MASTER OF ENGINEERING ELECTRICAL ENGINEERING

(Power Systems)

Scheme for Examination 2023-2025

FIRST SEMESTER

S. No.	Subject Code	Subject Name	L-T-P	Contact

EE(PS)-8101

External: 50
Sessional: 50
Credits: 4

EE(PS)-8102
Power System Operation and Control

L T P
4 0 0

External: 50
Sessional: 50
Credits: 4

Note: Examiner shall set eight questions covering entire syllabus. Candidate will be required to attempt any five questions.

Introduction: System load variation: System load characteristics, load curves - daily, weekly and annual, load-duration curve, load factor, diversity factor. Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, techniques of forecasting, basics of power system operation and control.

(10 hours)

Real Power - Frequency Control: Fundamentals of speed governing mechanism and modelling: Speed-load characteristics – Load sharing between two synchronous machines in parallel; concept of control area, LFC control of a single-area system: Static and dynamic analysis of uncontrolled and controlled cases, Economic Dispatch Control. Multi- area systems: Two- area system modelling; static analysis, uncontrolled case; tie line with frequency bias control of two-area system derivation, state variablemodel.

(12 hours)

Hydrothermal Scheduling Problem: Hydrothermal scheduling problem: short term and long term-mathematical model, algorithm. Dynamic programming solution methodology for Hydro- thermal scheduling with pumped hydro plant: Optimization with pumped hydro plant- Scheduling of systems with pumped hydro plant during off-peak seasons: algorithm.

(11 hours)

External: 50
Sessional: 50 50

EE(PS)-8105
Power System Deregulation

L T P
4 0 0

External: 50
Sessional: 50
Credits: 4

Note: Examiner shall set eight questions covering entire syllabus. Candidate will be required to attempt any five questions.

Introduction: Introduction to Power System Deregulation, difference between vertically integrated and restructured power systems, advantages of competitive environment in power system, components of restructured power system Role of ISO, ISO in Pool markets, ISO in Bilateral markets, Operational planning activities of a GENCO: Genco in Pool and Bilateral markets

(10 hours)

Transmission Pricing and Wheeling: Power wheeling: Definition and scope, cost components of transmission system, MW-mile and MVA-mile methodologies, Market Power, Bidding and Auction Mechanisms, Market Models, Transmission Open Access, Transmission Pricing

(12 hours)

Transmission Congestion Management: Transmission congestion problem, market power, Impact of Congestion and Congestion Management, congestion management methodologies, preventive and corrective congestion management approaches

(12 hours)

Available Transfer Capability: Introduction, definition, principles of ATC determination and factor affecting ATC, methods of static ATC determination. Non-market methods, Market based methods, Nodal pricing, Inter-zonal Intra-zonal congestion management, Price area congestion management, Capacity alleviation method.

(11 hours)

Recommended Books:

1. Kankar Bhattacharya, Math H.J. Boller, JaapE.Daalder, 'Operation of Restructured Power System' Klumer Academic Publisher – 2001
2. Mohammad Shahidehpour, and Muwaffaqalomoush, - "Restructured electrical Power systems" Marcel Dekker, Inc. 2001
3. Loi Lei Lai; "Power system Restructuring and Deregulation", Jhon Wiley & Sons Ltd., England.

EE(PS)-8156
Simulation Lab-I

L T P
0 0 2

Total Marks: 50
Credits: 1

Students will use appropriate software and

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SECOND SEMESTER

S. No	Subject Code	Subject Name	L-T-P	Contact hrs/ week	Credits	Theory		Practical*
						Internal Assessment	University Exam	
1	EE(PS)-8201	Power Systems Dynamics and Stability	4-0-0	4	4	50	50	----
2	EE(PS)-8202	EHVAC Transmission	4-0-0	4	4	50	50	----
3	EE(PS)-8203	Digital Control Systems	4-0-0	4	4	50	50	---
4	EE(PS)-8204	Elective-I	4-0-0	4	4	50	50	----
5	EE(PS)-8205	Elective-II	4-0-0	4	4	50	50	----
6	EE(PS)-8256	Simulation Lab-II	0-0-2	2	1	----	----	50
7	EE(PS)-8257	Research Seminar	0-0-3	3	2	----	----	50

* Practical marks are for continuous and end semester evaluation.

Total Marks: 600

EE(PS)-8201
Power Systems Dynamics and Stability

L T P
4 0 0

External: 50
Sessional: 50
Credits: 4

Note: Examiner shall set eight questions covering entire syllabus. Candidate will be required to attempt any five questions.

Power System Stability: Basic Concepts and definitions-classification of stability-rotor angle and

EE(PS)-8202
EHVAC Transmission

L T P
4 0 0

External: 50
Sessional: 50
Credits: 4

Note: Examiner shall set eight questions covering entire syllabus. Candidate will be required to attempt any five questions.

Introduction: Role of EHV AC Transmission, standard transmission voltages, average value of line parameters, power handling capacity.Line parameters Properties of bundled conductors, resistance, induction and capacitance of bundled conductor lines, temperature rise of conductors and current carrying capacity.

(08 hours)

EE(PS)-8203
Digital Control Systems

L T P
4 0 0

External: 50
Sessional: 50
Credits: 4

Note: Examiner shall set eight questions covering entire syllabus. Candidate

EE(PS)-8204(a)
Advanced Power Electronics Techniques and Devices for Power System

L T P
4 0 0

External: 50
Sessional: 50
Credits: 4

Note: Examiner shall set eight questions covering entire syllabus. Candidate will be required to attempt any five questions.

Introduction: Power semiconductor devices, power electronics switches and their selection criterion, conduction processes in semiconductors, pn-junction, charge control description of pn-junction operation.

(07 hours)

Power Diodes: Basic Structure, V -I Characteristics, Punch-through and non- punch through power diodes, Breakdown voltage considerations in punch through and non-punch through power diodes, conductivity modulation and on-state losses in power diodes, Switching Characteristics, Forward and Reverse Recovery Time; Schottky Diodes.

(08 hours)

Power Transistors: Constructional features of Power BJT, principle of operation, steady state V-I Characteristics: output characteristics; primary and secondary breakdown; Quasi-Saturation and hard saturation; emitter current crowding; switching characteristics; on-state losses; breakdown voltages; safe operating area.

(08 hours)

Power MOSFETs: Basic structure of Power MOSFETs, principle of operation, concept of parasitic BJT in Power MOSFET,I-V characteristics, switching characteristics with MOSFET circuit models, voltage breakdown and on-state conduction losses, Safe Operating area.

(08 hours)

Insulated Gate Bipolar Transistor: Basic structure of IGBT, on-state and block state operation, integrated thyristor in structure of IGBT, latch-up process, steady state I-V characteristics and switching characteristics, safe operating areas.

(07 hours)

Thyristor: Basic structure, V-I Characteristics, Turn ON & Turn OFF Characteristics, di/dt and dv/dt protection, turn on methods, Gate Turn-off thyristor: basic structure and switching characteristics.

(07 hours)

Recommended Books:

1. M.H. Rashid , Power Electronics Circuits Devices application,PHI.1994
2. P. C. Sen., Power Electronics TMH 1987.
3. P S .Bimbhra., Power Electronics, Khanna Publishers1993.
4. Cyril W Lander , Power Electronics, MHL ,1993.

EE(PS)-8204(b)
Power Electronics Converters for Smart Grid

L T P
4 0 0

External: 50
Sessional: 50
Credits: 4

Note: Examiner shall set eight questions covering entire syllabus. Candidate will be required to attempt any five questions.

Introduction to converters for DGs in Smart Grid: DC-DC converters: Buck,

External: 50

MASTER OF ENGINEERING ELECTRICAL ENGINEERING

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EE(PS)-8301 (a)
Power Quality

L T P
4 0 0

External: 50
Sessional: 50
Credits: 4

Note: Examiner shall set eight questions covering entire syllabus. Candidate will be required to attempt any five questions.

External: 50
Sessional: 50
Credits: 4

EE(PS)-8302(b)
Flexible AC Transmission System Controllers

L T P
4 0 0

External: 50
Sessional: 50
Credits: 4

Note: Examiner shall set eight questions covering entire syllabus. Candidate will be required to attempt any five questions.

Introduction: Background of AC Power flow in electric system, Concept of Real and Reactive power flow with governing equations and their control in Electric Transmission Systems; factors limiting the power flow in ac transmission system: reactive power control, loading capability and stability considerations; conventional control methods for reactive power; Introduction to FACTS technology; types of FACTS Controllers; objectives and benefits of FACTS Controllers.

(08 hours)

Shunt and Series Controllers: Methods of controllable VAR generation: variable impedance type static var compensators (SVC-based) and switching converter type Var generators (VSC-Based) ;benefits of shunt compensation; principles of operation, working and operating characteristics ,control schemes of :TCR,TSR,TSC,FC-TCR and TSC-TCR; benefits of series compensation, principles of operation, working, operating characteristics, control schemes of : GCSC,TSSC and TCSC.

(12 hours

VSC based Shunt and Series Controllers: principles of operation, working, internal and external control schemes and operating characteristics of STATCOM and SSSC, comparison between STATCOM and SVC.

(07 hours)

Static Voltage and Phase Angle Regulators: Concept of Voltage and Phase Angle regulators: power flow, real and reactive power flow control, improvement of transient stability, power oscillation damping; thyristor based voltage and phase angle regulators (TCVR and TCPAR); principle of operation, control schemes, working of thyristor controlled voltage regulators : for continuous controllable voltage and discrete level voltage control for R and RL loTJETQ10(r)-;uen0perennuous