SCHEME OF TEACHING AND EXAMINATION

DEPARTMENT OF ELECTRICAL ENGINEERING

M.Tech. in Power Systems Engineering

THIRD SEMESTER

S. No.	Board of Study	Subject Code	Subject	Periods per week			Scheme of exam			Total Marks	Credit L+(T+P)/2
							Theory/Practical				
				L	T	P	ESE	CT	TA		
1.	Electrical Engg.	**EE226301**	**Advanced Power System Planning & Management**	3	1	-	100	20	20	140	4
2.	Refer Table-III		**Elective-III**	3	1	-	100	20	20	140	4
3.	Electrical Engg.	**EE226391**	**Project-I**	-	-	28	100	-	100	200	14
4.	Electrical Engg.	**EE226392**	**Seminar**	-	-	3	-	-	20	20	2
TOTAL				**6**	**2**	**31**	**300**	**40**	**160**	**500**	**24**

Table-III

Elective-III			
S.N	**Board of Study**	**Subject Code**	**Subject**
1	Electrical Engg.	**EE226321**	**Electrical Energy Conservation & Audit**
2	Electrical Engg.	**EE226322**	ANN & Fuzzy Techniques
3	Electrical Engg.	**EE226323**	Power system Reliability

Lecture T- Tutorial P- Practical ESE- End Semester Exam
CT- Class Test TA- Teachers Assessment

Note(1)– $1/4^{th}$ of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a Particular academic session.

Note(2)– Choice of elective course once made for an examination cannot be changed in future examinations.

M.Tech. (Power Systems Engineering)

Subject	Advanced Power System Planning & Management	L = 3	T = 1	P = 0	Credits = 4
Subject Code EE226301	ESE	CT	TA	Total	ESE Duration
Evaluation Scheme	100	20	20	140	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1 To understand the concept of power system planning. 2 To study the concept of planning in generation 3 To understand the concepts of reliability planning. 4 To investigate the Computer aided planning methods. 5 To understand the concept of optimization techniques for solution by programming.	**CO1** The understanding of power planning, load forecasting. **CO2** The various planning in the generation, concept of cogeneration is gained. **CO3** The concepts of planning involved in power system reliability. **CO4** The different aspect of Computer aided planning methods, Environmental effects, the green house effect involved in planning **CO5** The concept of various optimization techniques for solution by programming will be understood.

UNIT I: Introduction of power planning: CO1

National and Regional Planning, structure of P.S., planning tools, Electricity Regulation, Electrical Load Forecasting, Load Forecasting Categories-Long term, Medium term, short term, very short term Applications of Load Forecasting, Factors Affecting Load Patterns Medium and long term load forecasting techniques and modeling. **[10 hrs]**

UNIT II: Generation planning: CO2

Integrated power generation cogeneration/captive power, Power pooling and power trading. Transmission and distribution planning. Power System Economics. Power sector finance, financial planning, private participation Rural Electrification investment, concept of rational tariffs. **[10 hrs]**

UNIT III: Power supply Reliability: CO3

Reliability planning. , Effect of failures on power system, Planning criteria, Risk analysis in power system planning ,System operation planning, load management, load prediction, reactive power balance, online power flow studies, state estimation, computerized management, power system simulator.. **[10 hrs]**

UNIT IV: Computer aided planning: **CO4**

Wheeling. Environmental effects, the green house effect, Technological impacts. Insulation coordination. Reactive compensation. **[8 hrs]**

UNIT-V: Optimal power system expansion planning: **CO5**

Formulation of least cost optimization problem incorporating the capital, operating and maintenance cost of candidate plants of different types (Thermal, Hydro, Nuclear, Non-conventional etc.) and minimum assured reliability constraint optimization techniques for solution by programming.. **[10 hrs]**

Text Books:

S. No.	Title	Authors	Publisher
1)	Markey operations in electric power systems Forecasting, Scheduling, and Risk Management	Shahidehpour M, Yamin H, Li z	John Wlley & sons
2)	Reliability evaluation of power systems	Billinton R, Allan R	Plenum Press New York

Reference Books:

S. No.	Title	Authors	Publisher
1)	Computational Methods in Power system Reliability	D. Elmakias	Springer-Verlag

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Subject Code EE226321	ESE	CT	TA	Total	ESE Duration
Evaluation Scheme	100	20	20	140	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1 To understand the concept of Energy auditing. 2 To study the efficient controls and starting efficiency of Electric motors. 3 To understand the concepts transformer loading and efficiency analysis 4 To understand the concept of lighting. 5 To discuss the effect of electric loads.	**CO1** The understanding of energy auditing, its importance and effectiveness. **CO2** Study of motors and variable speed drives and its load matching. **CO3** The concepts of transformer and its evaluation method of losses and auditing is understood. **CO4** The different lighting techniques and its reliability are understood. **CO5** The concept of various electric loads involved with high power and its reliability and energy management will be understood.

UNIT I: Energy auditing: **CO1**

System approach and End use approach to efficient use of Electricity; Electricity tariff types; Energy auditing: Types and objectives-audit instruments- ECO assessment and Economic methods-specific energy analysis-Minimum energy paths-consumption models-Case study. **[10 hrs]**

UNIT II: Energy efficient Electric motors: **CO2**

Energy efficient controls and starting efficiency, Motor Efficiency and Load Analysis, Energy efficient /high efficient Motors, Case study; Load Matching and selection of motors. Variable speed drives; Pumps and Fans, Efficient Control strategies, Optimal selection and sizing, Optimal operation and Storage; Case study. **[10 hrs]**

UNIT III: Transformer Loading/Efficiency analysis: **CO3**

Feeder/cable loss evaluation, case study, Reactive Power management, Capacitor Sizing, Degree of Compensation, Capacitor losses-Location, Placement, Maintenance, case study; Peak Demand controls-Methodologies, Types of Industrial loads, Optimal Load scheduling-case study. **[10 hrs]**

UNIT IV: Lighting: **CO4**

Energy efficient light sources-Energy conservation in Lighting Schemes- Electronic ballastPower quality issues-Luminaries, case study; Cogeneration- Definition and scope, topping and bottoming cycles, cogeneration technologies, industry suitable for cogeneration, sale of electricity to utility, impact of pricing on cogeneration, integrated energy system, potential of cogeneration in India. **[10 hrs]**

UNIT-V: Electric loads of Air conditioning & Refrigeration: **CO5**

Energy conservation measures- Cool storage .TypesOptimal operation-case study; Electric water heating-Geysers-Solar Water Heaters- Power Consumption in Compressors, Energy conservation measures; Electrolytic Process. **[8 hrs]**

Text Books:

S. No.	Title	Authors	Publisher
1)	"Energy Management"	Paul W., O'callaghan	McGraw Hill Book Company
2)	IEEE Bronze Book- Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities	Giovanni	IEEE Inc, USA.
3)	.Industrial Energy Management: Principles and Applications.,	Petrecca	The Kluwer international series - 207,(1999)

Reference Books:

S. No.	Title	Authors	Publisher
1)	Handbook of Energy Engineering	Albert Thumann & Paul Mehta	The Fairmont Press, INC
2)	Cleaner Production – Energy Efficiency Manual for GERIAP	UNEP, Bangkok	National Productivity Council
3)	Guide to Electric Load Management	Anthony J. Pansini, Kenneth D. Smalling	Pennwell Pub; (1998)

M.Tech. (Power Systems Engineering)

Subject	ANN & Fuzzy Techniques	L = 3	T = 1	P = 0	Credits = 4
Subject Code EE226322	ESE	CT	TA	Total	ESE Duration
Evaluation Scheme	100	20	20	140	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1. To understand the concept of neural networks and artificial models. 2. To explain various model classification and its functions. 3. To understand the basic concepts of dynamical systems. 4. To understand the concept of fuzzy logic and its control techniques.	**CO1** Students will gain the knowledge regarding neural networks and modeling. **CO2** Will be able to understand various dynamical system, model classifications and its features. **CO3** To solve various system by applying the concept of fuzzy logic. **CO4** Gain the knowledge regarding application of fuzzy logic. **CO5** Knowledge regarding. fuzzy logic system and its controlling.

UNIT I : Biological neurons and their artificial models: **CO1**

models of artificial neural networks, feed forward and feed backward networks, supervised and unsupervised learning, Neural network learning rules- Hebbian rule, perceptron rules, delta rules, Widrow-Hoff rule, correlation rule, winner- take- all rule, outstar learning rule. **[10 hrs]**

UNIT II: Single Layer Perceptron Classifier: **CO2**

Classification model, features, decision regions, discriminant functions, linear machine and minimum distance classification, training and classification using discrete Perceptron algorithm, single layer continuous Perceptron networks for linearly separable classification, multi category single layer Perceptron networks. Multi Layer Feed Forward Networks- Linearly non-separable pattern classification, delta learning rule for multi Perceptron layer, genaralised delta rules, error back propagation training.

[10 hrs]

UNIT III: Single Layer Feedback Networks: **CO3**

Basic concepts of dynamical systems, mathematical foundation of discrete time Hopfield networks, mathematical foundation of gradient type Hopfield networks transient response of continuous time networks, relaxation modeling in single layer feedback networks, optimization problems. Associative Memories: Basic concepts, linear associator, basic concept of and performance analysis of recurrent auto associative memory, bi-directional associative memory, associative memory of spatio-temporal patterns.

[10 hrs]

UNIT IV: Fuzzy sets. Fuzzy set operations : **CO4**

Properties, Membership functions, Fuzzy to crisp conversion. fuzzification and defuzzification methods, applications in engineering problems. **[8 hrs]**

UNIT V : Fuzzy control systems: **CO5**

Introduction, simple fuzzy logic controllers with examples, special forms of fuzzy logic models, classical fuzzy control problems. Inverter pendulum. image processing . home heating system . Adaptive fuzzy systems, hybrid systems. **[10 hrs]**

Text Books:

S. No.	Title	Authors	Publisher
1	Introduction to artificial neural systems	J.M. Zurada	Jaico Publishers, 1992
2	Neural Networks A comprehensive foundation	Simon Haykins	Macmillan College, Proc, Con, Inc, New York, 1994.

Reference Books:

S. No.	Title	Authors	Publisher
1	Fuzzy Control	D. Driankov, H. Hellendorn, M. Reinfrank	An Introduction., Narora Publishing House, New Delhi, 1993.
2	Fuzzy set theory and its applications	H.J. Zimmermann	Kluwer Academic Publishers, London.
3	Fuzzy sets and fuzzy logic	G.J. Klir, Boyuan	Prentice Hall of India (P) Ltd., 1997.

M.Tech. (Power Systems Engineering)

Subject	Power System Reliability	L = 3	T = 1	P = 0	Credits = 4
Subject Code EE226323	ESE	CT	TA	Total	ESE Duration
Evaluation Scheme	100	20	20	140	3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
1. To analyze the concept of power system reliability. 2. To understand the basics of generation and its case study. 3. To understand the operation of interconnected system, operating reserve and composite generation.	**CO1** Students will understand the basics of generation, power system reliability, load forecasting, its evaluation and application. **CO2** The concept of generation, its model, algorithm and case studies. **CO3** Students will understand the concept of interconnections in power system and its outcomes. **CO4** Gain the knowledge regarding operating reserves in power system. **CO5** Students will understand composite generation and reliability concept in transmission system.

UNIT I: Generating Capacity Basic Probability Methods: **CO1**

Introduction, The generation system model, Generating unit unavailability , Capacity outage probability tables, Comparison of deterministic and probabilistic criteria, Recursive algorithm for capacity model building , Recursive algorithm for unit removal, Alternative model –building techniques , Loss of load indices , Concepts and evaluation techniques , Numerical examples, Equivalent forced outage rate, capacity expansion analysis , Evaluation techniques , Perturbation effects, Scheduled outages , Evaluation methods on period bases , Load forecast uncertainty, Forced outage rate uncertainty , Exact method , Approximate method , Application, LOLE computation . **[10 hrs]**

UNIT II: Generating Capacity: **CO2**

Frequency and Duration Method, Introduction , The generation model , Fundamental development , Recursive algorithm for capacity model building , System risk indices, Individual state load model , Cumulative state load model , Practical system studies , Base case study , System expansion studies , Load forecast uncertainty . **[8 hrs]**

UNIT III: Interconnected Systems: **CO3**

Introduction , Probability array method in two interconnected system , Concepts , Evaluation techniques , Equivalent assisting unit approach to two interconnected system, Factors affecting the emergency assistance available through the interconnections, Introduction , Effect of tie capacity , Effect of tie line reliability , Effect of number of tie line , Effect of tie capacity uncertainty, Effect of load forecast uncertainty , Variable reserve versus maximum peak load reserve , Reliability evaluation in three interconnected systems, Direct assistance from two systems, Indirect assistance from two systems.

[10 hrs]

UNIT IV: Operating Reserve: **CO4**

General concepts, PJM method, Concepts, Outage replacement rate, Generation model , Unit commitment , Extensions to PJM method , Load forecast uncertainty, Derased (Partial output) stanes. Modified PJM method, Concepts, Area risk curves. Modelling rapid start unit, Modelling hot reserve units, Unit commitment risk, Numerical examples, Postponable outage, Concepts m Modelling postponable outages, Unit commitment risk , Security function approach , Concepts , Security function model, Response risk, Concepts, Evaluation techniques, Effect of disturbing spinning reserve, Effect of hydro- electric units, Effect of rapid start units, Interconnected systems. **[10 hrs]**

UNIT V: Composite Generation and Transmission systems: **CO5**

Introduction , Radial configurations , Conditional probability approach, Network configurations, State selection, Concepts , Application , System and load point indices , Concepts , Numerical evaluation, Application to practical systems. Data requirements for composite system reliability evaluation , Concepts , Deterministic data, Stochastic data , Independent outages, dependent outages, common mode outages, station originated outages. **[10 hrs]**

Text Books:

S. No.	Title	Authors	Publisher
1.	Reliability Evaluation of Power System	Roy Billinton, Ronald and Allan	Plenun Press, NYLondon.
2.	Reliability of Power System	G. F. Kovalev, L.M. Lebedeva	Springer

Reference Books:

S. No.	Title	Authors	Publisher
1.	Power system planing & relaibility	P.G. Jamdade, S.G. Jamdade	Tech-Neo Publications