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:** Credits: 4.5; Hours: 6

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

    - *Chakraborti,A., Soni,M.L., Gupta,P.V. and Bhatnagar,U.S., a Text Book on Power System Engineering, DhanpatRai 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).*
    - *Gupta, B.R., Power System Analysis and Design, S. Chand and Company Limited (2009).*
    - *Pabla, A.S., Electric Power Distribution, Tata McGraw–Hill (2008).*
    - *Wadhwa, C.L., Electrical Power Systems, New Age International (P) Limited, Publishers (2008).*

    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, Their solution methods.
    Hydrothermal Co-ordination: Hydro-scheduling, Plant models, Scheduling problems, Hydro-thermal scheduling problems and its approach.
    Power System Control: Power system control factors, Interconnected operation, Tie-line operations, Reactive power requirements, During peak and off peak hours, Elementary ideas of load frequency and voltage, 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.
    Power System Security: Factors affecting security, Contingency analysis, Network sensitivity, correcting the generation dispatch by using sensitivity method and linear programming.
    Dynamic Modelling of Power System components: Generators, Linear and non linear model using d-q transformation, Power capability curve, Reactive capability limits, V curves and compounding curves, Excitation systems, Turbine and speed governing systems, Loads.
    Small Scale Stability Analysis: 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
    Steady state power limit of a transmission line, Simulation studies of steady state stability of a power system, Characteristics of induction regulator, Volt-ampere characteristics of solar cell and determination of its internal, Resistance, Simulation of different transmission line models on PC, Simulation of steady state operation of a power system on PC, Simulation of load flow

methods and power system stability problems, Use of standards software packages for operation and control of power system.

5. **Specific goals for the course**

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

- Decide the scheduling of thermal units and hydro-thermal units for overall economy.
- Develop small scale model of alternator, excitation and governing systems.
- Design and apply control for frequency and voltage of power system represented by single or 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
    - Dynamic Modelling of Power System components
    - Voltage stability