Course Syllabi: UEE804: Operation and Control of Power Systems (L : T : P :: 3 : 1 : 2)

1. **Course number and name**: UEE804: Operation and Control of Power Systems

2. **Credits and contact hours**: 4.5 and 6

3. **Text book, title, author, and year**

Text Books / Reference Books

- *Chakraborti A., Soni,M.L., Gupta,P.V. and Bhatnagar,U.S., a Text Book on Power System Engineering, Dhanpat Rai and Co. (P) Ltd. (2008).*
- *Nagrath, I.J. and Kothari, D.P., Power System Engineering, Tata McGraw Hill (2007).*
- *Stevenson, W.D., Power System Analysis, McGraw Hill (2007).*
- *Kothari, D.P., Dhillon, J.S., Power System Optimization, PHI Learning (2010).*
- *Allen J. Wood, Bruce F. Wollenberg and Gerald B. Sheble, Power Generation, Operation and Control, Wiley-Interscience (2013).*
- *Kimbark, E. W., Power System Stability, Volumes-I, IEEE Press (1995).*
- *Jizhong Z., Optimization of power system operation, Edition Wiley (1996).*
- *Elgerd, O. Electric Energy Systems Theory, McGraw Hill Education Private Limited (2001).*

a. Other supplemental materials
   - Nil

4. **Specific course information**

a. Brief description of the content of the course (catalog description)

Economic Operation of Power Systems: Fuel consumption, Characteristics of thermal unit, Incremental fuel rate and their approximation, Minimum and maximum power generation limits.

Economic Dispatch: Economic dispatch problem with and without transmission line losses, Unit Commitment, methods for their solutions.

Hydrothermal Co-ordination: Hydro-scheduling, Plant models, Scheduling problems, Hydrothermal scheduling problems and its approach.

Power System Control: Ideas of load frequency and voltage control, Reactive power control, Block diagrams of P-f and Q-V controllers, ALFC control, Static and dynamic performance characteristics of ALFC and AVR controllers, Excitation systems model, concept of area and Tie-line operations.

Power System Security: Factors affecting security, Contingency analysis, Network sensitivity, correcting the generation dispatch by using sensitivity method and linear programming.

Small Scale Stability Analysis: d-q model of generator, State space representation, Eigen value and participation factor analysis.

Voltage Stability: Basic concepts, Voltage collapse, P-V and Q-V curves, Impact of load, Static and dynamic analysis of voltage stability, Prevention of voltage collapse.

Laboratory Work: Simulation of thermal scheduling with and without losses, Unit commitment by dynamic programming, simulation of hydro-thermal scheduling by gradient

method, Stability analysis of single area frequency control, Bias control of two area system and AVR.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Develop small scale model of alternator, excitation and governing systems.
- Decide the scheduling of thermal units and hydro-thermal units for overall economy.
- Design and apply control for frequency and voltage of power system represented by multi area.
- Comprehend power system security and contingency.
- Computation of small scale and voltage stability**.**

6. **Brief list of topics to be covered**

- Economic Operation of Power Systems
- Economic Dispatch
- Hydrothermal Co-ordination
- Power System Control
- Power System Security
- Small Scale Stability Analysis
- Voltage Stability