COURSE CONTENT

ECONOMIC OPERATION OF POWER SYSTEMS								
I Semester: EPS								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BPSD02	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Power system analysis								

I. COURSE OVERVIEW:

This course will illustrate the difference between economic load dispatch and unit commitment problem and provide the mathematical platform to solve economic load scheduling (with and without network losses) and unit commitment problem, solve hydro-thermal scheduling problem This subject will also cover the analyze of single area and two area systems for frequency deviation and help students to solve the OPF problem using ac and dc load flow methods.

II. COURSES OBJECTIVES:

The students will try to learn

I. Necessary conditions for economical load scheduling problem.
II. Various constraints, problem formulation and methods to solve the unit commitment problem.
III. Constraints related to hydel power plants, problem formulation and solution techniques for hydro-thermal scheduling problem.
IV. Necessity, factors governing the frequency control and analyze the uncontrolled and controlled LFC system.
V. Basic difference between ELS and OPF problem, formulation of the OPF problem and solution techniques.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

CO1	Solve the unit Commitment problem with various constraints using conventional optimization techniques and general transmission line loss formula.
CO2	Identify an optimal operation setup of power system for minimizes operation costs and meet desired needs.
CO 3	Categorize single area load frequency control and two area load frequency control to minimize the transient deviations and steady state error to zero.
CO 4	Analyze the importance of Reactive power control and Power Factor in power systems for efficient and reliable operation of power systems.
CO 5	Develop the appropriate control scheme for compensating reactive power.
CO 6	Identify the different types of compensating equipment for reducing reactive power to improve system's efficiency.

IV. COURSE CONTENT:

MODULE - I: ECONOMIC LOAD SCHEDULING (09)

Characteristics of steam turbine, variations in steam unit characteristics, economic dispatch with piecewise linear cost functions, Lambda iterative method, LP method, economic dispatch under composite generation production cost function, base point and participation factors, thermal system dispatching with network losses considered.

MODULE–II: UNIT COMMITMENT (10)

Unit Commitment, definition, constraints in unit commitment, unit commitment solution methods, priority, list methods, dynamic programming solution.

MODULE –III: HYDRO THERMAL SCHEDULING (08)

Characteristics of Hydroelectric units, introduction to hydrothermal coordination, long range and short-range hydro scheduling.

Hydroelectric plant models, hydrothermal scheduling with storage limitations, dynamic programming solution to hydrothermal scheduling.

MODULE –IV: LOAD FREQUENCY CONTROL (09)

Control of generation, models of power system elements, single area and two area block diagrams, generation control with PID controllers, implementation of Automatic Generation control (AGC), AGC features.

MODULE –V: OPTIMAL POWER FLOW (09)

Introduction to Optimal power flow problem, OPF calculations combining economic dispatch and power flow, OPF using DC power flow, algorithms for solution of the ACOPF, optimal reactive power dispatch.

V. TEXTBOOKS:

1. J J Grainger, W D Stevenson, “Power system analysis”, McGraw Hill, 1stEdition, 2003.
2. Allen JWood, Bruce F Wollenberg, Gerald B Sheblé, “Power Generation, Operation and Control”, WileyInterscience2ndEdition, 2013.

VI. REFERENCE BOOKS:

7. Olle, Elgerd, “Electric Energy Systems Theory an Introduction”, TMH, 2nd Edition, 1983. 3rdEdition 2006.

VII. ELECTRONICS RESOURCES:

5. NPTEL Economic Operation of Power Systems - NOC: Planning and Operational Studies of Power Systems.
6. NPTEL Economic Operation of Power Systems - NOC: Introduction to symmetrical components.
7. NPTEL Modern Power system analysis - NOC: Power Flow Analysis.

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Definition and terminology
4. Tech-talk topics
5. Assignments
6. Model question paper-I
7. Model question paper-II
8. Lecture notes
9. Early learning readiness videos (ELRV)
10. Power point presentations