Semester III

Self Study Course

Subject Code   : **PEPS31**
Teaching Scheme   :**08 T = 08**   **Credits**   : **04**
Evaluation Scheme   : **15 IE + 15 ME+70 ESE**   **Total Marks** : **100**
Duration of ESE   : **3hrs.**

Elective III

Subject Code   : **PEPS32x**
Teaching Scheme   : **03L + 02T = 05**   **Credits**   : **04**
Evaluation Scheme   : **15 IE + 15 ME+70 ESE**   **Total Marks** : **100**
Duration of ESE   : **3hrs.**

(A) AI Techniques to Power System

Unit 1:
Introduction to Artificial Intelligence: Introduction, Fuzzy systems, Artificial NeuralNetwork(ANN), Expert Systems, Genetic Algorithm, Evolutionary Programming. Biological neurons: Function of single biological neuron, function of artificial neuron, Basic terminology related to artificial neuron. Characteristics of ANN, Typical applications of ANN such as classification, pattern recognition, forecasting Properties, strength of NN,

Unit 2:
Different Architectures of ANN and Learning Processes: Different architectures of NeuralNetwork, types of activation function, concept of Learning with a Teacher, Learning without a Teacher, Learning Tasks (Any two learning methods and applications)

Unit 3:
Single Layer Network and Multi-layer Network: Single Layer Perceptron: architecture–trainingalgorithm, Least – Mean square algorithm, learning curves, Learning Rate, Annealing techniques. Feed forward Neural Network(MLP) , Back propagation algorithm. Limitation of Back propagation algorithm. Concept of learning rate, momentum coefficient, Generalization capacity

Unit 4:

Fuzzy Mathematics: Basic concept of Fuzzy Logic, Fuzzy set–Basic definition–Membershipfunction, Operations of fuzzy sets.

Fuzzy Theory: Fuzzy relations - Fuzzy graphs - Fuzzy analysis–Propositional logic, predictive logic,Fuzzy set theory.

Unit 5:

AI Applications in Power Systems: Application of ANN and Fuzzy logic in Power SystemPlanning, Operation and control – load forecasting, Unit Commitment, Load Dispatch and Protection

Text Books

1. Simon Haykin, "Neural Networks: A Comprehensive Foundation", 2nd Edition, Pearson Education.
2. Zimmermann, H. J., 'Fuzzy Set Theory and Its Applications', 2nd Edition, Kluwer Academic Publishers
3. El Hawaray "Electrical Power Applications with Fuzzy systems", IEEE Press.
4. Power System Optimization- D. P. Kothari, J. S. Dhillon, PHI
5. M.Ganesh,"Introduction to fuzzy sets and fuzzy logic" Prentice Hall India
6. Kelvin Waruicke, Arthur Ekwlle, Raj Agarwal, "AI Techniques in Power System", IEEE London U.K
7. S. Rajsekaram, G. A. Vijayalaxmi Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms
   Synthesis & Applications", Practice Hall India
8. S. N. Sivanandam, S. Sumathi, S. N. Deepa, "Introduction to Neural Network Using MATLAB 6.0", Tata McGraw Hill
9. George Klir& Tina. A. Folger, 'Fuzzy Sets, Uncertainty and Information', Prentice Hall of India Pvt. Ltd
10. G. F. Luger and W. A. Stubblefield, Artificial Intelligence. Redwood City, CA: Benjamin Cummings, 1993.

(B) Power System Deregulation

Unit 1:
Fundamentals of Restructured System: History of power system restructuring, concept of powersystem deregulation, regulation vs. deregulation, entities in deregulated system, market architecture, ancillary services

Unit 2:
Models of Restructuring: Pool Co and bilateral contractual models, ISO based markets models,reactive power balancing market, day ahead and hour ahead markets

Unit 3:

Transmission Pricing: Cost components in transmission pricing, embedded cost based transmission-pricing methods, Postage Stamp, MW-Mile, incremental cost based or location marginal pricing (LMP), Tracing of power.

Unit 4:

Transmission Open Access Issues: Available Transfer Capability (ATC) - definition and methods ofdetermination, transmission network congestion, congestion management techniques.

Unit 5:

Power Sector Restructuring in India: Electricity Act 2003, Evaluation of integrated, monopoly,state owned electricity boards, introduction to various institutions in Indian power sector & their role. Challenges before the Indian power sector, planning commission CEA, NT, PFC, ministry of power, SEBS.

Text Books

1. Electric Utility Planning and regulation – Edward Kahn , University of California- 2005
2. Various Indian Electricity Acts 1). Indian Electricity Act , 1910
3. The Electricity Supply Act , 1998 proposed Electricity Bill 2001
4. Electrical Energy Utilization And Conservation: - S.C. Tripathi(TMH Pub.)-2003
5. http://www.nptel.iitm.ac.in/

(C)Advance Control System

Unit 1:
Introduction: Review of State Variable Analysis, Controllability and Observability

Unit 2:
Digital Control Systems: Models of Digital Control Devices, State Description of Digital Processorsand Sampled Continuous Time Plants, Discretisation of Digital Continuous Time State Equations, Solutionof State Difference Equation.

Unit 3:
Controllability and Observability Tests For Digital Control Systems, Stability of Discrete Time Systems, Pulse Transfer Function and Its Realization, Stability Improvement By State Feedback, Pole-Placement Design And State Observers

Unit 4:
Lyapunov Stability Analysis: Basic Concepts, Stability Definitions, Stability Theorems, LyapunovFunctions for Linear and Non Linear Systems

Unit 5:
Optimal Control: Parameter Optimization Techniques, Lagrange Parameters Techniques, CalculusOf Variation, Unconstrained And Constrained Minimization Of Functional, Two Point Boundary Value Problems, Pontrygin's Minimum Principle, Optimal Regulator And Tracking Problems, Optimal Digital Control System

Text/ Reference Books

1. M.Gopal, Digital Control and State Variable Methods, Tata McGraw Hill, New Delhi, 1997
2. D.E. Kirk, Optimal Control Theory, Prentice Hall, 1970
3. M.Gopal, Digital Control Engineering, Wiley Eastern, 1988

(D) Generation Planning and Load dispatch

Unit 1:
Generation- Fossil fules, Hydropower and Nuclear power generation systems. Chronological Load Curves, Power duration curve, Integrated duration curve, Hydrography, Flow duration curve, Mass curve for Hydro Power generations. Co-ordination of steam, Hydro and Nuclear power stations. Optimum Generation allocation-Line losses neglected and including the effect of transmission losses for thermal power generations. Long range and short range Hydro generation scheduling. The short term and long term Hydro-thermal scheduling of generation.

Unit 2:
Load Forecasting & Generation Planning - Classification of loads –Load forecasting methodology-Energy forecastingpeak demand forecasting- Weather sensitive and Non-weather sensitive forecasting - Total forcast -
Annual and Monthly peak demand forecast.

Unit 3:
Generation system cost analysis: Cost analysis -capacity cost, production cost. Production analysisproduction
costing, production analysis involving nuclear unit, production analysis involving hydro unit. Fuel inventories-energy transaction and off-peak energy utilization.

Unit 4:
Generation System Reliability Analysis – probabilistic generating Unit-Model and Load model, effective load- Reliability analysis for isolated system-Interconnected system-Reliability analysis of interconnected system.

Unit 5:
Load dispatch & System Communication – Consideration for centralized control of system operations. Requirements of the central load dispatch centre. Telementry-Remote control and data transmission, etc. Power system reforms, deregulation of electric utilities, energy management &
conservation.

Books :
1) Power System Planning - R.L. Sullivan, McGraw Hill.
2) Economic Control of Interconnected System -Kirchmayers, L.K.,John Wiley and Sons, New York.

3) Generation of Electrical Energy - B.R. Gupta, Euresia Publishing House Pvt., Ltd., New Delhi.
4) Power System Restructing and Deregulation - by Loi Lei Lai
5) Restructed Electrical Power Systems - by Mohammad Shahidehopur, Muwaffaq Alomoush.
6) Privatization, Restructing, and Regulation of Network Utilities (Walras-Pareto Lectures) : by David M. Newbery.
7) Power to the People : Electric Power Deregulation : An Expose : Jack Duckworth
8) Understanding Electric Utilities and De-Regulation, Power Engineering : Lorrin Philipson, et al
9) Power Generation, Opearion and Control : A.J. Wood and B.F. Wollenberg:, John Wiley 1996
10) Understanding Electric Utilities and De-Regulation (Power Engineering) : by Lorrin Philipson, H. Lee Willis, Lorrion Philipson
11) The End of a Natural Monopoly : Deregulation and Competition in the Electric Power Industry : by P.Z.Grossman, D.H. Cole, P.Z. Grossman, D.H. Cole

(E) PLC and SCADA

Unit 1: Introduction to PLC

Role of automation in Industries, benefits of automation, Necessity of PLC, History and evolution of PLC, Definition, types, selection criterion, Overall PLC system, PLC Input and output modules (along with Interfaces), CPU, programmers and monitors, power supplies, Solid state memory , advantages and disadvantages

Unit 2: Programming of PLC

Programming equipment, Various techniques of programming, Ladder diagram fundamentals, proper construction of ladder diagram, basic components and their symbols in ladder diagram, MCR (master control relay) and control zones, Boolean logic and relay logic
Timer and counter- types along with timing diagrams, shift registers, sequencer function, latch instruction Arithmetic and logical instruction with various examples

Unit 3: Advance PLC function

Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices, programming ON/OFF Inputs to produce ON/OFF outputs.
Analog PLC operation, PID control of continuous processes, simple closed loop systems, problems with simple closed loop systems, closed loop system using Proportional, Integral & Derivative (PID), PLC interface, and Industrial process example.

Unit 4: application of PLC
PLC interface to various circuits : Encoders, transducer and advanced sensors (Thermal, Optical, Magnetic, Electromechanical, Flow, Level sensors)
Measurement of temperature, flow, pressure, force, displacement, speed, level
Developing a ladder logic for Sequencing of motors, Tank level control, ON OFF temperature control, elevator, bottle filling plant, car parking
Motors Controls: AC Motor starter, AC motor overload protection, DC motor controller, Variable speed (Variable Frequency) AC motor Drive.

Unit 5: SCADA Systems

Introduction, definitions and history of Supervisory Control and Data Acquisition, typical SCADA system Architecture, Communication requirements, Desirable Properties of SCADA system, features, advantages, disadvantages and applications of SCADA. SCADA Architectures (First generation - Monolithic, Second generation - Distributed, Third generation – Networked Architecture), SCADA systems in operation and control of interconnected power system, Power System Automation (Automatic substation control and power distribution), Petroleum Refining Process, Water Purification System, Chemical Plant

Text Books:

1. Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson, 2nd Edition
2. John R. Hackworth, Frederick D., Hackworth Jr., "Programmable Logic Controllers Programming Methods and Applications", PHI Publishers
3. John W. Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", PHI Learning, New Delhi, 5th Edition
4. Ronald L. Krutz, "Securing SCADA System", Wiley Publications.
5. Stuart A Boyer, "SCADA supervisory control and data acquisition", ISA, 4th Revised edition
6. Sunil S. Rao, "Switchgear and Protections", Khanna Publications.
7. L.A. Bryan, E. A. Bryan, "Programmable Controllers Theory and Implementation" Industrial Text Company Publication, Second Edition

Industrial Training

Subject Code	**: PEPS33**		
Teaching Scheme	**: 05FW= 05**	**Credits**	**: 05**
Evaluation Scheme	**: 150 TW + 50 PEE**	**Total Marks**	**: 200**

WORK EXPECTED TO BE CARRIED OUT

The **INDUSTRIAL TRAINING,** the contents of the subjects which they have studied during their first year of the course. As mentioned in the title itself, the Training may be carried out in relevant industry/Area.

Following are the important points that shall govern this Training :

- The Training shall be undertaken individually by the Students in Industries, Organizations.
- The students shall report weekly to the allotted Supervisor (same as Pre Dissertation) to apprise him/ her about the progress of the work.
- To undertake extensive training for ONE MONTH, as envisaged in the Course scheme.
- To submit TRAINING CERTIFICATE from the competent authority from Industry/ Organization/ Plant, in respect of satisfactory completion of the Training.

The Training carried out by the Candidate shall be assessed & evaluated by the Department to award suitable marks/ grades to the Candidate, in Term Work. However, the marks shall be granted on the basis of candidate's performance in VIVA VOCE to be conducted in the presence of External Examiner for POE.

Pre-dissertation

Subject Code   : **PEPS34**

Teaching Scheme   : 06T= 06   **Credits**   : 05

Evaluation Scheme   : 100 TW + 50 PEE   **Total Marks**   : 150

WORK EXPECTED TO BE CARRIED OUT

The Pre Dissertation is the preliminary work required to be carried by the Candidate, under the supervision of his/ her allotted Supervisor, towards acquiring the goals of his/ her targeted Dissertation work.

The PRE DISSERTATION work shall involve (but not limited to) the categories of preparation as mentioned below, as far as possible :

- Discussing the proposed work with his/ her Guide in the period allotted during the week. Finalizing broad topic to be taken for Dissertation work.

Extensive literature Survey on the related topic & collection of hard copies of the research papers. Securing permission from the Company, if the work is to be experimented/ investigated in Company. Developing outline of Model/ Experiment(s)/ investigations/ analysis to be carried out.

If model is to be fabricated, the list of required materials/ equipments/ instruments shall be prepared. Their suppliers / manufacturers shall be contacted & the quotations shall be kept ready.

- Related Computer software shall be mastered, if computer simulation is there. Presentation of work.
- Any other specific preparation.

The above mentioned tentative preparation(s) may change partially depending on the individual's need & requirements. However, the PRE DISSERTATION work shall be assessed with respect to all such preparation categories only for award of marks in Term Work. However, the marks in POE shall be awarded in the presence of EXTERNAL EXAMINER based on Candidate's performance in Presentation and/or viva voce.

Semester IV

Final Dissertation

Subject Code : **PEPS41**
Teaching Scheme : **24T = 24**   **Credits** : **18**
Evaluation Scheme : **150TW + 200PEE**   **Total Marks** : **350**

WORK EXPECTED TO BE CARRIED OUT

The AICTE envisages expanding the research attitude/ thinking/ potential/ interest of the Candidate while pursuing his/her Post Graduate Course in Engineering & Technology. This reflection is observed in the **FINAL DISSERTATION** work carried out by the Candidate.

The following points shall govern the procedure & quality of Final Dissertation work to be carried out by the Candidates:

- The Candidate shall work under the SUPERVISOR appointed by the Department, to whom he/ she shall be reporting every week, as per time table schedule.
- The Supervisor shall monitor the progress of work.
- The FINAL DISSERTATION shall be carried out as per Topic & Plan prepared during the PRE DISSERTATION work.
- The work carried out shall meet the standard & quality as defined by the Department.
- The final Dissertation shall be allowed to be submitted only after successful & satisfactory deliver of the GRAND SEMINAR in the Department.

The FINAL DISSERTATION carried out by the Candidate shall be assessed & evaluated by the Department for TERM WORK to award suitable marks to the Candidate on the basis of performance in following areas :

(i)	Quality of Work & Innovativeness	:	75
(ii)	Publications based on the Work	:	50
(iii)	Grand Seminar	:	25
	T O T A L	:	150

However, the marks shall be granted on the basis of candidate's performance in PRESENTATION and/ or VIVA VOCE to be conducted in the presence of External Examiner for POE.

DETAILED EVALUATION PROCEDURE

EXAMINATION	PROCEDURE OF EVALUATION
MSE (MID SEMESTER EXAMINATION) **(10-MARKS)**	The Mid Semester Examination marks shall be awarded by the concerned Subject Teacher on the basis of candidate‟s performance in the written examination conducted by the Department. Usually, the MSE‟s of two subjects shall be held on the same day. This will be ONE HOUR examination.
(IE) INTERNAL EVALUATION **(20-MARKS)**	The marks allotted for IA shall be awarded by the concerned Subject Teacher on the basis of Candidates performance in: Alertness/ response in the Class (05) Attendance (05) Assignments/ Tutorials (10)
(ESE) END SEMESTER EXAMINATION **(70-MARKS)**	The ESE shall be conducted by the University, as per schedule floated by it, as per its governing rules & regulations. This will be THREE HOURS written examination. The Theory paper of ESE shall comprise of EIGHT questions in all, out which the Candidate shall be required to answer ANY FIVE. All the Questions shall carry equal marks (14).
(TW) TERM WORK	The TERM WORK (TW) shall be there for the practical passing head and other passing Heads, for which theory evaluation is not there. The procedure of evaluation is already mentioned under the syllabus of respective head.
POE (PERFORMANCE & ORAL EXAMINATION)	The POE shall be there for all the passing heads where TW is there. The procedure of evaluation is already mentioned under the syllabus of respective head.