

Course Name: Power System

Course Code: EE 502

Credit: 4

Prerequisites:

Sl. No.	Subject	Description	Level of Study
01	Basic Electrical Engg.	Electrostatics, AC fundamental	1 st year of Engg.
02	Physics	Basic idea of Lightning, magnetism, electromagnetism, electric field and electric potential, capacitance and capacitor	HS
03	Mathematics	Differentiation, Integration.	HS

Course Objective:

- To introduce the students to the general structure of the network for transferring power from generating stations to the consumers.
- To expose the students to the different electrical & mechanical aspects of the power network along with its environmental and safety constraints.
- To familiarize the students with the price structure of Indian power market.

Course Outcomes:

At the end of the course, a student will be able to:

1. Ability to design and analyze the real time electrical transmission system with respect to various electrical parameters considering environmental and economic obligations
2. Develop the ability to implement the appropriate safety equipments for design of electrical power system with enhancing the efficiency of the transmission and distribution system with environment friendly technology.
3. Ability to implement the knowledge of basic mathematical ,physical and electrical principles to formulate significant electrical hazards
4. Judge the suitability of installing overhead and underground power transmission strategies considering electrical, mechanical, environmental, performance, safety and economic constraints
5. Chose the appropriate type of power generating station following norms and guidelines related to cost, environment, societal and ethical issues. Also review the different tariff systems available and determine the one most appropriate for a given scenario to optimize the revenue earned.

6. Recognize the need to continuously follow the advancements in technology and incorporating them in the present system to improve efficiency

CO- PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE502.1	3	-	3	3	-	3	3	-	3	3	2	1
EE502.2	3	-	-	1	-	-	-	3	3	3	2	2
EE502.3	3	-	-	-	-	-	3	-	3	3	-	2
EE502.4	3	-	-	-	-	3	3	-	3	3	2	2
EE502.5	3	-	-	-	-	3	3	3	3	3	3	2
EE502.6	3	-	3	3	-	3	3	3	-	-	-	3

* Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) and If there is no correlation, put “-”

Syllabus Indicating CO:

Module No.	Content	Relevant CO's
1	<p>Overhead transmission line: Choice of frequency, Choice of voltage, Types of conductors, Inductance and Capacitance of a single phase and three phase symmetrical and unsymmetrical configurations. Bundle conductors. Transposition. Concept of GMD and GMR. Influence of earth on conductor capacitance.</p> <p>Overhead line construction: Line supports, Towers, Poles, Sag, Tension and Clearance, Effect of Wind and Ice on Sag. Dampers.</p>	CO1,CO2,CO3,CO4

	<p>Insulators: Types, Voltage distribution across a suspension insulator string, String efficiency, Arching shield & rings, Methods of improving voltage distribution across Insulator strings, Electrical tests on line Insulators.</p> <p>Corona: Principle of Corona formation, Critical disruptive voltage, Visual critical corona discharge potential, Corona loss, advantages & disadvantages of Corona. Methods of reduction of Corona.</p>	
2	<p>Cables: Types of cables, cable components, capacitance of single core & 3 core cables, dielectric stress, optimum cable thickness, grading, dielectric loss and loss angle.</p>	CO2,CO3,CO4,CO6
3	<p>Performance of lines: Short, medium (nominal , T) and long lines and their representation. A.B.C.D constants, Voltage regulation, Ferranti effect, Power equations and line compensation, Power Circle diagrams.</p>	CO1,CO2,CO3,CO4
4	<p>Generation of Electric Power: General layout of a typical coal fired power station, Hydro electric power station, Nuclear power station, their components and working principles, comparison of different methods of power generation. Introduction to Solar & Wind energy system.</p> <p>Tariff: Guiding principle of Tariff, different types of tariff.</p>	CO1,CO2,CO3,CO4,CO5,CO6

Gaps in Syllabus:

Sl. No.	Gap	Action taken	Relevance to POs
1	Power System Operation: This is a modern concept introduced in Power System useful to deal with power loss reduction as well as better consumer involvement in the power business scenario. Topics covered: Smart Grid, Supervisory Control and Data Acquisition (SCADA) in power system, Application of digital communication technology to make electricity market consumer friendly.	The various topics are addressed by lecture classes, providing notes & real case analysis.	PO 1, PO 2, PO 5
2	Economic Operation of Energy Generation Systems: In the interconnected power system consisting of various types of energy resources this topic tells about the objective and methods to implement a optimal and reliable operation. Topics covered: Optimal load scheduling, use of artificial intelligence in load flow optimization.	Additional lecture classes are organized to cover the topics. Research literatures are provided for this	PO 1, PO 5
3	Voltage Stability: This is an ever important area which is currently of huge research initiatives. Topics covered: Synchronous Phase Modifier capacity determination, sending end power circle diagram, FACTS.	These are covered by lectures and providing research papers.	PO 1, PO 2, PO 4, PO 7
4			
5			

Lecture Plan:

Sl. No.	Date	Topics	Remarks
1		A general idea on power system, choice of frequency and choice of voltage	Relate with real life example
2		Performance of overhead transmission lines: voltage regulation ,Efficiency	
3		Types of conductors	Discuss with good diagram of conductors
4		Short and medium transmission lines and their representation	Discuss about the equivalent circuit dia.

5		Long transmission line and its representation	Discuss about the equivalent circuit dia.
6		Inductance of a three phase symmetrical and unsymmetrical configurations	
7		A,B,C,D Constants	About importance of A,B,C,D
8		Capacitance of a single phase symmetrical and unsymmetrical configurations	
9		Characteristic Impedance, surge Impedance loading, Ferranti effect	
10		Capacitance of a three phase symmetrical and unsymmetrical configurations	
11		Power equations and line compensation, power circle diagram	Requirement of line compensation
12		Bundle conductors, Transposition, concept of GMD and GMR, influence of earth on capacitance of a conductor	
13		Numerical on short, medium and long transmission line along with A,B,C,D parameters and power circle diagram.	numerical
14		Numerical on Inductance and capacitance of single and three three phase symmetrical and unsymmetrical transmission lines	
15		Introduction, Comparison with overhead line, Necessary requirements, General construction of cable	
16		Overhead line construction: Line supports, Towers	
17		Types of cables, cable components	With a piece of cable in class
18		Poles, Sag	
19		Capacitance of single core cable, dielectric stress	
20		Tension and clearance	
21		Optimum thickness of cable	

22		Grading with numerical problems	
23		Effect of wind and ice on sag, Dampers	numerical
24		Capacitance of 3 core cable, dielectric loss and loss angle	
25		Numerical problems on sag	
26		Numerical problems of underground cable	
27		Tariff: Guiding principle of Tariff	
28		Insulators: Types of insulators	
29		Different types of tariff with numerical problems	
30		Voltage distribution on suspension insulator string. String efficiency	
31		Methods of improving voltage distribution across insulator strings	
32		Electrical tests on line insulators	
33		Principle of corona formation, critical disruptive voltage, visual disruptive voltage with mathematical expression	
34		Corona loss ,advantage & disadvantage of corona, methods of reduction of corona	
35		Numerical on corona	numerical

Recommended Books:

1. **Electrical power system, Subir Roy, Prentice Hall**
2. **Power System Engineering, Nagrath & Kothery, TMH**
3. **Elements of power system analysis, C.L Wadwa, New age international**
4. **Electrical Power System, Ashfaq Hussain, CBS Publishers & Distributors**