| IV Year-I Semester | | L | T | P | C |
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| **POWER SYSTEM OPERATION AND CONTROL (R1641023)** | | | | | |

**Prerequisite Course:**

**Course Description and Objectives:**

This subject deals with Economic operation of Power Systems, Hydrothermal scheduling and modeling of turbines, generators and automatic controllers. It emphasizes on single area and two area load frequency control and reactive power control.

**Objectives:**

1. To understand optimal dispatch of generation with and without losses.
2. To study the optimal scheduling of hydro thermal systems.
3. To study the optimal unit commitment problem.
4. To study the load frequency control for single area system with and without controllers
5. To study the load frequency control for two area system with and without controllers
6. To understand the reactive power control and compensation of transmission lines.

**Course Outcomes:**

Upon completion of the course, the student will be able to achieve the following outcomes.

| Cos | Course Outcomes | Pos |
|---|---|---|
| 1 | Able to compute optimal scheduling of Generators | 04 |
| 2 | Able to understand hydrothermal scheduling. | 03 |
| 3 | Understand the unit commitment problem | 04 |
| 4 | Able to understand importance of the frequency. | 05 |
| 5 | Understand importance of PID controllers in single area and two area systems. | 05 |
| 6 | Will understand reactive power control and compensation for transmission line. | 04 |

**Syllabus:**

**UNIT – I: Economic Operation of Power Systems**

Optimal operation of Generators in Thermal power stations, – Heat rate curve – Cost Curve – Incremental fuel and Production costs – Input–output characteristics – Optimum generation allocation with line losses neglected – Optimum generation allocation including the effect of transmission line losses – Loss Coefficients – General transmission line loss formula.

**UNIT–II: Hydrothermal Scheduling**

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models – Scheduling problems – Short term hydrothermal scheduling problem.

**UNIT–III: Unit Commitment**

Optimal unit commitment problem – Need for unit commitment – Constraints in unit commitment – Cost function formulation – Solution methods – Priority ordering – Dynamic programming.

**UNIT–IV: Load Frequency Control-I**

Modeling of steam turbine – Generator – Mathematical modeling of speed governing system –

Transfer function – Modeling of Hydro turbine –Necessity of keeping frequency constant – Definitions of Control area – Single area control system – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case. Proportional plus Integral control of single area and its block diagram representation – Steady state response.

**UNIT–V: Load Frequency Control-II**

Block diagram development of Load Frequency Control of two area system uncontrolled case and controlled case. Tie-line bias control. Load Frequency Control and Economic dispatch control.

**UNIT–VI: Reactive Power Control**

Overview of Reactive Power control – Reactive Power compensation in transmission systems – Advantages and disadvantages of different types of compensating equipment for transmission systems – Load compensation – Specifications of load compensator – Uncompensated and compensated transmission lines: Shunt and series compensation – Need for FACTS controllers.

**Text Books:**

1. Electric Energy systems Theory – by O.I.Elgerd, Tata McGraw–hill Publishing Company Ltd., Second edition.
2. Modern Power System Analysis – by I.J.Nagrath&D.P.Kothari Tata McGraw Hill Publishing Company Ltd, 2nd edition.

**Reference Books:**

1. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., Thompson, 3rdEdition.
2. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
3. Power System Analysis by HadiSaadat – TMH Edition.

Power System stability & control, PrabhaKundur,TMH