BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
SECOND SEMESTER 2022-2023
Course Handout

28 /12/2024

Course No : EEE F312
Course Title : Power Systems
Instructor-in-charge : Prof. STP Srinivas
Co- Instructor : Prof. Mithun Mondal

1. Learning Outcomes:
   a) The student will be able to model the power system network and understand its performance characteristics.
   b) The student would be able to perform the stability and fault analysis of the power system network.
   c) The student would be able to understand the basic control of the frequency and voltage in the network.
   d) The student will be able to comprehend the concepts of protection of the power system network.

2. Scope and objective:
   This course introduces the students to the basic features of the modern power systems, analysis and operation under steady state and transient conditions.
3. Course description:
   Review and importance of power system, Present power system scenario, Transmission line parameters and modeling, Characteristics and performance of lines, Load flow studies, Optimal system operation, Automatic Generation and voltage Control, Power system fault analysis, Power Systems stability, Introduction of power system protection.

4. Text Book:
   1. Nagrath I.J. and D.P.Kothari, "Power System Engineering" TMH, 1994.

5. Reference books:

   1. Glover J Duncan and Sarma Mulukutala S, "Power System Analysis and Design" 3rd edition, Thomson Brooks/Cole, 2003.
   2. C.L Wadhwa, "Electrical Power Systems", 6th edition, New Age International Publications, 2010.

6. Course Plan:

Lecture No.	Learning objective	Topic to be covered	Chapter in the Text Book
1.	A perspective of the Power system: Review the importance and structure of a power system	Introduction	T: 1.1 to 1.4
2-4	Electric Power Generation	Generation of electricity using Thermal, Nuclear, Hydropower, and renewable energy (only working principles and terminology description)	T: 1.5 to 1.11
5	Performance Metrics	Load curve, definitions of cold, hot, spinning reserves, plant capacity factor, diversity factor, average load, peak load, load factor, and demand factor	T: 1.3
6-7.	OH Transmission line modeling	Inductance calculations for isolated and single-phase all configurations	2.1 to 2.7
8-9.	OH Transmission line modeling	Inductance calculations for three-phase double circuit and transposed systems, proximity, and skin effects	2.8 to 2.12
10-11.	OH Transmission line modeling	Capacitance calculations of 1-ph and 3-ph systems.	3.1 to 3.6
12.	OH Transmission line modeling	Effect of earth, methods of GMD (Modified) bundle conductors.	3.7 to 3.9
13.	P.U System	One line diagram and per unit system	4.3 to 4.4
14-16	Characteristics and performance of lines	Analysis of short and medium lines	5.1 to 5.3
17 – 18	Characteristics and performance of lines	Long transmission lines, Equivalent circuit of long lines,	5.4 to 5.5
19	Characteristics and performance of lines	Interpretation of long line and Ferranti effect.	5.7 to 5.8
20-21	Load flow studies	Importance, Y Bus formulation, load flow problem	6.3 to 6.4
22– 25	Load flow studies	Gauss – Siedel & Newton	6.5 to 6.6

		Raphson Method	
26-27	Optimal system operation	Optimal operation, Unit commitment, AGC	7.1 to 7.3
28	Symmetrical Fault Analysis	Transient Short Circuits	9.1 to 9.3
29	Symmetrical Fault Analysis	Short circuit and selection of circuit breakers	9.4 to 9.5
30	Symmetrical Components	Transformation, phase shift	10.1 to 10.3
31	Symmetrical Components	Sequence impedances of line generation and transformers	10.4 to 10.8
32	Symmetrical components	Construction of sequence networks	10.9
33 – 34	Unsymmetrical fault analysis	Line to ground, line to line, and double line to ground faults, open conductor fault	11.1 to 11.6
35	Power Systems stability	Dynamics of a synchronous ,machine	12.1 to 12.2
36	Power system stability	Steady-state stability of simple systems	12.3 to 12.6
37-38	Power system stability	Equal area criterion	12.7 to 12.8
39	Power system transient	Generation of over voltages protection of lines against lightning Protection against surges	13.4 to 13.5 13.6 to 13.7
40-41	Power system protection	Relaying elements and quantities, current and voltage transformers, Relay types and characteristics	15.3 to 15.5

Evaluation Scheme:

No	Components	Duration	Marks	Date/Time	Nature of Components
1	Mid-term	90 Min	30%, 90M	Timetable	CB
3	Quiz (2)	45Min	30%, 90M	In class	CB
4	Comprehensive Exam	3 Hours	40% 120M	Timetable	OB

Chamber consultation Hours: To be announced in the class.

Course Notices: Notices will be displayed in CMS

Make-up Examination: ***No makeup for quizzes***. Make-up for the tests will be granted only on extremely genuine grounds only. ***In case of request on genuine grounds***, ***prior application and approval should be made to seek this.***

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester, and no type of academic dishonesty is acceptable.

Instructor-In-Charge
EEE F312.