GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRICAL ENGINEERING (07)

POWER SYSTEM RESTRUCTURING

SUBJECT CODE: 2740702

M.E. SEMESTER - IV

Type of course: Master of Electrical Engineering (Power system Group)

Prerequisite: Computer methods in power system analysis (2710711) and **P**ower System Management & Optimization (2720717)

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Content	Total Hrs	% 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	4	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	7	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	7	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	10	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.	5	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,	6	15

	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		
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	**6**	**15**

Reference Books:

1. NPTEL Cource-Restructured Power Systems, A. R. Abhyankar, S. A. Khaparde, Available: http://nptel.iitm.ac.in/courses/108101005/
2. Fundamentals of Power System economics Daniel Kirschen and Goran Strbac, John Wiley & Sons Ltd, 2004 (for chapter 1,2,3 &5)
3. Making competition work in electricity Sally Hunt, John Wiley & Sons, Inc., 2002
4. Power system restructuring and deregulation by Loi Lei Lai Wiley India

Course Outcome:

- 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.

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.