

Branch Name:	Electrical Engineering
ProgramCode:	ET213
CourseName:	Elective:IV- Restructuring & Deregulation of Power System
CourseCode:	2ET2130401T
Pre-requisiteCourse:	Computer methods in power system analysis and Power SystemManagement & Optimization.

Course Objectives:

1. To understand concepts of various restructuring methods and market models.
2. To identify different problem related power system and solve it using restructuring methods.
3. To understand about transmission line congestion management and bidding of power schemes.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	4	-	-	4	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No	Topic	Total Hours	Weightage (%)
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%

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.

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).

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the comprehensive treatment towards new dimensions associated with the power systems.	2 Understanding
CLO2	Understand the basic differences between the conventional power system operation and the restructured one.	2 Understanding
CLO3	Know about the background related to fundamentals of microeconomics.	1 Remembering
CLO4	Know about the changes in operational aspects with new operational challenges like congestion management and ancillary service management will be elaborated..	1 Remembering
CLO5	Analyze and design the power markets and market architectural aspects.	4 Analyze 6 Creating
CLO6	Evaluate the efficient pricing of transmission network usage operation and GENCO bidding strategies and market power with mitigation techniques.	5 Evaluate

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1				M			L				M		M			L
CLO2	L			M			L				M		M			L
CLO3		L		H		M						M				L
CLO4		L		H		M						M				L
CLO5	L		L		M			M		L		M		M	H	
CLO6		H	L	M				H			L			L	H	