MASTER OF ENGINEERING
(ELECTRICAL ENGINEERING)
Power System Specialization

Scheme for Examination 2021-2023

SECOND SEMESTER

S. No	Subject Code	Subject Name	L-T-P	Contact hrs/week	Credits	Theory		Practical*
						Internal Assessment	University Exam	
1	EE-8201	Power Systems Dynamics and Stability	4-0-0	4	4	50	50	----
2	EE-8202	EHVAC Transmission	4-0-0	4	4	50	50	----
3	EE-8208	Digital Control Systems	4-0-0	4	4	50	50	---
4	EE-8209	Elective-I	4-0-0	4	4	50	50	----
5	EE-8210	Elective-II	4-0-0	4	4	50	50	----
6	EE-8251	Simulation Lab-II	0-0-2	2	1	----	----	50
7	EE-8252	Research Seminar	0-0-3	3	2	----	----	50

* Practical marks are for continuous and end semester evaluation.

Total Marks: 600 **Total Credits: 23**

Elective-I
EE-8209 (a) Advanced Power Electronics Techniques and Devices for Power Systems
EE-8209 (b) Power Electronics Converters for Smart Grid

Elective-II
EE-8210 (a) Fast Transients in Power Systems
EE-8210 (b) Hybrid Electric Vehicles

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THIRD SEMESTER

S. No	Subject Code	Subject Name	L-T-P	Contact hrs/week	Credits	Theory		Practical*
						Internal Assessment	University	

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FOURTH SEMESTER

S. No.	Subject Code	Subject Name	L-T-P	Contact hrs/week	Credits	Practical Marks*	
						Internal Evaluation	External Evaluation
1	EE-8451	Thesis	- - -	25	15	100	100

*Practical marks are for continuous and end semester evaluation.

Total Marks: 200 **Credits: 15**

Note:

1. Duration of end semester examination in each theory and laboratory course is three hours.

2. The examination in the subject of thesis is to be conducted jointly by two examiners, one of which will be the thesis supervisor, and the other, an external examiner.

3. The requirement for the award of ME is successful completion of 12 theory courses,2 practical courses, 1 research seminar and satisfactory completion of thesis.

Total M.E.Marks:1650 **Total M.E. Credits: 77**

EE-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

EE-8106
Artificial Intelligence Techniques 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.

Artificial Intelligence: Definition, problem solving methods, searching techniques, knowledge representation, reasoning methods, predicate logic, predicate calculus, multivaluelogic.

(08 hours)

Fuzzy Logic: Concepts, fuzzy relations, membership functions, matrix representation, defuzzification methods.

(10 hours)

Artificial Neural Network: Introduction, multi-layer feed forward networks, back propagation algorithms, radial basis function and recurrent networks

(10 hours)

Evolutionary Techniques: Introduction and concepts of genetic algorithms and evolutionary programming

(07 hours)

Hybrid Systems: Introduction and Algorithms for Neuro-Fuzzy, Neuro-Genetic, Genetic-Fuzzy systems

(05 hours)

Application of AI Techniques: Load forecasting, load flow studies, economic load dispatch, load frequency control, reactive power control, speed control of DC and AC motors

(05 hours)

Recommended Books:

1. NP Padhy , Artificial Intelligence and Intelligent Systems, Oxford University Press
2. Rajasekaran S. and Pai G.A.V., "Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and applications”, PHI New Delhi.
3. Lin C. and Lee G., "Neural Fuzzy Systems", Prentice Hall International Inc.
4. Goldberg D.E. “Genetic Algorithms in Search Optimization & Machine Learning”, Addition Wesley Co., New York.
5. Kosko B., "Neural Networks & Fuzzy Systems A dynamical systems approach to machine intelligence, Prentice Hall of India. 6. Taylor C.W., "Power System stability" Mc-Graw Hill, New York.
6. Artificial Intelligencl

EE-8107
Smart Grid Technologies

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.

Concept of Smart Grid: Concept of Smart Grid, working definition of Smart Grid, need of Smart Grid, Functions of Smart Grid components, smart grid technologies, intelligent architecture of smart grid.

(06 hours)

Smart Metering and Automation Technologies: Introduction to Smart metering; key components of smart metering; an overview of the hardware used in smart metering: Signal acquisition, Signal conditioning, Analogue to digital conversion, Computation, Input/output; communication infrastructure and protocols for smart metering; PMU; demand side integration.

(09 hours)

Smart Grid Communications Technologies: Communication channels, dedicated and shared communication channels, communication technologies and protocols/standards for information exchange.

(07 hours)

Smart Sub-Stations: Concept of smart substations; Substation Automation

EE-8151
Simulation Lab-I

L T P
0 0 2

Total Marks: 50
Credits: 1

Students will use appropriate software and toolboxes to carry out following problem analysis:

1. To study PID controller for digital control system.
2. To carry out stability analysis of power system.
3. To perform modeling and simulation of power system components.
4. To carry out optimal power flow analysis in power system.
5. To carry out economic load dispatch in power system.
6. To study load forecasting using suitable AI technique.
7. To apply AI technique for speed control of DC and AC motors.

EE-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 voltage stability.

(10 hours)

Transient Stability: Swing equation-equal area criterion-critical clearing time and angle solution of swing equation-Numerical methods -Euler method-Runge-Kutte method synchronous machine representation–classical model-load modelling concepts-modelling of excitation systems-modelling of prime movers-effect of excitation system and governors- Multimachine stability –extended equal area criterion-transient energy function approach.

(12 hours)

Small Signal Stability: state space representation – eigen values- modal matrices-small signal stability of single machine infinite bus system –effect of field circuit dynamics-effect of excitation system-small signal stability of multimachine system.

(12 hours)

Voltage stability: generation aspects - transmission system aspects – load aspects – PV curve – QV curve – analysis with static loads – Loadability limit - sensitivity analysis-continuation power flow analysis

(11 hours)

Recommended Books:

1. Kundur, P. “Power System Stability and Control‟, McGraw-Hill International Editions, 1994.
2. Padiyar.K.R. “Power System Dynamic”’ BS Publications.
3. Anderson, P.M and Fouad, A.A “Power System Control and Stability” Wiley Interscience Publication, 2nd Edition.

EE-8208
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 will be required to attempt any five questions.

Introduction: Digital control scheme-configuration, Advantages, uses, implementation problems, sampling process, Sample and hold circuit, zero-order hold, Basic discrete time signals, z-transform, relationship between s-plane and z-plane, z-transform methods, inverse z transform methods, region of convergence initial and final value theorem.

(07 hours)

Pulse transfer function and steady state Errors: Block diagram reduction method, pulse transfer function, Multi-loop and MIMO systems, signal flow graph, Mason's gain formula in discrete-time domain, steady state errors, time domain analysis of second order systems time responses.

(07 hours)

Stability Analysis: Introduction, jury stability test, bilinear transformation, stability by pole locations, Introduction to root locus method, rules of construction of root loci, Introduction to frequency domain analysis, Bode plots, Nyquist plots.

(09 hours)

State Space Analysis: Introduction, definitions, realization of pulse transfer functions Diagonalizations; linear transformation, eigen vector, cofactor method Discretization of continuous time system, similarity transformation, solution of discrete-time state equations.

(09 hours)

Feedback Controllers and Lyapunor Stability Analysis: Controllability, Condition for state controllability, Observability, condition for observability, pole placement, determination of state feedback gain matrix, output, feedback-state observers, Reduced order observer design, Regulator Design, Lyapunor stability Analysis.

(09 hours)

Digital control system: Digital temperature control system, Digital position control system, Stepping motor and their control.

(04 hours)

Recommended Books:

1. KUO, B.C., Digital Control Systems , Oxford Series
2. George V I and Kurian C.P., Digital Control Systems, Cengage Learning

EE-8210 (b)
Hybrid and Electric Vehicles

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: Hybrid Electric Vehicle, Review of Conventional Vehicle: Introduction to Hybrid Electric Vehicles: Types of EVs, Hybrid Electric Drive-train, Tractive effort in normal driving.

(07 hours)

Electric Drives: Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Electric Propulsion unit, Configuration and control of DC Motor drives,

EE-8251
Simulation Lab-II

L T P
0 0 2

Total Marks: 50
Credits: 1

Students will use specialized software toolboxes to carry out following problem analysis:

1. To design and implement Multi-level inverter for smart grid applications.
2. To design drivers for electric vehicles.
3. To carry out small signal stability analysis in power system.
4. A case study of converters for DGs in Smart Grids.
5. To carry out stability analysis of digital control system using modern optimization techniques.
6. To study line loadability limits of a EHV line.
7. To plot PV curve – QV curve of a line for voltage stability analysis.
8. To study travelling waves phenomena on a transmission line.

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THIRD SEMESTER

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EE-8305 (a)

EE-

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FOURTH SEMESTER

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