



Semester – IV

Subject Name: Electrical Power Transmission and Distribution

Subject Code: 09EE3402

Diploma Branches in which this subject is offered: Electrical Engineering

Objective: The electricity is generated in bulk at remote places near to sources available, after that electricity transmitted long distance for distribution purpose, and then distributed for utilization at cities, villages, agricultural and industry. The transmission and distribution of electric power is a complex issue, which requires knowledge of different types of transmission and distribution line and various equipment associates with them. Electricity is continuously available to the consumers with economically and without interruption for that technical man power required for operation of transmission and distribution network. It is therefore required that the technical man power should be also able to work independently in the various area of transmission and distribution network. S/he should be also able to operate various control equipment's independently in normal and abnormal conditions. Essential efforts are made in this course to develop above skills in the students.

Credits Earned: 5 Credits

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

1. Analyze different transmission line components and configurations to assess their suitability in power systems.
2. Evaluate transmission line performance and recommend suitable compensation and improvement techniques.
3. Compare and evaluate HVAC and HVDC systems to determine optimal transmission solutions for given conditions.
4. Evaluate distribution systems, substations and underground cable network to ensure reliability, safety and performance.

Pre-requisite of course: Basic knowledge of D.C. and A.C. Circuits, Electrical Machines, Generation of Electrical Power and Electrical Measurement & Instrumentation

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term work	
4	0	2	5	50	30	20	25	25	150

Contents:



Unit	Topics	Contact hours	Weightage (%)
1	Transmission Line Parameters and Components • Introduction • Basic structure and elements of Power system • Classification of transmission system • Comparison between Overhead and Underground system • Effect of system voltage and power factor • Economical transmission voltage • Voltage level for generation, transmission and distribution system • Conductor materials, Conductors used in overhead lines • Lines supports • Comparison between single circuit and double circuit transmission line • Overhead line insulators • Comparison between pin type and suspension type insulator • Distribution of potential over a string of suspension insulator • String efficiency and its improving methods • Sag and Tension • Spacing and clearance of line conductors	14	25
2	Transmission Lines Performance • Introduction • Skin effect, Proximity effect, Ferranti effect • Corona effect and its effect on transmission line • Performance of transmission line • Transposition of line • Classification of transmission line • Performance of short and medium transmission line • Effect of load power factor on regulation and efficiency • Load Dispatch Center	11	20
3	Extra High Voltage Transmission • Introduction • Necessity and problem involved of EHV transmission • Advantages and reason of adoption of EHV transmission • HVAC transmission and its advantages and limitation • HVDC transmission and its advantages and limitation • Comparison of HVAC and HVDC	08	14



	• Types of HVDC system • Equipment's used in HVDC transmission • Application of HVDC system • Use and scope of HVDC system in India • Impact of wind power, solar power and other renewable energy on transmission system • Flexible AC transmission system (FACTS) • Types of FACTS controller and devices		
4	Power Distribution System • Introduction • Classification of distribution system • AC distribution system • Importance of distribution system • Component of distribution system • Difference between feeder, distributor and service main • Various connection schemes of distribution system • Requirements of good distribution scheme • Comparison between calculation of AC distribution and DC distribution • AC distribution problem solving methods • Three phase load circuits • Distributed power generation	11	20
5	Sub-Stations and Underground Cables • Introduction • Sub-Station and its function • Types of sub-station • Indoor and outdoor sub-station • Comparison between outdoor and indoor sub-station • Selection and location of site for a sub-station • Transformer sub-station, Pole mount sub-station, Terminal sub-station, Underground sub-station • Equipments and control room of sub-station • Necessity of battery room • Bus-Bar and its various arrangement • Position of various equipment in sub-station • Key line diagram of sub-station for various voltage level • Underground cable and its main requirements • Advantages and disadvantages of underground cable over overhead lines • Comparison between underground cable and overhead line system • General construction of cable • Classification of cable • Insulation used in cable • Cable laying and its methods	12	21



	Requirement and applications of various types of cable		
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Suggested Theory Distribution:

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

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
40%	40%	10%	10%	0%	0%

Suggested Laboratory Work / Activity:

Following are the activities which can be undertaken to accelerate the attainment of the various outcomes in this course

Sr. No.	Unit No.	Name of Topics	Contact Hours
1	1	Identify and study different types of conductors used for overhead transmission lines with their properties and applications.	2
2	1	Examine various line support structures used in transmission and distribution systems and compare their features.	2
3	1	Investigate different types of insulators used in overhead systems and state their practical applications.	2
4	1	Analyze voltage distribution across suspension insulator units and suggest methods to improve it.	2
5	2	Investigate the effects of corona effect, skin effect and proximity effect on conductor performance.	2
6	2	Evaluate the performance of a short transmission line in terms of voltage regulation and efficiency.	2
7	2	Analyze the performance of a medium transmission line using appropriate methods.	2
8	2	Study the role and functions of a Load Dispatch Centre in power system operation.	2
9	3	Analyze the structure and working of Extra High Voltage (EHV) AC transmission system in India.	2
10	3	Examine the basic configuration and operation of HVDC transmission systems.	2
11	4	Analyze different AC distribution network	2



		configurations such as radial and ring systems.	
12	4	Calculate voltage drop and determine sending and receiving end voltages for a distribution feeder.	2
13	5	Examine different types of substations and compare various bus-bar arrangements.	2
14	5	Investigate construction, classification and applications of underground cables.	2

Instructional Method:

- The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- Practical examination will be conducted during the semester for evaluation of performance of students in laboratory.
- Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.
- Show video or animation of Transmission and Distribution network

References:

- A.Chakrabarti, M.L.Soni, P.V.Gupta & U.S.Bhatnagar “*A Textbook on Power System Engineering*”, Dhanpat Rai & Co. 2014
- V. K. Mehta & Rohit Mehta “*Principles of power system*”, S. Chand and Co. 2014
- J. B Gupta. “*A Course in Power System*”, S. K. Kataria & Sons, 2017
- C. L. Wadhwa “*Electrical Power System*”, New Age International Publisher, 2017
- S. Sivanagaraju & S. Satyanarayana “*Electrical Power Transmission and Distribution*”, Pearson, 2017

Supplementary Resources:

- <http://www.sldcguj.com/RealTimeData/RealTimeDemand.php>
- <https://nptel.ac.in/courses/108105053/2>
- <https://nptel.ac.in/courses/108108033/>
- <http://nptel.ac.in/courses/108102047/>
- <http://nptel.ac.in/courses/108105058/9>
- <https://nptel.ac.in/courses/108104051/10>
- <https://nptel.ac.in/courses/108101040/6>
- <https://nptel.ac.in/courses/108107112/2>



9. <https://nptel.ac.in/courses/105101085/20>