Syllabus for Diploma Engineering

Electrical Engineering

Semester – IV

Subject Name: Electrical Power Transmission and Distribution

Subject Code: 09EE2402

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 equipments 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

1. To learn basic concept regarding material used and structure of transmission line.
2. To understand the basic concept of transmission line parameters, their calculations and basics of load dispatch center.
3. To analyse the concepts of High Voltage DC & AC Transmission and understand the basic concepts of Flexible AC Transmission System.
4. To knowledge regarding distribution system and its design.
5. To knowledge about Sub-Station and different types of underground cable.

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 • Compare volume of conductor materials in different systems • 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 • Distribution of potential over a string of suspension insulator • String efficiency and its improving methods • Sag and Tension • Spacing and clearance of line conductors • Vibrations and Dampers	**14**	**25**
2	**Transmission Lines Performance** • Introduction • Important terms • 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 • Performance of long transmission line • Various compensation of lines • 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	**08**	**14**

	limitation • HVDC transmission and its advantages and limitation • Comparison of HVAC and HVDC • 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 • Key diagram of 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 • 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	**12**	**21**

	• Comparison between underground cable and overhead line system • General construction of cable • Classification of cable • Insulation used in cable • Cable laying and its methods • Selection of cable as per standard and its procedure • Rating and rating factor of cable • Requirement and applications of various types of cable		

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	All	**Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their portfolio** A. Prepare a report based on transmission and distribution line network in Gujarat B. Collect the information on components of transmission and distribution line. C. Evaluate transmission line performance parameters of a given line. D. Prepare survey of electrical high voltage line and HVDC lines using internet. E. Visit high voltage substation / pole mounted substation and write a report	6

2	All	**Prepare a model(Micro-Project) showing: In Group** A. Single line diagram of electric power system.(Generating Sub-station, High voltage Sub-station) B. Single line diagram of a given distribution system.(Industrial/Commercial) C. Short line and medium transmission line. D. Sub-station.	6
3	1	Collect different samples of Overhead Conductors, Underground Cables, Line supports and Line Insulators. (In Group)	2
4	All	**Prepare a power point presentation.(In Group)** A. Different types of insulator, conductors and tower used in transmission and distribution system with its parameters. B. Load Dispatch Center (No of LDC available in Gujarat state) C. Distributed power generation D. New trends in wireless transmission of electrical power. E. Bus-bar arrangement F. Underground cables	4
5	All	**Collect information on:** A. Testing of insulators B. A.C Distribution System adjacent to your institute. C. Draw a layout diagram of 11KV/400 V substation in your campus/ adjacent substation. **D.** Cables used in various distribution system	6
6	5	Demonstrate cable joint procedure using cable joint kit	2
7	1	Testing of Insulation materials in High Voltage lab	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 during the 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