

Subject Code: 1ET2130401	Subject Title: Elective:IV- Restructuring & Deregulation of Power System
Pre-requisite Subject	Computer methods in power system analysis and Power System Management & Optimization.

Course Objective: After learning the course, the students should be able to:

- This course provides detailed concepts of various restructuring methods and market models which can be useful in solving the problems of power systems engineering.
- Also give the information about transmission line congestion management and bidding of power schemes.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)								
Lecture	Tutorial	Practical	Credit	Theory				Practical				Total
				University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	-	-	4	24	60	16	40	-	-	-	-	100

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	Introduction to restructuring of power industry: Reasons for restructuring of power industry; Understanding the restructuring process, Entities involved, The levels of competition, The market place mechanisms, Sector-wise major changes required; Reasons and objectives of deregulation of various power systems across the world.	05	10%
2	Fundamentals of Economics: Consumer and suppliers behavior, Total utility and marginal utility, Law of diminishing marginal utility, Elasticity of demand and supply curve, Market equilibrium, Consumer and supplier surplus, Global welfare, Deadweight loss.	06	15%
3	The Philosophy of Market Models: Monopoly model, Single buyer model, Wholesale competition model, Retail competition model, distinguishing features of electricity as a commodity, Four pillars of market design, Cournot, Bertrand and Stackelberg competition model.	07	15%
4	Transmission Congestion Management: Transfer capability, Importance of congestion management, Effects of congestion, Classification of congestion management methods, ATC, TTC, TRM, CBM, ATC calculation using DC and AC model, Nodal pricing, Locational Marginal Prices (LMPs), Implications of nodal pricing, Price area congestion management Capacity alleviation methods, Re-dispatching, Counter-trade, Curtailment	08	20%
5	Ancillary Service Management: Type and Classification of ancillary services, Sources of reactive power, Black start capability service, Provisions of ancillary services, Markets for ancillary services, Co-optimization of energy and reserve services, Loss of opportunity cost, International practices of ancillary services.	05	10%
6	Pricing of transmission network usage and loss allocation: Introduction to transmission pricing, Principles of transmission pricing, Classification of transmission pricing, Rolled-in transmission pricing paradigm, Marginal transmission pricing paradigm, Composite pricing paradigm, Merits and de-merits of different paradigms, Classification of loss allocation methods, Pro-rata methods, Incremental methods, Power flow tracing based allocation.	06	15%

7	Market power and generators bidding: Attributes of a perfectly competitive market, The firm's supply decision under perfect competition, Imperfect competition, Monopoly, Oligopoly, Electricity markets under imperfect competition Sources of market power, Effect of market power, Identifying market power, HHI Index, Entropy coefficient, Lerner index, Market power mitigation, Effects of contract for differences, Role of demand side bidding, Financial markets, Introduction to optimal bidding by a generator company.	06	15%
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Course Outcome:

After learning the course, the students should be able to:

- This course is intended to provide a comprehensive treatment towards understanding of the new dimensions associated with the power systems.
- The course will bring out the differences between the conventional power system operation and the restructured one. The course will prepare a background with fundamentals of microeconomics.
- In this course the design of power markets and market architectural aspects, the changes in operational aspects with new operational challenges like congestion management and ancillary service management will be elaborated.
- One of the outcome of the course also efficient pricing of transmission network usage operation and Genco bidding strategies and market power with mitigation techniques.

List of Text Books:

1. Fundamentals of Power System economics Daniel Kirschen and Goran Strbac, John Wiley & Sons Ltd, 2004 (for chapter 1,2,3 & 5).
2. Making competition work in electricity Sally Hunt, John Wiley & Sons, Inc., 2002.

List of Reference Books:

- 1 Power system restructuring and deregulation by Loi Lei Lai Wiley India.
- 2 Restructured Power Systems, A. R. Abhyankar, S. A. Khaparde, Available: <http://nptel.iitm.ac.in/courses/108101005/> (NPTEL Course)