PS5102 POWER SYSTEM OPERATION AND CONTROL

DETAILED SYLLABUS

UNIT I 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.

UNIT II REAL POWER - FREQUENCY CONTROL

Fundamentals of speed governing mechanism and modelling: Speed-load characteristics – Load sharing between two synchronous machines in parallel; concept of control area, LFC control of a single-area system: Static and dynamic analysis of uncontrolled and controlled cases, Economic Dispatch Control. Multi-area systems: Two-area system modelling; static analysis, uncontrolled case; tie line with frequency bias control of two-area system derivation, state variable model.

UNIT III HYDROTHERMAL SCHEDULING PROBLEM

Hydrothermal scheduling problem: short term and long term-mathematical model, algorithm. Dynamic programming solution methodology for Hydro-thermal scheduling with pumped hydro plant: Optimization with pumped hydro plant-Scheduling of systems with pumped hydro plant during off-peak seasons: algorithm. Selection of initial feasible trajectory for pumped hydro plant- Pumped hydro plant as spinning reserve unit-generation of outage induced constraint-Pumped hydro plant as Load management plant.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH

Statement of Unit Commitment (UC) problem; constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints; UC solution methods: Priority-list methods, forward dynamic programming approach, numerical problems. Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. Base point and participation factors-Economic dispatch controller added to LFC control.

UNIT V STATE ESTIMATION

Need for power system state estimation- Network observability – DC state estimation model-State estimation of power system – Methods of state estimation: Least square state estimation, Weighted least square state estimation, Maximum likelihood- Bad data detection and identification.

OBJECTIVES:

- To understand the fundamentals of speed governing system and the concept of control areas.
- To provide knowledge about Hydrothermal scheduling, Unit commitment and solution techniques.

- To impart knowledge on the need of state estimation and its role in the day to day operation of power system.

REFERENCES

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5 P. Kundur, "Power System Stability & Control", McGraw Hill Publications, USA, 1994