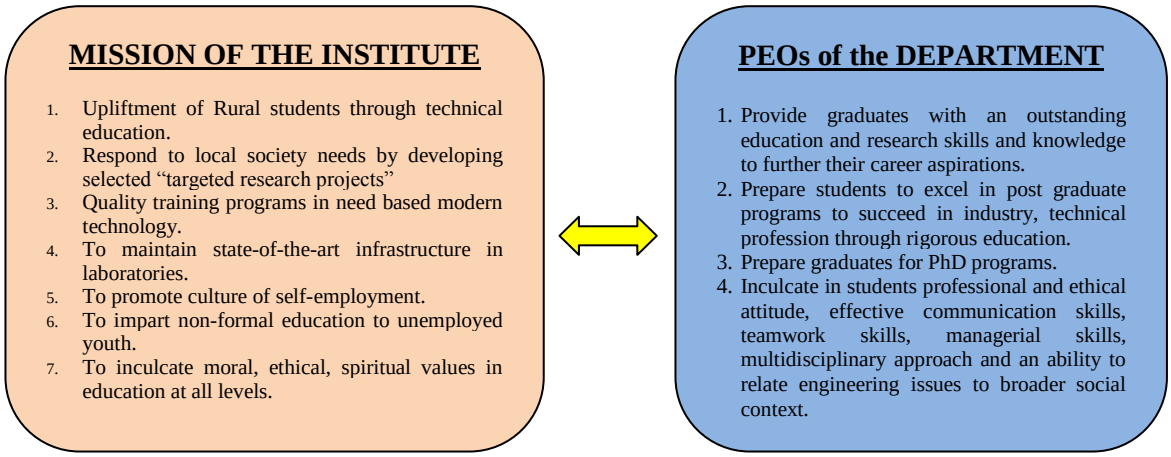
PROGRAMME OUTCOMES

PO 1	• An ability to critically identify, formulate and solve Electrical Engineering problems
PO 2	• Demonstrate ability to work in multidisciplinary teams
PO 3	• To have knowledge of professional and ethical responsibilities
PO 4	• To identify thrust area of research, design and implementation of knowledge gained
PO 5	• To have confidence for self education and lifelong learning
PO 6	• An ability to use research based techniques and skills for Theses, Projects and Publications in Conferences and/ or peer reviewed Journals

MAPPING BETWEEN DEPARTMENT PEOs AND MISSION OF INSTITUTE

The mission statement of the Institute envisages promoting the rural masses to face the challenges of fast changing world. The mapping of department PEOs with mission of the Institute is as shown below:

- VS: Very Strong
- S: Strong
- W: Weak



PEO/ Institute Mission	1	2	3	4	5	6	7
PEO 1		S			VS		S
PEO 2		S	S		VS		S
PEO 3		VS	S				S
PEO 4	W			VS	S	S	VS

MAPPING BETWEEN PEOs AND POs

PEO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
PEO 1	VS			VS		
PEO 2		S	S			
PEO 3			S		S	
PEO 4		S				VS

VS : Very Strong

S : Strong

W : Weak

PROGRAM CURRICULUM

The structure of the curriculum provides both breadth and depth across the range of engineering topics relevant to Power Engineering. The program is spread over four semesters and it has total twelve theory subjects (six core, four program electives and two open electives which are chosen from the list of seventeen elective subjects) and two practical courses besides pre-thesis seminar, pre-thesis project and Thesis.

The structure is designed in such a manner that along with enhancing the knowledge of engineering problems, post- graduates are fortified with the lab work for searching advanced engineering solutions, technical services for many diverse fields.

Students are also encouraged to select best technical topic ideas on latest technology for their pre-thesis seminar and to explore a variety of research methods during pre-thesis project. Besides this, the thesis work develops the ability to use the modern engineering tools necessary for engineering practice including research areas.

After conferred Autonomous Status by University Grants Commission (UGC), New Delhi in 2012 under section 2(f) and 12(B) of UGC Act 1956, college has administrative power to make decisions regarding changes in curriculum for refinement based on future expected scenario, current industry need, program outcomes and program educational objectives. Program Co-ordinator and Faculty members have taken the initiative and identified changes in terms of courses for improvement of curriculum. The administrative system BOS, Academic Council and Program Assessment Committee have implemented necessary changes like Choice based Credit system and Thesis Grading system from 2014 admission batch.

GURU NANAK DEV ENGNINEERING COLLEGE, LUDHIANA

ELECTRICAL ENGINEERING DEPARTMENT

SYLLABUS SCHEME FOR M.TECH. (POWER ENGG.) FULL-TIME

2014 ONWARDS

Sr. No.	Description of Subject	No. of Subjects	Credits per Subject	Total Credits
1	Core	6	4	24
2	Program Elective (Department Elective)	4	3	12
3	Program Elective (Open Elective)	2	3	6
4	Laboratory	2	2	4
5	Pre Thesis Seminar	1	1	1
6	Pre Thesis Project	1	3	3
7	Thesis	1	15	15
G. Total				65

Sr. No.	Subject Code	Subject Name	Description of Subject	Credits
SEMESTER – I				
1	MTPEE – 501	Advanced Power System Analysis	Core	4
2	MTPEE – 502	Power System Operation and Control	Core	4
3	MTPEE – 503	Advanced Electrical Machines	Core	4
4	MTPEE – 507	Power System Software Lab	Core	2
5	MTPEE – XXX	Department Elective - I	Program Elective	3
6	MTPEE – XXX	Department Elective - II	Program Elective	3
Total Credit				20
SEMESTER – II				
1	MTPEE – 504	HVDC Transmission	Core	4
2	MTPEE – 505	Power System Protection	Core	4
3	MTPEE – 506	EHVAC Transmission	Core	4
4	MTPEE – 508	Industrial Automation Lab	Core	2
5	MTPEE – XXX	Department Elective - III	Program Elective	3
6	MTXX – XXX	Open Elective - I	Program Elective.	3
Total Credit				20
SEMESTER – III				
1	MTPEE – XXX	Department Elective - IV	Program Elective	3
2	MTXX – XXX	Open Elective - II	Program Elective	3
3	MTPEE – 509	Pre Thesis Seminar	Core	1
4	MTPEE – 510	Pre Thesis Project	Core	3
Total Credit				10
SEMESTER – IV				

1	MTPEE – 511	Thesis	Core	15

GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA

ELECTRICAL ENGINEERING DEPARTMENT

MASTER OF TECHNOLOGY (FULL-TIME) POWER ENGINEERING COURSE SUBJECTS (2014 ONWARDS)						
Sr. No.	**Subject code**	**Course title**	**Type**	**L**	**P**	**Credits**
1	MTPEE – 501	Advanced Power System Analysis	Core	4	-	4
2	MTPEE – 502	Power System Operation and Control	Core	4	-	4
3	MTPEE – 503	Advanced Electrical Machines	Core	4	-	4
4	MTPEE – 504	HVDC Transmission	Core	4	-	4
5	MTPEE – 505	Power System Protection	Core	4	-	4
6	MTPEE – 506	EHVAC Transmission	Core	4	-	4
7	MTPEE – 507	Power System Software Lab - I	Core	-	4	2
8	MTPEE – 508	Industrial Automation Lab - II	Core	-	4	2
9	MTPEE – 509	Pre Thesis Seminar	Core	-	1	1
10	MTPEE – 510	Pre Thesis Project	Core	-	3	3
11	MTPEE – 511	Thesis	Core	-	-	15
12	MTPEE – 601	Research Methodology	Program Elective	3	-	3
13	MTPEE – 602	Advanced Power Electronics	Program Elective	3	-	3
14	MTPEE – 603	Digital Control System	Program Elective	3	-	3
15	MTPEE – 604	Energy Efficient Machines	Program Elective	3	-	3
16	MTPEE – 605	Power System Planning	Program Elective	3	-	3
17	MTPEE – 606	Power Systems Stability	Program Elective	3	-	3
18	MTPEE – 607	Advanced Electrical Drives	Program Elective	3	-	3
19	MTPEE – 608	Microprocessors & their applications	Program Elective	3	-	3
20	MTPEE – 609	Industrial Instrumentation and Process Control	Program Elective	3	-	3
21	MTPEE – 610	Power System Transients	Program Elective	3	-	3
22	MTPEE – 611	Operation and Modeling of Restructured Power System	Program Elective	3	-	3
23	MTPEE – 612	Power System Reliability	Program Elective	3	-	3
24	MTPEE – 613	Renewable Energy Resources	Program Elective	3	-	3
25	MTPEE – 614	Reliability Engineering	Program Elective	3	-	3
26	MTPEE – 615	Optimization Techniques	Program Elective	3	-	3
27	MTPEE – 616	Neural Networks & Fuzzy Logic	Program Elective	3	-	3

28	MTPEE – 617	Economics and Organization of Power Sector	Program Elective	3	-	3

MTPEE – 501 ADVANCED POWER SYSTEM ANALYSIS

Internal Marks : 50	L	C
External Marks : 100	4	4
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Construct network matrices by singular and non-singular transformation and bus impedance matrices by algorithmic approach.
b. Develop mathematical model and find solution of optimal power flow problems.
c. Investigate state of a power system by power flow analysis as well as state estimation.
d. Investigate security of Power System using Short Circuit and Contingency Analysis.

CONTENTS

1. FORMATION OF NETWORK MATRICES & TRANSFORMATION

Incidence and network matrices, formation of network matrices by singular and non-singular transformation.

2. FORMATION OF BUS IMPEDANCE MATRICES

Formation of single phase bus impedance matrix using algorithmic approach including the effect of mutually coupled elements.

3. POWER FLOW ANALYSIS

Review of power flow without and with tap changing and phase shifting transformers, power flow analysis with series and shunt compensating devices, power flow for radial distribution network.

4. OPTIMAL POWER FLOW

Optimal power flow problem formulation and solution techniques.

5. POWER SYSTEM SECURITY

Factors effecting power system security, short circuit and contingency analysis, network sensitivity using load flow, correcting the generation dispatch by using sensitivity method and linear programming.

6. STATE ESTIMATION

State estimation from on line measurements, method of least squares, the line power flow state estimation.

BOOKS RECOMMENDED

1. G.N. Stagg and A. H.EI- Abiad, *Computer Methods in Power System Analysis*, Mc Graw– Hill, International Edition.
2. George L .Kusic , *Computer Aided Power Systems Analysis*, Prentice Hall.
3. Arrillaga, C.P. Arnold and S.J. Harker, *Computer Modelling of Electrical Power Systems*.
4. O.I. Elgerd, *Electric Energy Systems-An Introduction*, Tata Mc Graw Hill.
5. M.A. Pai, *Computer Techniques in Power Systems Analysis*, Tata McGraw Hill.
6. P.M. Anderson, *Analysis of Faulted Power System*, IEEE Press Book.
7. Related IEEE/IEE Publication.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE– 502 POWER SYSTEM OPERATIONS AND CONTROL

Internal Marks : 50	L	C
External Marks : 100	4	4
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Analyze the difference in characteristic curves for different types of generation.
b. Understand economic dispatch problem, unit commitment problem and apply various solution methods to these problems.
c. Understand hydro-thermal co-ordination, concept of energy banking and power trading.
d. Retrieve the techniques of automatic generation control.

CONTENTS

1. CHARACTERISTICS OF POWER GENERATION UNITS

Characteristics of steam units, variation in steam unit characteristics, cogeneration plants, hydro electric units.

2. ECONOMIC DISPATCHOF THERMALUNITS

Economic Dispatch Problem, Thermal dispatching with network losses considered, penalty factors, lambda iteration method, Gradient method, Newton's method, Dynamic Programming, Base point and participation factors.

3. UNIT COMMITMENT & SOLUTION METHODS

Economic Dispatch unit commitment, constraints in unit commitment, priority method, dynamic programming, analytical method, introduction to optimal power dispatch considering unit commitment.

4. HYDROTHERMALCO-ORDINATION

Introduction to long range and short range hydro scheduling, Types of short range scheduling problem, Scheduling energy, the short term hydro-thermal scheduling problems and its solution by Lambda-Gamma iteration method and gradient method.

5. AUTOMATIC GENERATION CONTROL

Generator, Prime mover, Governor, Tie line and load models ,Load frequency control, Load frequency and economic dispatch control ,Automatic voltage Control, Load frequency control with generation rate constraints, Decentralized control.

6. INTERCHANGEOF POWER AND ENERGY

Economy Interchange between Inter connected utilities, Inter utility Economy Energy Evaluation, Capacity Interchange, Diversity Interchange, Energy Banking, Emergency Power Interchange, Power pools, Transmission Effects and Issues.

BOOKS RECOMMENDED

1. Allen J. Wood and Brace F Woollen berg, *Power Generation Operation and Control*, John Willey & Sons 2nd Edition.
2. D.P. Kothari and J.S. Dhillon, *Power System Optimization, Prentice*-Hall of India, Pvt. Ltd,. New Delhi
3. L.K. Kirchmayer, *Economic Operation of Power Systems, John* Willey &Sons, N.Y.
4. D.P. Kothari and I.J. Nagrath, *Modern Power System Analysis*, Tata Mc Graw- Hill Publishing Company Ltd., New Delhi.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 503 ADVANCED ELECTRICAL MACHINES

Internal Marks : 50	L	C
External Marks : 100	4	4
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Construct equivalent circuit of poly phase synchronous machines.
b. Understand the parameters related to steady state analysis of cylindrical and salient pole synchronous machines.
c. Analyze multi circuit transformers for finding out the parameters and understand concept of in rush current.
d. Analyze the harmonics in waveforms.

CONTENTS

1. POLYPHASE SYNCHRONOUS MACHINES

Mathematical: Basic Synchronous machine parameters, Voltage Flux linkage and inductance relations, Park's transformation–its physical concept, equations of performance.

2. BALANCED STEADY STATE ANALYSIS

Phasor equations and phasor diagrams, Power-angle characteristics, cylindrical rotor and Salient pole machines, Short circuit ratio.

3. TRANSIENT ANALYSIS & MACHINE DYNAMICS

Three phase short-circuits, Armature and field transients, Transient torque, Sudden reactive loading and Unloading, Transient Analysis-a qualitative approach , Reactance and Time-Constants from equivalent circuits, Measurement of reactance, Transient Power-angle characteristics, The basic electro mechanical equation, Linearized Analysis, Large Angular/oscillation, Non-linear analysis.

4. TRANSFORMERS & ITS TRANSIENTS

Multi-Circuit Transformers: General theory, Equivalent circuits, Three winding transformer as a multi-circuit transformers, Determination of parameters, In-rush current phenomena, Qualitative approach, Analytical approach, In-rush current in 3-phase transformers.

5. EXCITATION PHENOMENA IN TRANSFORMERS

Harmonics in Single–phase transformers, Harmonics in three-phase transformers, Disadvantages of harmonics, Suppression of harmonics.

6. UNBALANCED OPERATION OF THREE-PHASE TRANSFORMERS

Single-phase load on three-phase transformers, Single-Phasing in 3-phase transformers, Effect of using tertiary winding.

BOOKS RECOMMENDED

1. Edikins B., Generalized *theory of electrical Machines.*
2. Concordia , *Synchronous machines*.
3. E.W. Kim bark, *Power System Stability*, Vol. III., Wiley
4. Fitzgerald A.E., Kingsley C. and Umans S.D., *Electric Machinery*, 6th Edition, Mc Graw Hill
5. Bimbra, P.S., *Generalized theory of electrical Machines*, Khanna Publications
6. Draper A, *Electrical Machines,* Longman London, 1972
7. MIT Staff, *Magnetic Circuits and Transformer.*
8. Daniels A. R., *Introduction to Electrical Machines*" MacMillan, London 1976.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 504 HVDC TRANSMISSION

Internal Marks : 50	L	C
External Marks : 100	4	4
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Compare merits of HVDC transmission over EHVAC transmission.
b. Comprehend the control of HVDC links and converter connections.
c. Understand the concept of harmonics and needs for compensation.
d. Analyze multi-terminal HVDC systems and protection schemes.

CONTENTS

1. HVDC TRANSMISSION & LINKS

Introduction, Comparison, merits and demerits of HVDC over EHVAC, types of HVDC links, equivalent Circuit of HVDC link, Basic means of control of HVDC link, CIA, CEA&CC, control characteristics, combined characteristics of a converter.

2. CONVERTERS

Converter connection, rectifier & inverter waveforms, complete analysis of 3-phase (6pulses) bridge converter, equations of voltage and current on AC & DC side.

3. COMPENSATION

Need of reactive power compensation, methods of compensation in HVDC substation.

4. HARMONICS

Fundamentals of Harmonics, reason of production and harmonic filters.

5. HVDC MULTI-TERMINAL SYSTEMS

Introduction, schematic representation and applications of multi-terminal HVDC systems.

6. PROTECTIVE SYSTEMS

Faults in converters and HVDC system, protective schemes.

BOOKS RECOMMENDED

1. K.R, Padiyar, *HVDC Power Transmission System*, WileyEasternLtd,1990
2. E.W. Kimbark, *Direct Current TransmissionVol:1*, WileyInterscience,1971.
3. J. Arrillage, *H.V.D.C. Transmission*, Peter Peregrines, 1983.
4. J. Arrillage, Computer *Modeling of Electrical Power System,* JohnWiley1993.

5. S. Rao, *EHV-AC and Transmission Engineering Practice*, Khanna Publishers1990.
6. Related IEEE/IEE Publications.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 505 POWER SYSTEM PROTECTION

Internal Marks : 50	L	C
External Marks : 100	4	4
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Apply knowledge of circuit breakers to suggest suitable breaker for a particular application.
b. Select and model various components (like CT, CVT, and numerical relay) for protection purpose.
c. Design and simulate over current, distance and differential protection schemes for power
   Systems.
d. Develop the advanced schemes for power system protection using new technologies.

CONTENTS

1 . FUNDAMENTALS OF PROTECTIVE RELAYS

Types of relays, their classifications and theory Phase and amplitude comparators, Static Comparators, Computer Applications to protective relaying.

2. TRANSMISSION LINE PROTECTION

Carrier Current Protection, Applications of microwave Channels for protective relaying ,Selection of suitable static relaying, scheme for transmission line protection, Performance specifications of distance relays, effect of fault resistance and effects of power swings on operation of relays, Distance relay settings, Requirement of Characteristic for different zeros, Selection of suitable static relaying schemes for transmission lines.

3. GENERATORS AND TRANSFORMERS PROTECTION

CT's and PTs burden and accuracy and their connections, Protection of rotor winding, Miscellaneous protection schemes for generators and transformers, over fluxing protection of transformers.

4. DIFFERENTIAL RELAYS

Operating Characteristics, Restraining Characteristics, Analysis of Electromagnetic and differential Static relays schemes.

5. BUS ZONE PROTECTION

Types of bus-bar faults, Protection requirements, protection schemes and modern trend in bus-bar protection.

6. CIRCUIT BREAKERS

Physical stress in circuit breakers, Vacuum circuit breakers, SF6 Circuit breakers , Direct current C.B's, Short circuit testing of circuit breakers, Comparison of different types of circuit breakers.

BOOKS RECOMMENDED

1. T.S. Madhava Rao ,*Power System Protection (Static Relays)*,Tata Mc Graw-Hill,1989.
2. A.R. Van C. Warrington ,*Protective Relays* ,Chapman and Hall London, 1968.
3. S.K. Basuand S. Chaudhary ,*Power System Protection* , Raju Primlan Oxford and IBH Press 1983.
4. Ravindra Nalh M. Chander, *Power System Protection and Switch Gear*, John Wiley Eastern 1989.
5. Sunil S. Rao, *Power System Protection and Switch Gear*, Khanna Publishers1989.
6. Related IEEE/IEE Publications.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 506 EHVAC TRANSMISSION

Internal Marks : 50	L	C
External Marks : 100	4	4
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Analyse the electrostatic field of EHV AC transmission lines.
b. Analyse EHV AC transmission line parameters and Corona Loss.
c. Understand the Lightning Phenomenon, Lightning Protection, and FACT devices.
d. Design EHV transmission lines based on steady state limits.

CONTENTS

1. EHVAC TRANSMISSION TOWERS

Introduction to EHVAC Transmission, tower Configurations, types of self- supporting Lattice towers, flexible and semi flexible towers.

2. TRANMISSION LINE AND RELEVANT PARAMETERS

Thermal rating of lines, temperature rise of conductors and current carrying capacity of lines and cables, corona, corona loss, properties of bundled conductors, average value of line parameters, power handling capacity, selection of cable for EHVAC transmission, electrical characteristics and cable insulating materials.

3. ELECTROSTATIC FIELD OF EHV LINES

Capacitance of long objects under transmission lines, electrostatic field of 3-phase single circuit and double circuit AC lines, biological effects of electrostatic fields.

4. LIGHTNINGANDLIGHTNINGPROTECTION

Overvoltage factors, type of surge arresters, rating and classification of surge arresters based on applications, insulation withstand characteristics of long air gaps.

5. DESIGN ANALYSIS

Voltage stability, design of EHV lines based on steady-state limits, series and shunt compensation, reactive power control apparatus.

6. INTRODUCTION TO FACTS & APPLICATIONS

Introduction to FACT devices: SVC, TCSC, SSSC, STATCOM and UPFC, applications.

BOOKS RECOMMENDED

1. R.D. Begamudre, *EHVAC Transmission*, Wiley Eastern Ltd., 2nd edition.
2. *Transmission Line*, Reference Book: 345KV and above EPRI, Palo Alto USA.
3. *Electrical Transmission and Distribution,* Reference Book, Oxford book Company, Calcutta.
4. S. Rao, *EHVAC and HVDC Transmission Engineering*, Practice, Khanna Publishers.
5. Related IEEE/IEE Publications.
6. FACTS, Hingorani**.**

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 507 POWER SYSTEM SOFTWARE LAB – I

Internal Marks : 50	P	C
External Marks : 50	2	2
Total Marks : 100		

COURSE OUTCOMES

After studying this course, the students will

a. Construct the impedance and admittance matrices using software.
b. Understand the procedure and steps needed to implement a load flow system study and interpret the results provided by the software.
c. Apply a short circuit analysis study for symmetrical and unsymmetrical faults and are able to interpret the results of the analysis.
d. Understand and able to perform transient stability analysis.

CONTENTS

1. Development of algorithms & flow charts and digital simulation of the following using ETAP/ MATLAB Software package:

a. Z-bus and Y-bus formulation
b. Load flow studies
c. Fault analysis
d. Transient stability studies
e. Economic load dispatch

MTPEE– 508 INDUSTRIAL AUTOMATION LAB – II

Internal Marks : 50	P	C
External Marks : 50	2	2
Total Marks : 100		

COURSE OUTCOMES

After studying this course, the students will

a. Retrieve the basic knowledge of PLC.
b. Create simple working program on PLC.
c. Understand the use of PLC in process control industry.
d. Analyze the SCADA system and its application.

CONTENTS

1. Programmable Logic Controller (PLC) –General introduction, basic concepts, different types of programming: ladder programming, Instruction List programming, High level programming, flow diagram programming.
2. Simple introductory programs.
3. Use of PLC for: Simple domestic or commercial lighting automation, water level control.
4. Industrial applications of PLC using Timer and Counter Function.
5. Study & use of SCADA Software for different process control systems.

MTPEE – 509 PRE-THESIS SEMINAR

Internal Marks : 100	P	C
External Marks : --	1	1
Total Marks : 100		

COURSE OUTCOMES

After studying this course, the students will

a) Evaluate various latest topics in power systems.
b) Analyze and develop a thought process for presentation.
c) Understand others point of view, thereby encouraging team work.
d) Evaluate the impact of various technologies on environment.

CONTENTS

Students have to study from National/International Journals, Internet and books etc. related to latest topics and developments in the area of Electrical Engineering and deliver a seminar individually for 25-30 minutes along with Seminar Report.

MTPEE – 510 PRE-THESIS PROJECT

Internal Marks : 50	P	C
External Marks : 50	3	3
Total Marks : 100		

COURSE OUTCOMES

After studying this course, the students will

a. Acquire ability to work in team.
b. Evaluate application of a particular tool/ component for specific application.
c. Acquire ability to apply thinking and problem solving skills.
d. Apply knowledge gained for analysis and design of circuits.

CONTENTS

The students are required to work in team and to formulate software/hardware based projects showing applications of the knowledge gained during the course work. The students should be able to find out the ratings/ suitability of various components/software in their project work.

MTPEE – 511 THESIS

Internal Marks : 200	P	C
External Marks : 100	15	15
Total Marks : 300		

COURSE OUTCOMES

After studying this course, the students will

a. Feel encouraged taking up a research problem.
b. Contact the engineering fraternity.
c. Acquire knowledge for finding solutions to problems in emerging areas.
d. Able to present their ideas in written form and feel encouraged to present technical papers..

CONTENTS

Each student will be required to complete a Dissertation and submit a written Report on the topic on any of the areas of modern technology related to Electrical Engineering including interdisciplinary fields in the Final semester of M.Tech. Course.

MTPEE– 601 RESEARCH METHODOLOGY

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Understand the difference between various types of research.
b. Apply various statistical techniques for analysis of data.
c. Construct and analyze hypothesis through various test.
d. Learn to write the report.

CONTENTS

1. METHODS OF RESEARCH

Nature and Objectives of research, historical, descriptive and experimental Study and formulation of research problem, Scope of research and formulation of hypotheses, Feasibility, preparation and presentation of research proposal.

2. INTRODUCTION TO STATISTIC ALANALYSIS

Measures of central tendency and dispersion, Mean, median, mode, range, mean deviation and standard deviation, Regression and correlation analysis, Probability and probability distributions, Binomial, Poisson, Geometric, Negative binomial, Uniform, Exponential, Normal and Log-normal distribution, Basic ideas of testing of hypotheses, Tests of significance based on normal, tand Chi-square distributions, Analysis of variance technique.

3. DESIGN OF EXPERIMENTS

Basic principles, study of completely randomized and randomized block design, Edition and tabulation of results, presentation of results using figures, tables and text, quoting of references and preparing bibliography, Use of common software like SPSS, Mini Tab and/or MATLAB for statistical analysis.

BOOKS RECOMMENDED

1. Borth Wayne C., *the Craft of Research*, Chicago Guides to Writing Edition and Publishing.
2. Johnson R.A., *Probability and Statistics*, PHI, New Delhi.
3. Meyer P.L., *Introduction to Probability and Statistical, Applications*, Oxford, IBH.
4. Hogg, R.V. and Craig A.T., *Introduction to Mathematical Statistics*, MacMillan.
5. Goon, A.M., Gupta, M.K. and Dasgupta, *Fundamentals of Statistics*, World Press.
6. Gupta, S.C. and Kapoor V.K., *Fundamentals of Mathematical Statistics*, Sultan Chand and Sons.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 602 ADVANCED POWER ELECTRONICS

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Understand the Design Consideration of Gate and Basic drive system.
b. Understand the design of Practical Converter in Electronic circuit.
c. Understand about different types of Power supplies.
d. Apply Power Electronics in commercial and industrial applications.

CONTENTS

1. INTRODUCTION

Power Electronic Systems, Power Semiconductor switches, Basic electrical and magnetic circuit concepts, Temperature Control and Heat Sinks: Control of semiconductor device temperatures, Heat transfer by conduction, Heat sinks, Heat transfer by radiation and convection

2. POWER SUPPLY APPLICATIONS

Switching dc Power Supplies: Introduction, Comparison of Linear power supplies and switching power supplies, dc-dc converters with electrical isolation, Control of SMPS, Power supply protection, Electrical isolation in the feedback loop, Designing to meet power supply specifications, Power Conditioners and Uninterrupted Power Supplies: Introduction, Power line disturbances, Power Conditioners, Uninterrupted Power Supplies (UPS).

3. RESIDENTIAL AND INDUSTRIAL APPLICATIONS

Electric Utility Applications: Introduction, HVDC, Static Var Compensators, Interconnection of Renewable Energy Sources and Energy storage Systems to the Utility Grid.

4. PRACTICAL CONVERTER DESIGN CONSIDERATIONS

Snubber Circuits: Types of Snubber circuits, needs of Snubber circuit with diode, thyristor and transistors, Turn-off Snubber, over voltage snubber, turn on snubber, Snubber for bridge circuit configurations, GTO Snubber circuit.

5. GATE AND BASIC DRIVE CIRCUITS

Design Consideration, De-coupled drive circuits, electrically isolated drive circuits, cascade connected drive circuits, Power device protection in drive circuits, circuit layout considerations.

BOOKS RECOMMENDED

1. Undeland and Robbins, *Power electronics: converters, Applications and Design*, John Wiley and Sons.
2. Rashid M.H., *Power Electronics,* Handbook, Elsevier Press (Academic Press Series).
3. Finney D., *The Power Thyristor and its Applications*, McGraw Hill, New York.
4. Lander C. W. *Power Electronics*, McGraw Hill Book Co., U.K.
5. Rashid M.H., *Power Electronics - Circuits, Devices and Applications*, PHI, India.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE– 603 DIGITAL CONTROL SYSTEMS

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Understand Digital Control Systems.
b. Apply knowledge to find Time Response of Digital Control Systems.
c. Analyse the stability of Digital Control Systems.
d. Create Digital Control System and analyse by using State Variable Technique.

CONTENTS

1. OVERVIEW OF DIGITAL CONTROL

Configuration of the basic Digital Control Systems, types of sampling operations, Sample and Hold operations, Sampling theorem, Basic discrete time signals.

2. ANALYSIS OF DIGITAL CONTROL

Z-Transforms, Properties of Z-Transform, Inverse Z-Transforms, Pulse Transfer Function, Difference equations, Z-Transform method for solving the difference equations, Block diagram and signal flow graph analysis, Time response of digital control systems.

3. STABILITY METHODS

Mapping between s-plane and z-plane, stability methods: Modified Routh Criterion Jury's method, modified Schur-Cohn criterion.

4. MODELING AND DESIGN OF DIGITAL CONTROL SYSTEMS

Digital temperature control System, Digital position control system, stepping motors and their control, Design of Digital compensator using frequency response plots.

5. STATE VARIABLE ANALYSIS OF DIGITAL CONTROL SYSTEMS

Review of state variable methods, state variable description of digital control systems, conversion of state variable models to pulse transfer function and vice versa, solution of state difference equations, controllability and observability.

BOOKS RECOMMENDED

1. Gopal M., *Digital Control and State Variable Methods*, Tata McGraw-Hill.
2. Ogata K., *Discrete Time Control Systems*, Pearson Education,(Singapore)(Thomson Press India).
3. Kuo B.C, *Digital Control Systems*,Prentice Hall.
4. Nagrath I.J. & Gopal M., *Control System Engg*., John Wiley & sons.

5. Aggarwal K.K., *Control System Analysis and Design*, Khanna Publisher

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE-604 ENERGY EFFICIENT MACHINES

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Comprehend the need of energy efficient machines for energy conservation.
b. Understand the concept of power factor and energy efficient motors.
c. Justify the use of motors and adjustable drive systems for various applications.
d. Calculate savings and pay back periods for energy efficient machines.

CONTENTS

1. INTRODUCTION

Need for Energy Efficient Machines in Recent Energy Scenario, Energy Conservation and Energy Auditing in Industries, Review of Types of Induction Motors and their Characteristics, Classification of Induction Motors Based on Torque-Slip Characteristics, the P.F. in Sinusoidal Systems, P.F. Improvement.

2. ENERGY EFFICIENT MOTORS

Standard Motor Efficiency, Energy Efficient Motors, Efficiency Determination Methods, Direct Measurement Method, Loss Segregation Method, Comparison, Motor Efficiency Labeling, Energy Efficient Motor Standards.

3. APPLICATION OF ELECTRIC MOTORS

Varying Duty Applications, Voltage Variation, Voltage Unbalance, Over Motoring, Poly-Phase Induction Motors Supplied by Adjustable Frequency Power Supplies.

4. ADJUSTABLE DRIVE SYSTEMS

Adjustable Speed Systems, Application of Adjustable Speed Systems to Fans, Pumps and Constant Torque Loads.

5. ECONOMICS OF ENERGY EFFICIENT MOTORS

Motor Life Cycle, Direct Savings and Pay Back Analysis, Efficiency Evaluation Factor, Present Worth Method with Constant Power Costs, Present Worth Method with Increasing Power Costs, Net Present Worth Method.

BOOKS RECOMMENDED

1. John C. Andreas, *Energy efficient electric motors*, Marcel Dekker Inc. 1992.
2. Thuman A., *Introduction to Efficient Electric System Design*, The Fairmount Press Prentice Hall.
3. Tripathi S.C., *Electric Energy Utilization and Conservation*, Tata McGraw-Hill, 1991.
4. Belove C., *Handbook of Modern Electronics and Electrical Engineering*, John Wiley & Sons.
5. Gupta B.R., *Generation of Electric Power*, S Chand Publishers, 2009.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE– 605 POWER SYSTEM PLANNING

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Understand the objectives of national and regional planning strategies of electric power.
b. Acquire knowledge about the concept of load forecasting.
c. Apply the concept of generation, transmission and distribution planning in power system.
d. Evaluate loss of energy indices and calculate voltage and power loss.

CONTENTS

1. POWER SYSTEM PLANNING & RELIABILITY

Power System Planning, Objective, Stages in Planning and Design, Key Indices of Power System Reliability and their Calculations, Linkage between Reliability and Capacity Planning.

2. GENERATING SYSTEM CAPABILITY PLANNING

Probabilistic Models of Generating Units, Growth Rate, Rate of Generation Capacity, Outage Performance and System Evaluation of Loss of Load and Loss of Energy Indices, Power Supply Availability Assessment.

3. INTERCONNECTED SYSTEMS

Multi Area Reliability Analysis, Power Pool Operation and Power Exchange Energy Contracts, Quantification of Economic and Reliability Benefits of Pool Operation.

4. LOAD FORECASTING & EXPANSION PLANNING

Electricity Consumption Pattern, Peak Demand and Energy Forecasting by Trend and Economic Projection Methods, Formulation of Least Cost Optimization Problem Involving Capital, Operation and Maintenance Costs of Candidate Units of Different Types.

5. INVESTMENT PLANNING MODELS

Traditional Generation Expansion Planning Models, Integrated Resource Planning Models, Production Cost Simulation Models, Load Characteristics, Design of Sub Transmission Lines and Distribution, Substations, Design Considerations of' Primary and Secondary Distribution Systems, Voltage Drop and Power Loss Calculations, Distribution System, Voltage Regulation, Application of Capacitors to Distribution Systems.

BOOKS RECOMMENDED

1. Wallach Y.,*Power System Planning*, McGraw Hill International.
2. Sullivan P., *Power System Planning*, McGraw Hill International.
3. Dasari, S., *Electric Power System Planning*, IBT Publishers, New Delhi.
4. BillintonR., *Power System Reliability Calculation*, MIT Press, USA.
5. Endreyni, *Reliability Modeling in Electric Power System*, John Wiley, New York.
6. McDonald J.R., *Modern Power system Planning*, McGraw Hill International.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 606 POWER SYSTEM STABILITY

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Develop model of power system components for stability studies.
b. Carry out transient stability analysis of a single machine infinite bus system.
c. Carry out small signal stability analysis of single machine infinite bus and multi-machine systems.
d. Understand the problems associated with sub-synchronous resonance and voltage instability and make investigations for voltage stability improvement of a power system.

CONTENTS

1. MODELING OF POWER SYSTEM COMPONENTS

Generators (Non-linear and linear models using d-q transformation, power capability curve), Excitation System (IEEE standard models), Turbine and Speed Governing System, Loads (Induction motors and composite loads).

2. TRANSIENT STABILITY ANALYSIS

Single Machine - Infinite Bus System, Equal Area Criterion, Multi-machine Stability, Network Reduction and Numerical Integration Methods, Methods of Improvement.

3. SMALL SIGNAL STABILITY ANALYSIS

Eigen Value and Participation Factor Analysis, Single machine - Infinite Bus and Multi-machine Simulation, Effect of Excitation System and AVR, Improvement of Damping - Power System Stabilizer and SVS supplementary controls.

4. SUB SYNCHRONOUS OSCILLATIONS

Sub Synchronous Resonance (SSR) Phenomenon, Counter measures to SSR problems.

5. VOLTAGE STABILITY

P-V and Q-V curves, Impact of Load and Tap-changer Dynamics, Static Analysis, Sensitivity and Continuation Methods, Dynamic Simulation, Introduction to Bifurcation Analysis, Proximity Indices, Methods to Enhance Stability Margin.

BOOKS RECOMMENDED

1. Kundur P, *Power System Stability and Control*, McGraw Hill.

2. Taylor C.W., *Power System Voltage Stability*, McGraw Hill.
3. Anderson P.M. and Foud A. A., *Power System Control and Stability*, IEEE Press.
4. Kimbark E., *Power System Stability*, Vol. I, II and III, IEEE Press.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE - 607 ADVANCED ELECTRICAL DRIVES

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Model and analyze electrical motor drives.
b. Apply the theories of electrical machines, power electronic converters and control system design to implement drive systems which are appropriate for specific performances.
c. Understand the speed control and braking methods of electrical drives.
d. Demonstrate the application of DC and induction motor drives.

CONTENTS

1. INTRODUCTION

Definition, Types of Loads, Steady State & Transient Stability of a Drive, State of Art of Power Electronics and Drives, Selection of Motor Rating.

2. D.C. DRIVES

Review of Braking and Speed Control of D.C. Motors, Multi-Quadrant Operation and Loss Minimization in Adjustable Speed Drives, Mathematical Modeling of Dc Drives, Stability Analysis, Modern Control Techniques: Variable Structure, Adaptive Control.

3. INDUCTION MOTOR DRIVES

Introduction, Induction Motor Characteristics at Rated (Line) Frequency and Rated Voltage, Speed Control by Varying Stator Frequency and Voltage, Impact of Non Sinusoidal Excitation on Induction Motors, Variable Frequency Converter Classifications, Variable Frequency PWM-VSI Drives, Variable Frequency Square Wave VSI Drives, Variable Frequency CSI Drives, Comparison of Variable-Frequency Drives, Line Frequency Variable Voltage Drives Reduced Voltage Starting ("Soft Start") of Induction Motors, Speed Control By Static Slip Power Recovery, Mathematical Modeling of Induction Motor Drives, Transient Response and Stability Analysis.

4. SYNCHRONOUS MOTOR DRIVES

Adjustable Frequency Operation, Voltage Fed Drive, Current Fed Self-Controlled Drive.

5. AUTOMATION USING DRIVES

Sensor Less Vector Control and Direct Torque Control Drive, Recent Trends in Automation and Case Studies.

BOOKS RECOMMENDED

1. Dubey G.K., *Power Semiconductor Controlled Drive*, Prentice Hall, New Jersey.
2. Sen P.C., *Thyristor Controlled DC Drives*, Wiley, New York.
3. Murphy J.M.D. and Turnbull F.G., *Power Electronics Control of AC Motors*, Franklin Book Co.
4. Bose B.K., *Power Electronics and AC Drives*, Prentice Hall, New Jersey.
5. Bose B.K., *Power Electronics and Variable Frequency Drives-Technology and applications.*
6. Ned Mohan, *Power Electronics: Converters Applications and Design*, Wiley India Edition.
7. Related IEEE/IEE Publications.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 608 MICROPROCESSORS AND THEIR APPLICATIONS

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Understand the internal architecture of 8085 and 8086 microprocessor, addressing modes and timing methods.
b. Understand peripheral interfacing of 8086.
c. Analyze interfacing of external electrical devices to the processor or according to the user requirements to create novel products and solutions for power engineering based applications.
d. Understand protective relaying and measurements using microprocessor.

CONTENTS

1. MICROPROCESSOR

Intel 8085- Introduction, Register Structure, Memory Addressing, Addressing Modes, Instruction Set, Timing Methods, CPU Pins and Associated Signals, Instruction Timing and Execution, Programming I/O, Interrupt System, DMA, SID & SOD Lines, Instruction Set, 8085 Based System Design, Intel 8086–Introduction, Architecture, Addressing Modes, Instruction Set, Memory Management, Assembler Dependent Instructions, Input/Output, System Design using 8086.

2. PROGRAMMING OF 8086 PERIPHERAL INTERFACING

Parallel versus Serial Transmission, Synchronous and Asynchronous Serial Data Transmission, Interfacing or Hexadecimal Key Board and Display Unit, Interfacing of Cassette Recorders and Parallel, Serial Interface Standards.

3. MICROPROCESSOR APPLICATIONS TO POWER ENGINEERING

Speed Control of Motors, P.F. Control, Numerical Relay Control and Heat Control, Programming of Numerical Relay.

4. PROTECTIVE RELAYING

Over-Current, Impedance, MHO, Reactance, Bi-Directional Relays.

5. MEASUREMENTS

Frequency, Power Angle & Power Factor, Voltage and Current, KVA, KW, KVAR, Maximum Demand, Resistance, Reactance, Temperature Controls.

BOOKS RECOMMENDED

1. Rafiquzzaman M., *Theory and Applications*, Prentice Hall(India) Publications 1993.
2. Ram B, *Fundamentals of Microprocessors and Microcomputers*, Dhanpat Rai and Sons.
3. Gaonkar R.S., *Microprocessor Architecture, Programming and Applications* John Wiley 1989.
4. Cheng L.Y., Gibson, G.A.PHI 1992.
5. Leventhal, L.A., *Introduction to Microprocessor, Software, Hardware, Programming.*
6. Related IEEE/IEE Publications.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 609 INDUSTRIAL INSTRUMENTATION AND PROCESS CONTROL

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Apply the knowledge of transducers for suggesting various applications and analyze the role of process control in estimation of errors and calibrations.
b. Evaluate the use of transducer for measurement of various non-electrical quantities and design Signal Conditioning circuits.
c. Evaluate and implement PID controllers in industrial applications.
d. Create the process control techniques for industrial processes.

CONTENTS

1. INTRODUCTION

Introduction to Sensors and Measurement Systems, Static and Dynamic Response of a Transducer System, Estimation of Errors and Calibrations Transducers and Sensors; their Characteristics and Parameters.

2. TRANSDUCERS

Strain Gauge, Load Cell, LVDT, Capacitive Transducers, Piezoelectric Transducers, Ultrasonic Transducers, Measurement of Temperature viz; Thermistor, Thermocouple, RTD and Problems Related to Temperature Sensors, Measurement of Pressure, Flow, pH, Torque and Viscosity, Problems and Solutions on Industrial Automation.

3. SIGNAL CONDITIONING CIRCUITS

Introduction to Process Control, Architecture of Industrial Automation Systems.

4. PID CONTROLLERS

P, PI and PID Control Controller Tuning, Implementation of PID Controllers.

5. CONTROL AND INDUSTRIAL AUTOMATION

Role of Instrumentation in Monitoring, Control and Industrial Automation special Control Structures, Feed Forward and Ratio Control, Predictive Control, Control of System with Inverse Responses, Cascade Control, Overriding Control, Selective Control and Split Range Control.

BOOKS RECOMMENDED

1. Ernest O Doeblin, *Measurement Systems*, Mc-Graw Hill.

2. W.D. Coopper& A.D. Helfrick, *Electronic Instrumentation and Measurement Techniques*, PHI.
3. B.C. Nakra and K.K. Choudhary, *Instrumentation Measurement Analysis*, Tata McGraw-Hill.
4. Mani Sharma, *Instrumentation systems,* Rangan.
5. Related IEEE/IEE Publications.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 610 POWER SYSTEMS TRANSIENTS

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Define, classify, interpret and model the transient phenomena in power system.
b. Understand the concept of switching surges.
c. Analyze transient phenomena and develop the strategies to mitigate associated problems.
d. Evaluate the transient process due to lightning.

CONTENTS

1. INTRODUCTION TO TRANSIENTS

Origin and Nature of Power System Transients, Traveling Waves on Transmission System, The Line Equation, The Shape Attenuation and Distortion of Waves, Reflection of Traveling Waves, Successive Ref1ections, Traveling Waves on Multi-Conductor Systems, Transition Points on Multiconductor Circuits.

2. THEORY OF GROUNDWIRES

Direct Stroke to a Tower, Effect of Reflection Up and Down the Tower, The Counterpoise.

3. SWITCHING SURGES& LIGHTENING

Switching Surge: Normal Frequency Effects, High Charging Currents, Cancellation Waves, Recovery Voltage, Restricting Phenomena, Lightening: Charge Formation, Mechanism of Lightening Stroke, Mathematical Model of Lightening Stroke.

4. PROTECTION

Protection of Transmission Systems against Surge.

5. FREQUENCY

High Frequency Oscillations and Terminal Transients of Transformer.

BOOKS RECOMMENDED

1. Bewley L.V., *Traveling waves on transmission systems*, *power,* Publication lnc NewYork,1963.
2. Rudenterg R., *Electric Stroke waves in Power Systems*, Harvard University Press, Cambridge, Massachusetts, 1968.

3. Wood A.G., *Electrical Transients in Power Systems*, Wiley lnterscience, 1971.
4. EPRI, *Transmission Line,* Reference Book 345KV and above, 1984.
5. *Surge Protection in Power Systems*, IEEE Publication, 79EHD 144-46PWR.
6. Regaller K., *Surges in High Voltage Networks*, Plenum Press, 1980.
7. Related IEEE/IEE Publications.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE - 611 OPERATION AND MODELING OF RESTRUCTURED POWER SYSTEM

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Understand components and models of restructured power systems.
b. Develop mathematical model and find solutions of market dispatch and transmission congestion management problems.
c. Evaluate available transfer capability of transmission system.
d. Analyze and compare different methods of transmission pricing and wheeling.

CONTENTS

1. INTRODUCTION

Overview of Restructured Power System, Difference between Vertically Integrated and Restructured Power Systems, Advantages of Competitive Environment in Power System, Components of Restructured Power System, Restructuring Models, Transmission Open Access, National and International Scenarios.

2. MARKET DISPATCH

DC and AC Optimal Power Flow Formulations, Generation and Demand Bidding, Social Welfare, Market Dispatch for Social Welfare Maximization, Shadow Prices, Locational Marginal Pricing and its Components.

3. TRANSMISSION CONGESTION MANAGEMENT

Transmission Congestion Problem, Market Power, Congestion Management Methodologies, Preventive and Corrective Congestion Management Approaches, Rescheduling and Load Auctions.

4. AVAILABLE TRANSFER CAPABILITY

Introduction, Definition, Principles of ATC Determination, Methods of Static ATC Determination.

5. TRANSMISSION PRICING AND WHEELING

Definition and Scope, Cost Components of Transmission System, MW-Mile and MVA-Mile Methodologies, Proportionality Sharing Principle, Loss Modeling, Transmission Pricing in India.

BOOKS RECOMMENDED

1. Loi Lei Lai, *Power system restructuring and deregulation*, John Wiley & Sons Ltd.
2. P. Venkatesh, B.V. Manikandan, S. Charles Raja, and A. Srinivasan, *Electric Power Systems, Analysis, Security and Deregulation*, PHI Learning Pvt. Ltd., New Delhi.
3. Lorrin Philipson and H. Lee Willis, Marcel Dekker, *Understanding electric utilities and deregulation*, New York, CRC Press, 2005.
4. Marijallic, Francisco Galiana and Lestor Fink, *Power system restructuring engineering & economics*, Kulwer Academic Publisher, USA-2000.
5. Santoso Surya, Beaty H. Wayne, Dugan Roger C., McGranaghan Mark F., *Electric power system quality*, McGraw Hills, 2002.
6. R.D. Christie, B.F. Wollenberg, and I. Wangensteen, *Transmission management in the deregulated environment*, Proc. of the IEEE, vol. 88, no. 2, pp. 170-195, Feb. 2000.
7. A. Kumar, S.C. Srivastava, and S.N. Singh, *A Zonal Congestion Management Approach Using Real and Reactive Power Rescheduling*, IEEE Trans. Power Syst., vol. 19, no. 1, pp. 554-562, Feb. 2004.
8. L.A. Tuan, K. Bhattacharya, and J. Daalder, *Transmission congestion management in bilateral markets: An interruptible load auction solution*, Elect. Power Syst. Res., vol. 74, no. 3, pp. 379-389, Jun. 2005.
9. A.J. Conejo, J. Contreras, D.A. Lima, and A.P. Feltrin, *Zbus Transmission Network Cost Allocation*, IEEE Trans. Power Syst., vol.22, no.1, pp.342-349, Feb. 2007.
10. A. R. Abhyankar, S. A. Khaparde, S. A. Soman, P. Pentayya, *A Transmission Pricing Mechanism Based on Power Tracing for Central Transmission Utility in India*, International Journal of Emerging Electric Power Systems, Volume 2, Issue 1 2005 Article 1033
11. K. Singh, N.P. Padhy, and J. Sharma, *Influence of Price Responsive Demand Shifting Bidding on Congestion and LMP in Pool-Based Day-Ahead Electricity Markets*, IEEE Trans. Power System, vol. 26, no. 2, pp 886-896, May 2011.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 612 POWER SYSTEM RELIABILITY

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Retrieve basic reliability modeling.
b. Apply probability techniques to power system problems and load forecasting.
c. Understand the method of evaluation of transmission system reliability.
d. Apply reliability calculation approach to composite systems.

CONTENTS

1. BASIC RELIABILITY CONCEPTS

The General Reliability Function, Hazard rate, MTTF, Markov Processes.

2. STATIC GENERATING CAPACITY RELIABILITY EVALUATION

Capacity Outage Probability Tables, Loss of Load Probability Method, Frequency and Duration Approach.

3. SPINNING GENERATION CAPACITY RELIABILITY EVALUATION

Spinning Capacity Evaluation, Load Forecast Uncertainty, Derated Capacity Levels.

4. TRANSMISSION SYSTEM RELIABILITYEVALUATION

Average Interruption Rate Method, Frequency and Duration Method, Stormy and Normal Weather Effects, The Markov Process Approach.

5. COMPOSITE SYSTEMRELIABILITYEVALUATION

Conditional Probability Approach, Two–Plant Single Load System.

BOOKS RECOMMENDED

1. Billinton R., *Power System Reliability Calculation*, MIT Press, USA.
2. Endreyni, *Reliability Modeling in Electric Power System*, John Wiley, New York.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 613 RENEWABLE ENERGY RESOURCES

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Analyze the advantages and disadvantages of various schemes for harnessing energy from renewable sources.
b. Analyze to compare economics of harnessing power from renewable sources.
c. Analyze the solar energy prospectus in India.
d. Evaluate the energy harnessing from biomass.

CONTENTS

1. ENERGY RESOURCES

Renewable Energy Sources, Energy and Global Climate Change Energy Parameters, Atmospheric Aspects of Electric Energy Generation, Impact of Renewable Energy Generation on Environment, Electromagnetic Radiation from Extra High Voltage Overhead Lines.

2. SOLAR, WIND AND GEOTHERMAL ENERGY

Solar Radiation and its Measurement, Solar Thermal Energy Collectors, Solar Thermal Energy Conversion Systems, Solar Photovoltaic System, Wind Turbines and Rotors, Modes of Wind Power Generation, Estimation of Wind Energy Potential, Selection of Optimum Wind Energy Generator (WEG), Geothermal Sites, Geothermal Field, Geothermal Resources, Geothermal Electric Power Plant.

3. FUEL CELLS & BIOMASS

Principle of Operation of Fuel Cell, Fuel Processor, Fuel Cell Types, Energy Output of a Fuel Cell, Efficiency, and EMF of a Fuel cell, Operating Characteristics of fuel cells, Thermal efficiency of a Fuel cell, Introduction to Biomass as Energy Source.

4. HYDROGEN ENERGYSYSTEM

Hydrogen Production, Hydrogen Storage, Development of Hydrogen Cartridge, Gas Hydrate.

5. HYBRID ENERGY SYSTEMS

Hybrid Systems and its types, Electric and Hybrid Electric Vehicles, Hydrogen-Powered-Electric Vehicles.

BOOKS RECOMMENDED

1. Kothari DP, Singal K.C. and Ranjan Rakesh, *Renewable energy sources and emerging technologies*, 2nd edition, Prentice Hall (India).
2. G.D. Rai, *Non-Conventional Sources of Energy*, Khanna Publishers.
3. Bansal N.K., M.K leemann, M. Heliss, *Renewable energy sources and conversion technology*, Tata McGraw Hill1990.
4. Abbasi S.A., Abbasi N, *Renewable energy sources and their environmental impact,* PHI, 2001
5. Mittal KM, *Renewable energy Systems,* Wheelar Publishing, New Delhi, 1997
6. Mukherjee D, *Renewable energy Systems,* New Age International, New Delhi, 2004

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 614 RELIABILITY ENGINEERING

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Conceptualize probability distributions and real appreciation of reliability engineering.
b. Create models of simple engineering systems for reliability studies.
c. Evaluate of reliability indices through different methods.
d. Understand hazard models and apply methods of enhancing system reliability.

CONTENTS

1. RELIABILITY MATHEMATICS

Random Experiments, Probability, Random Variables, Distribution Functions, Discrete Distributions, Continuous Distributions.

2. NETWORK MODELLING AND RELIABILITY EVALUATION OF SIMPLE SYSTEMS

Series Systems, Parallel System, Series-Parallel Systems, Partially Redundant Systems, Stand by Redundant Systems.

3. NETWORKS AND RELIABILITY EVALUATION OF COMPLEX SYSTEMS

Cut Set Method, Tie-Set Method, Connection Matrix Techniques, Event Trees, Fault trees.

4. PROBABILITY DISTRIBUTIONS IN RELIABILITY EVALUATION

General Reliability Function, Poisson Distribution, Normal Distribution, Exponential Distribution.

5. DISCRETE & CONTINUOS MARKOV CHAINS

General Modelling Concept, Stochastic Transitional Prob, Matrix, Time Dependent prob. Evaluation, Limiting State Prob. Evaluation, Absorbing States, General Modelling Concepts, State Space Diagrams, Stochastic Transitional Probability Matrix, Evaluating Limiting State Probabilities.

BOOKS RECOMMENDED

1. Srinath L.S., *Reliability Engineering*, Affiliated East, West Press Pvt. Ltd., New Delhi.
2. Balagurusamy E., *Reliability Engineering*, Tata McGraw Hill Publishing Company Ltd., New Delhi.

3. Billinton R. &Allan R.N., *Reliability Evaluation of Engg. Systems*: *Concepts & Techniques,* Plenum Press, N.Y. and London.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 615 OPTIMIZATION TECHNIQUES

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Classify the optimization problems and their solution methods into various categories.
b. Understand and apply analytical methods for the solution of unconstrained and constrained optimization problems with continuous variables.
c. Develop mathematical model and find optimal solutions of linear programming and transportation problems.
d. Understand and apply analytical methods for the solution of single and multi-variable unconstrained and constrained optimization problems with non-continuous variables.

CONTENTS

1. INTRODUCTION TO OPTIMIZATION

Statement of an Optimization Problem, Classification of Optimization Problems, Optimization Techniques, Engineering Applications of Optimization.

2. CLASSICAL OPTIMIZATION TECHNIQUES

Single Variable Optimization, Multivariable Optimization with no Constraints, Multivariable Optimization with Equality Constraints, Multi variable Optimization with in Equality Constraints.

3. LINEAR PROGRAMMING &TRANSPORTATION PROBLEM

Standard Form of Linear Programming, Graphical Solution, Simplex Method, Two phase simplex Method, Computer Implementation of The Simplex Method, Duality theory, North-West Corner Rule, Least Cost Method, Vogel Approximation Method, Testing for Optimality.

4. NON-LINEAR PROGRAMMING: ONE–DIMENSIONAL MINIMIZATION METHODS

Unimodal Function, Dichotomous Search, Fibonacci Search, Quadratic Interpolation method, Cubic Interpolation Method.

5. NON-LINEAR PROGRAMMING - UNCONSTRAINED & CONSTRAINED OPTIMIZATION TECHNIQUES

Random Search Method, Steepest Descent Method, Conjugate Gradient Method, Variable Metric Method, Interior Penalty Function Method, Exterior Penalty Function Method.

BOOKS RECOMMENDED

1. Rao, S.S., *Optimization : Theory and Application Wiley Eastern Press, 2nd edition 1984.*
2. Deb Kalyanmoy,.*Optimisation for Engineering Design-Algorithms and Examples.*, Prentice Hall India-1998
3. Taha H.A., *Operations Research -An Introduction,Prentice* Hall of India,2003.
4. Fox, R.L., *Optimization methods for Engineering Design*, Addition Welsey, 1971.
5. Ravindran A., Ragsdell K.M. and Reklaitis G.V. , *Engineering Optimization: Methods And applications* , Wiley, 2008
6. Godfrey C. Onwubolu , B. V. Babu , *New optimization techniques in engineering* , Springer, 2004

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 616 NEURAL NETWORKS & FUZZY LOGICS

Internal Marks : 50	L	C
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Acquire a thorough knowledge on biological neurons and artificial neurons, comparative analysis between human and computer, artificial neural network models, characteristics of ANN's.
b. Learn different types of activation functions, learning strategies, learning rules, perceptron models, single and multi-layer feed-forward and feed-back Neural Networks.
c. Apply concept of classical and Fuzzy Sets, Fuzzy Logic System components fuzzification and defuzzification.
d. Apply the neural network conceptual knowledge to real-world electrical problems and applications.

CONTENTS

1. NEURAL NETWORK CHARACTERISTICS

History of development in neural networks principles, artificial neural net terminology, Model of a neuron, Topology, Learning, types of learning, Supervised, Unsupervised, Re-enforcement learning, Knowledge representation and acquisition.

2. ALGORITHMS& MODELS

Basic Hop filed model, Basic learning laws, unsupervised learning, Competitive learning, K-means clustering algorithm, Kohonen's feature maps.

3. NEURAL NETWORKS

Radial basis function neural networks, Basic learning laws in RBF nets, Recurrent back propagation, Introduction to counter propagation networks, CMAC network and ART networks.

4. APPLICATIONS

Application of neural networks for electric load and electricity price forecasting, Optimization and decision-making.

5. FUZZY LOGICS

Basic concepts of fuzzy logic, Fuzzy vs. Crisp set, Linguistic variable, Membership functions, Operations of fuzzy sets, Fuzzy IF-THEN rules, Variable inference techniques, De-Fuzzification

Basic fuzzy inference algorithm, Fuzzy system design, FKBC & PID control , Antilock Breaking system(ABS), Industrial applications.

BOOKS RECOMMENDED

1. Haykin S., *Neural Networks*.
2. ROSS J.T., *Fuzzy logic with engineering application*
3. Kosko B., *Neural Networks & Fuzzy Logic*.
4. Wasserman P.D., *Neural computing theory & practice,* ANZA PUB.
5. Ibrahim A. M., *Introduction to applied Fuzzy Electronics*, PHI.
6. Zurada J.M., *Introduction to artificial neural systems*, Jaico Pub.
7. Driankor D., Hellendorn H., Reinfrank M., *An Introduction to Fuzzy control*, Narosa Pub.
8. Jnie J., LINKERS D., *Fuzzy Neural Control*, PHI.
9. Related IEEE/IEE Publications.
10. Riza C., Berkiu & Trubatch, *Fuzzy System Design Principles, Building Fuzzy IF-THEN Rule* Bases IEEE Press.

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

MTPEE – 617 ECONOMICS AND ORGANIZATION OF POWER SECTOR

	L	C
Internal Marks : 50		
External Marks : 100	3	3
Total Marks : 150		

COURSE OUTCOMES

After studying this course, the students will

a. Understand the need of Management Process for Power Utility.
b. Apply Financial Accounting during construction in power sector.
c. Understand the Economics Evaluation of Investment Proposal in Power sector.
d. Understand the different structure of a Utility Organization.

CONTENTS

1. MANAGEMENT AND ITS GOALS

Organization and Management, the management process, Managerial skills and Managerial performance, Policy and Objectives of a Power Utility, the Goal of a Firm.

2. UTILITY FINANCIAL ACCOUNTING

Balance Sheet, Income Statements and Cash Report, Depreciation, Interest charges during construction, Financial Statement Analysis.

3. INVESTMENT PROPOSAL

Interest and compounding, Measure of price- public versus private perspective, Economic evaluation of investment proposal, Internal Rate of return, Pay-Back Period.

4. ELECTRICITY TARIFFS

Traditional approach, Long-run Marginal costs, General Principles of Tariff Construction, Objectives of tariff, Generating system costs, Basic concept of cost levelization, Levelized busbar cost, spot and real time pricing

5. UTILITY ORGANIZATION

Functional structure, Divisional Structure, Matrix structure, Hybrid structure, main concerns of electric utilities, Performance of electric utilities.

BOOKS RECOMMENDED

1. Bartol K. M. and David C., *Management*, Martin McGraw-Hill, INC.
2. Weston J.F., *Brigham Essential of Managerial Finance*, Dryden Press
3. Stoll, *Least-Cost Electric Utility Planning*, John Wiley.
4. Stickney C.P. and Weil R.L., *Financial Accounting*, Dryden Press

5. Berrie T. W., *Electricity Economics and Planning*, IEE Power Series.
6. Levy H. and Sarnat M., *Capital Investment and Financial Decisions*, Prentice Hall

Note

1. Eight questions, well distributed out of the entire syllabus, are to be set.
2. Five questions are to be attempted.

THE STRUCTURE OF CURRICULUM WHICH HELPS FOR THE ATTAINMENT OF THE POs AND THE PEOs

Sr. No.	Course Name	Course Code	PEO 1 Provide graduates with an outstanding education and research skills and knowledge to further their career aspirations.		PEO 2 Prepare students to excel in post graduate programs to succeed in industry, technical profession through rigorous education.		PEO 3 Prepare graduates for Ph.D. programs.		PEO 4 Inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, managerial skills, multidisciplinary approach and an ability to relate engineering issues to broader social context.	
			Attained PO		Attained PO		Attained PO		Attained PO	
			PO 1	PO 4	PO 2	PO 3	PO 3	PO 5	PO 2	PO 6
1.	Advanced Power System Analysis	MTPEE – 501	√		√		√		--	
2.	Power System Operation and Control	MTPEE – 502	√		√		√		--	
3.	Advanced Electrical Machines	MTPEE – 503	√		√		√		--	
4.	HVDC Transmission	MTPEE – 504	√		√		√		--	
5.	Power System Protection	MTPEE – 505	√		√		√		--	
6.	EHVAC Transmission	MTPEE – 506	√		√		√		--	
7.	Power System Software Lab	MTPEE – 507	√		√		√		√	
8.	Industrial Automation Lab	MTPEE – 508	√		√		√		√	
9.	Pre Thesis Seminar	MTPEE – 509	√		--		√		√	
10.	Pre Thesis Project	MTPEE – 510	--		√		√		√	
11.	Thesis	MTPEE – 511	√		√		√		√	
12.	Research Methodology	MTPEE – 601	√		√		√		√	
13.	Advanced Power Electronics	MTPEE – 602	√		√		√		--	
14.	Digital Control System	MTPEE – 603	√		√		√		--	
15.	Energy Efficient Machines	MTPEE – 604	√		√		√		--	
16.	Power System Planning	MTPEE – 605	√		√		√		√	
17.	Power Systems Stability	MTPEE – 606	√		√		√		--	
18.	Advanced Electrical Drives	MTPEE – 607	√		√		√		--	
19.	Microprocessor & their applications	MTPEE – 608	√		√		√		√	
20.	Industrial Instrumentation	MTPEE – 609	√		√		√		√	

	and Process Control					
21.	Power System Transients	MTPEE – 610	√	√	√	--
22.	Operation and Modeling of Restructured Power System	MTPEE – 611	√	√	√	--
23.	Power System Reliability	MTPEE – 612	√	√	√	--
24.	Renewable Energy Resources	MTPEE – 613	√	√	√	√
25.	Reliability Engineering	MTPEE – 614	√	√	√	--
26.	Optimization Techniques	MTPEE – 615	√	√	√	√
27.	Neural Networks & Fuzzy Logic	MTPEE – 616	√	√	√	--
28.	Economics and Organization of Power Sector	MTPEE – 617	√	√	√	√

THE MAJOR STAKEHOLDERS OF PROGRAM

- Student
- Faculty
- Alumni
- Employer (Industry)
- Parents

Student

- Most prominent role in the program.
- Student's feedback is considered to introduce innovative teaching and learning methodologies.
- Students input help in program to introduce the elective courses to meet current trends.

Faculty

- Involve a vital role in working of the program.
- Faculty involves in various committees to check the consistency of the program.
- Faculty provides inputs for designing the program, PEOs/POs establishment, course objectives and assessment.
- Faculty analysis and review form is used to identify and implement necessary actions.

Alumni

- Focus group because they are a measure of the long-term success of our program.
- Alumni feedback helps in curriculum design to meet recent trends in engineering.
- Alumni recollect their existence during their program of study and advise the department with necessary inputs in point of student career.

Employer

- Represents the major end users of our graduates.
- Give higher focus to the program on future data to create awareness with current industry.
- Give inputs which overcome the gap between program and industry.

Parents

- Expects their wards in good professional career and higher education.
- Occasionally meetings with parents are done and feedback about the various activities of the department is obtained.
- Parents are also part of various committees of the department.

FACULTY PROFILE

Faculty Name	Designation	Specialization
Dr.Y.S. Brar	Professor	Power Systems
Pf.Jaswinder Singh	Associate Professor & Head	Control Systems
Pf.Khushdeep Singh	Associate professor	Power System Protection
Pf.Preetinder Singh	Associate Professor	Electrical Machines
Pf.Rupinderjit Singh	Associate Professor	Non Conventional Energy
Dr.Kanwardeep Singh	Associate Professor	Power System
Pf.Harminder Singh	Assistant Professor	Power Electronics
Pf.Gagandeep Singh Sodhi	Assistant Professor	Applied Electronics
Dr. Navneet Singh Bhangu	Assistant Professor	Power System Reliability
Pf.Harmeet Singh Gill	Assistant Professor	Power Electronics
Pf.Arvind Dhingra	Assistant Professor	Energy Audit, Power Systems
Pf.Ravinder Kaur	Assistant Professor	Electrical Measurements
Pf. Shivani Arora	Assistant Professor	Power Electronics
Pf. Tarandeep Kaur Gill	Assistant Professor	Power Systems
Pf.Samreet Kaur Gosal	Assistant Professor	Control Systems
Pf. Neha Kaushal	Assistant Professor	Power Systems
Pf. Baljeet Singh	Assistant Professor	Power Systems
Pf. Sonia Grover	Assistant Professor	Power Systems