COURSE TITLE	**INTERCONNECTED POWER SYSTEMS**
COURSE CODE	**01EE1603**
COURSE CREDITS	**5**

Objective:

1 The aim of the subject is to develop an understanding of the basic concepts related to interconnected system. This subject also explains how mathematical modeling of the power system can be carried out to find out behavior of the power system during normal and abnormal conditions. This subject also deals with the topics about how economic operation and planning of the power system network can be carried out.

Course Outcomes: After completion of this course, student will be able to:

1 Describe the fundamental concepts and recent trends of interconnected power system.

2 Carry out load flow and stability analysis of interconnected power system.

3 Select appropriate parameters for economic operation of power system

4 Demonstrate the need of frequency and voltage control in interconnected power system

Pre-requisite of course: Power system I and Power Systems II

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
4	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction** Concept of Interconnection, Hierarchical Grid arrangements, Cascade Tripping, Islanding, Load dispatch center, Power Generation Scenario in Gujarat and India	3
2	**Power system matrices** Brief explanation of Graph theory, Primitive Network, Y-bus formation methods, Singular transformation method, Direct method, effect of addition and deletion of shunt elements on YBus	6
3	**Load flow studies** Introduction, Static Load Flow Equations, Bus Classifications, Approximate method, Gauss-Seidel Method, Newton Raphson Method, Decoupled Load Flow Method, Fast Decoupled Load Flow Method, DC power flow, Tap changing transformer, Comparison of different methods	12

DR. AMIT DILIPKUMAR VED
Digitally signed by (Name of HOD)

DR. RAJENDRASINH BAHADURSINH JADEJA
Digitally signed by (Name of Dean/ Principal)

Contents : Unit	Topics	Contact Hours
4	**Economic operation of power systems** Generator operating cost, Economic operation of generators within thermal plant, Optimal operation by co-ordination equation, Penalty factor, Derivation of transmission loss formula (Kron's method), Constraints in unit commitment – Spinning reserve – Thermal unit constraints – Solution using Priority List method, Dynamic programming method, Power Exchanges, Spot Pricing, Models (Vertically integrated), Purchasing Agency	10
5	**Frequency and voltage control methods** Speed governing mechanism, Mathematical modelling, Adjustment of Governor characteristics, Single area control, Flat frequency control, Selective frequency control, Tie line load bias control, Methods of voltage control	8
6	**Power System Stability** Introduction, Mechanics of angular motion, The swing Equation, transfer reactance, power relations, Steady state stability, Synchronizing power coefficient, Analysis of steady state stability, steady state stability with automatic voltage regulators, Transient stability, simplified transient generator model, The equal area stability criterion, solution of swing equation	13
7	**Wide Area Measurement Systems** Basic architecture, Components of WAMS, Application of WAMS, Phasor Measurement Unit : Architecture, Functions and application	4
Total Hours		**56**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment-1** Determine the bus admittance matrix for interconnected power system using MATLAB programming	2
2	**Experiment-2** Perform load flow analysis for power system by using power world simulator.	2
3	**Experiment-3** To solve static load flow equation using approximate method of Load Flow using MATLAB programming.	2
4	**Experiment-4** To solve static load flow equation using Gauss-Seidel Method of Load Flow using MATLAB programming	2
5	**Experiment-5** To solve static load flow equation using Newton Raphson Method of Load Flow using MATLAB programming.	2
6	**Experiment-6** To solve static load flow equation using Fast Decoupled Load Flow Method of Load Flow using MATLAB programming	2

DR. AMIT DILIPKUMAR VED
Digitally signed by (Name of HOD)

DR. RAJENDRASINH BAHADURSINH JADEJA
Digitally signed by (Name of Dean/ Principal)

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
7	**Experiment-7** Perform economic load dispatch in power world simulator.	2
8	**Experiment-8** Determine the penalty factor for the given system	2
9	**Experiment-9** Determine Beta- coefficient for the given system	2
10	**Experiment-10** Perform transient stability analysis and find critical clearing angle by using power world simulator	2
11	**Experiment-11** To solve swing equation by using step by step method in MATLAB.	2
12	**Experiment-12** Simulation of Automatic Generation Control (AGC) & Automatic Voltage Regulator(AVR) without & with Controller.	2
Total Hours		**24**

Textbook :

1 Modern Power System Analysis, D. P. Kothari, I. J. Nagrath, Tata McGraw-Hill Education, 2022

2 Power System Analysis and Stability, S.S. Vadhera, Khanna Publication, 2005

References:

1 Elements of Power System Analysis , Elements of Power System Analysis , John Grainger, William Stevenson, McGraw-Hill Publishers, 2004

2 Electrical Power System , Electrical Power System , C.L Wadhva, New-age international publishers, 2016

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
10.00	20.00	35.00	20.00	10.00	5.00

Supplementary Resources:

1 https://onlinecourses.nptel.ac.in/noc19_ee62/course

2 https://nptel.ac.in/courses/108/107/108107028/#

DR. AMIT DILIPKUMAR VED
Digitally signed by (Name of HOD)

DR. RAJENDRASINH BAHADURSINH JADEJA
Digitally signed by (Name of Dean/ Principal)

Supplementary Resources:

3 http://nptel.ac.in/courses/108105067/1#

4 https://www.powerworld.com/download-purchase/demo-software

DR. AMIT DILIPKUMAR VED

Digitally signed by (Name of HOD)

DR. RAJENDRASINH BAHADURSINH JADEJA

Digitally signed by (Name of Dean/ Principal)