



Semester – IV

Subject Name: Electrical Power Transmission and Distribution

Subject Code: 09EE0402

Diploma Branches in which this subject is offered: Electrical Engineering

Objective: The electricity is generated in bulk at remote places near to coal mines (thermal power plants), dams (hydro power plant), so transmitted to long distances and then distributed in various load for to this power plants likes cities, villages and to industry. The transmission and distribution of electric power is a complex issue which requires knowledge of different types of transmission lines and power equipment. Technical man power are required to operate and maintain the power transmission and distribution system so that electrical energy is continuously available to the consumers economically. It is therefore required that the technical man power should be also able to work independently in the various area of transmission and distribution system. S/he should be 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: 6 Credits

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

1. To learn basic concept regarding material used in line and structure of transmission line.
2. To understand the basic concept of transmission line parameters, their calculations also the effects on transmission lines and basics of LDC.
3. To understand the concepts of High Voltage DC and High Voltage AC Transmission.
4. To understand the concepts of Flexible AC Transmission System.
5. To knowledge regarding distribution system and design related to distribution system
6. To knowledge about Sub-Station and different types of underground cable, cable design and parameters and testing of cable.

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



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	6	50	30	20	25	25	150

Contents:

Unit	Topics	Contact hours	Weightage (%)
1	Transmission Line Parameters and Components <ul style="list-style-type: none">• Introduction• Power system structure.• Electrical supply system• Elements of transmission system• Typical AC electrical power supply system• Classification of transmission system• Effect of system voltage and power factor• Conductor materials• Conductor for overhead lines• Voltage level for transmission and distribution system• Economical transmission voltage• Lines supports• Overhead line insulators• Comparison between single circuit and double circuit transmission line• Distribution of potential over a string of suspension insulator• String efficiency and its methods of improving• Sag and Tension• Spacing and clearance of line conductors• Vibrations and Dampers	14	25
2	Transmission Lines Design and Performance <ul style="list-style-type: none">• Introduction• Important terms• Constant and parameter of transmission line• Effects of line parameters.• Equivalent circuit representation of line parameters• Skin effect• Proximity effect• Ferranti effect• Corona and its effect on transmission line	11	20



	<ul style="list-style-type: none">• 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• Performance of long transmission line• Various compensation of lines• Load Dispatch Center• Function of Load Dispatch Center• Equipment used in Load Dispatch Center		
3	High Voltage AC and DC Power Transmission <ul style="list-style-type: none">• Introduction• Necessity of EHV transmission• Problem involved in EHV transmission• Aspects of EHV AC power transmission• Advantages and reason of adoption of EHV AC transmission• Limitation of high voltage AC transmission• HVDC transmission• Principle of HVDC system operation• Line diagram of HVDC transmission system• Advantages and limitation of HVDC transmission• Types of DC link• Types of HVDC system• Application of HVDC system• Comparison between EHVAC and HVDC transmission• Equipment's used in HVDC transmission• 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)• Need of FACTS• Control of power system using FACTS devices• Types of FACTS controller and devices• Advantages of FACTS	08	14
4	Power Distribution System <ul style="list-style-type: none">• Introduction• Classification of distribution system• Position of distributor in supply system• Importance of distribution system• AC distribution system• Component of distribution system• Difference between feeder, distributor, service main	11	20



	<ul style="list-style-type: none">• Requirement of distributor system• Methods of connection schemes• Methods of feeding secondary distributor• Requirements of good distribution scheme• Comparison between calculation of AC distribution and DC distribution• Design consideration of distribution system• Calculation of single phase AC and three phase AC distributor• AC interconnected system• Distributed Generation		
5	Sub-Stations and Underground Cables <ul style="list-style-type: none">• Introduction• Sub-Station and its function• Types of sub-station• Indoor and outdoor sub-station• Advantages and disadvantages of outdoor type sub-station over indoor type sub-station• Comparison between outdoor and indoor sub-station• Selection and location of site for a sub-station• Key diagram of sub-station• Transformer sub-station, Pole mount sub-station, Terminal sub-station, Underground sub-station• Equipment for sub-station• Control room of sub-station• Battery and battery room• Sub-Station earthing• 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• Types of cable• Oil filled and gas pressure cable• Insulation in cable• Selection of cable as per standard• Cable laying and its methods• Procedure for selection of HT and LT cable• Rating of cable• Operating problem with cables	12	21



	<ul style="list-style-type: none"> • Rating factors of cable • Measurement of insulation resistance of cable • Fault in underground cables • Testing of cable • 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%	35%	15%	10%	0%	0%

Suggested List of Tutorial/Practical:

Sr. No.	Unit No.	Name of Topics	Contact Hours
1	1	Write a tutorial on single line diagram of power system, Classification of transmission system, Comparison of volume of conductor material in overhead transmission system and practical transmission and distribution voltage level	2
2	1	Write a tutorial on main elements of transmission system	2
3	1	Demonstrate testing of insulators	2
4	1	Prepare report on different types of insulator, and tower used in transmission and distribution system with its parameters.	2
5	2	Write tutorial on classification of transmission line	2
6	2	Visit Load Dispatch Center and Prepare its report	2
7	3	Write tutorial on HVDC transmission system	2
8	3	Demonstrate short and medium transmission line	2
9	4	Visit nearby distribution system and prepare its report	2
10	5	Visit a sub-station and prepare a report on it.	2
11	5	Use crimping tools, fit lug on cable	2
12	5	Draw bus-bar arrangement and given blue print of a sub-station	2
13	5	Prepare a report on visit cable industry and types of cable used in electrical system.	2
14	5	Demonstrate cable joint procedure	2



Instructional Method:

- a. 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.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.
- e. Show video or animation of Transmission and Distribution network

References:

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

Supplementary Resources:

1. <https://posoco.in/>
2. <http://www.sldcguj.com/RealTimeData/RealTimeDemand.php>
3. <https://www.youtube.com>
4. <http://www.getco.in/>
5. <https://nptel.ac.in/courses/108105053/2>
6. <https://nptel.ac.in/courses/108108033/>
7. <http://nptel.ac.in/courses/108102047/>
8. <http://nptel.ac.in/courses/108105058/9>
9. <https://nptel.ac.in/courses/108104051/10>
10. <https://nptel.ac.in/courses/108101040/6>
11. <https://nptel.ac.in/courses/108107112/2>
12. <https://nptel.ac.in/courses/105101085/20>
13. <http://www.powergrid.com/>
14. <http://www.pgvcl.in>