NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B.Tech. in Electrical Engineering**
Semester:	**VII**
Course Code:	**2EEDE16**
Course Title:	**Restructured Power System**
Course Type:	(□ Core/ □ Value Added Course / √ **Department Elective**/ □ Institute Elective/ □ University Elective/ □ Open Elective/ □ Any other)
Year of Introduction:	**2021 – 22**

Credit Scheme

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

At the end of the course, students will be able to-

1. compare the new dimensions associated with traditional power system and restructured power system
2. identify the various entities involved in the operation of restructured power market; and power market models
3. illustrate electricity transmission pricing approaches and ancillary services market
4. analyse the reform initiatives in Indian Power Sector

Syllabus: **Total Teaching hours: 45**

Unit	Syllabus	Teaching hours
Unit-I	**The Electricity Industry under Restructuring – An Overview** Introduction, reasons for restructuring / deregulation of electricity industry, understanding the restructuring process, different entities involved in restructured electricity market, reasons and objectives of deregulation of various power systems across the world – US, UK, Nordic Pool, Chile, developing countries, benefits from a competitive electricity market.	**08**
Unit-II	**Power Market Models in Restructured Environment** Introduction, Various market models – monopoly model, single buyer model, wholesale competition model, retail competition model, comparison of various market models, four pillars of market design – imbalance, scheduling and dispatch, congestion management, ancillary services, market architecture – bilateral / forward contracts, spot market, ISO or TSO model.	**12**
Unit-III	**Transmission Pricing in Open Access** Introduction to power wheeling, cost components involved in transmission, objectives of transmission pricing, principles of transmission pricing, different transmission pricing methodologies – Postage stamp method, Contract path method, MW – Mile method, Power flow tracing, Marginal transmission pricing paradigm, merits and demerits of various transmission pricing	**10**

	methodologies, introduction to Financial Transmission Rights (FTR) and Power Purchase Agreement (PPA).	
Unit-IV	**Ancillary Services Management** Overview of ancillary services, types of ancillary services, classification of ancillary services – load generation balancing related services, voltage control and reactive power support devices, black start capability service, ancillary services management in developing countries.	**08**
Unit-V	**Reforms in Indian Electricity Sector** Framework of India electricity sector, reform road map in Indian power sector, Availability Based Tariff (ABT) – introduction, necessity, working mechanism, effects of ABT, overview of Indian energy exchange and its operation, open access issues and draft on electricity (Amendment) Bill 2020.	**07**

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/ References:

1. Kankar Bhattacharya, Math H.J. Boller and Jaap E.Daalder, Operation of Restructured Power System, Kluwer Academic Publishers.
2. Mohammad Shahidehpour and Muwaffaq alomoush, Restructured Electrical Power Systems, Marcel Dekker, Inc.
3. Loi Lei Lai, Power System Restructuring and Deregulation, John Wiley & Sons Ltd., England.
4. Steven Stoft, Power System Economics: Designing Markets for Electricity, Wiley-IEEE Press.
5. Lorrin Philipson, H. Lee Willis, Understanding electric utilities and de-regulation, Marcel Dekker Publication.
6. Daniel S. Kirschen, Goran Strbac, Fundamentals of Power System Economics, Wiley.
7. Bhanu Bhushan, "ABC of ABT - A primer on Availability Tariff" - www.cercind.org.
8. Recent research literature, reports published by CERC / CEA and Indian Grid Code.

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2021-22 and onwards