GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Electrical Engineering / Renewable Energy

Course / Subject Code: DI03000101

Course / Subject Name :Electrical Power Transmission & Distribution

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	PCC

Prerequisite:	Acquaintance with fundamental concepts of AC & DC, circuit principles and laws to solve electrical circuits.
Rationale:	The "Electrical Power Transmission and Distribution" course is a critical infrastructure that ensures the reliable delivery of electrical energy from power generation sources to consumers This course deals in detail with elements & performance of overhead transmission line and HVDC transmission systems, distribution system components & cables. By studying this course, students gain the expertise needed to design, operate, and maintain efficient electrical networks, ensuring reliable electricity supply for residential, commercial, and industrial use.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Apply mechanical and electrical design aspects of various types of conductors, support and insulator to maintain overhead line.	A
02	Analyze performance of transmission line.	A
03	Illustrate various types of HVDC transmission system.	U
04	Identify basic components of power system distribution.	U

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Elements of overhead transmission lines** **Contents:** (1) Single line diagram with components of the electric supply transmission and distribution system. (2) Classification of transmission lines, standard voltage levels used in India. (3) Comparison between Overhead and Underground system (4) Different types of conductors and its properties i)Solid Conductor ii) Hollow Conductor. iii) Stranded conductor: AAC, AAAC, ACSR, High performance conductor iv) Photonic coating on conductor, covered conductor, dynamic line rating (5) Skin effect, Proximity effect (6) Bundled Conductors. (7) Types of line supports and its desirable properties i)Steel Pole ii) RCC pole iii) Lattice steel tower. (8) Types of Insulators and its materials i)pin type ii) Suspension type iii) Strain insulator iv) Shackle insulator v) Stay insulator. (9) Desirable properties of insulators and Causes of Insulator failure. (10) String efficiency and methods of Improving String efficiency. (11) Basic numerical based on String efficiency. (12) Sag and its calculations. (13) Effect of Atmospheric Conditions on sag. (14) Basic numerical based on sag. (15) Corona effect: Factors affecting corona, Advantages and disadvantages of corona, Methods of reducing corona effect. (16) Right of way (ROW) in transmission lines.	12	30%

2.	**Performance of Transmission Lines** **Contents:** (1) Transmission line parameters (constants) and their representation in short & medium transmission lines. (2) Differentiate the features of short, medium and long transmission lines. (3) Transposition of line conductors & its necessity. (4) Performances of short and medium transmission lines (End condenser method, T and π Method). (5) Effect of load power factor on performance of short and medium transmissions lines. (6) Numerical based on line parameters and performance of short & medium transmission lines. (7) Ferranti effect. (8) Grid system in India and it's hierarchy. (9) Concept of One Sun, One World, One Grid. (10) Importance and functions of Load dispatch center.	12	28 %
3.	**HVAC and HVDC System:** **Contents:** (1) Economic consideration in the choice of system voltage. (2) Economic consideration in the choice of conductor size (Kelvin's law). (3) Advantage and limitations of EHV AC transmission system. (4) Concept of choice of HVDC transmission vs EHVA.C. Transmission for Long high-power transmission lines. (5) Single line diagram of HVDC transmission. (6) Types of HVDC transmission systems. (7) Merits, demerits and applications of HVDC transmission system. (8) Comparison between HVDC and HVAC transmission systems. (9) HVDC system in India. (10) Need of FACTS, Types of FACTS Devices and Advantages of FACTS.	09	20 %

4.	**A.C. Distribution System:** **Contents:** (1) Requirement of an ideal AC distribution. (2) Feeder, Distributor & Service Mains in Distribution system. (3) Classification of Distribution System (4) AC Distribution System: i) Primary Distribution ii) Secondary Distribution. (5) Different Schemes of Distribution connection. 1.Radial System 2. Ring Main System 3. Inter connected System. (6) Design Consideration for Feeder and Distributors. (7) Voltage drop and load calculation for concentrated and distributed load. (8) Numerical based on AC distribution. (9) Necessity of cables & general construction of underground cable. (10) Classification of cables. (11) Cable laying and cable jointing. (12) Recycling cables.	12	22 %
	Total	**45 Hrs.**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
25 %	**35 %**	**40 %**	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	A Course In Power Systems	Gupta J. B.	S.K.Kataria& Sons, New Delhi, 2013, ISBN: 978-9350143735
2	Electric Power Transmission and Distribution	Sivanagaraju S. Satyanarayana S.	Pearson Learning, New Delhi, 2008, ISBN: 978-8131707913,
3	Electrical Power Systems	Uppal S.L	Khanna publication, New Delhi, 2011, ISBN:978-8174092380
4	Electrical Power System	Wadhwa C. L.	New Age International Publishers, New Delhi, 2018 ISBN: 978-9393159175,
5	Principles of power system	Mehta V. K.	S. Chand and Co., New Delhi, 2020, ISBN: 978-8121924962,
6	Handbook of Electrical Power Distribution	Ramamurthy G.	Universities press, Hyderabad 2009, ISBN: 9788173716843
7	Generation and Utilization of Electrical Energy	S. Sivanagaraju	Pearson, New Delhi, 2011 ISBN:978-81-317-33325
8	A Textbook on Power System Engineering	P.V. Gupta, M.L. Soni, • U.S. Bhatnagar, A. Chakrabarti	Dhanpat Rai & Co., New Delhi, Latest edition

(b) Open-source software and website:

1. https://nptel.ac.in (for online courses and video of all engineering branches)
2. https://www.electrical4u.com/transmission-line-in-power-system/
3. https://www.geeksforgeeks.org/transmission-lines/
4. https://eee.poriyaan.in/topic/mechanical-design-of-transmission-lines-12130/
5. https://eee.poriyaan.in/topic/definition-of-sag-12131/
6. https://www.electrical4u.com/high-voltage-direct-current-transmission/
7. https://www.electricaltechnology.org/2021/10/electric-power-distribution-network.html
8. https://www.myelectrical2015.com/2019/05/right-of-way-row-transmission-line.html?m=1 (ROW)

9. https://powermin.gov.in/en/content/power-grid (Grid System)
10. https://www.electronicshub.org/flexible-ac-transmission-systemfacts/
11. https://powermin.gov.in/

Suggested Course Practical List:

Sr. No.	Practical Outcome/Title of experiment	CO1	CO2	CO3	CO4
1	Demonstrate various types of conductors used in overhead transmission lines.	√			
2	Demonstrate different types of line supports employed in transmission system and distribution system.	√			
3	Demonstrate different types of insulators used in overhead transmission and distribution system	√			
4	Calculate sag in overhead transmission line for given data.	√			
5	Determine string efficiency of suspension type insulator for given data.	√			
6	Determine voltage regulation and transmission efficiency of short transmission line.		√		
7	Determine voltage regulation and transmission efficiency of medium transmission line.		√		
8	Prepare technical report on load dispatch center.		√		
9	Prepare report on EHV A. C transmission system in India.			√	
10	Prepare report on HVDC transmission systems in India.			√	

11	To study about FACTS and its devices.			√	
12	Prepare a report after studying distribution system of a residential colony.				√
13	To study performance characteristics of typical AC distribution system in radial & ring main configuration.				√
14	To Solve problem related to voltage drop and sending/ receiving end voltage of distribution line.				√
15	Prepare a report about types of cables used in distribution system by visiting nearby cable suppliers/industries or otherwise with the help of internet.				√
16	Study about recycle cables and electrical/electronic waste.				√

List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications
01	Transmission line trainer kit
02	Demonstration piece of AAC, ACSR conductors, Bundle Conductor etc
03	Demonstration piece of Pin insulator, Disc of suspension insulator, Shackle insulator, Silicon rubber insulator
04	Prototype of Radial, parallel and ring main feeder.
05	Cut-section of different types of cable.
06	Various safety devices used for first aid and electrical hazards.

Suggested Activities for Students:

Beyond classroom and laboratory learning, the following co-curricular activities are recommended to enhance the achievement levels of various outcomes in this course. Students are encouraged to undertake these activities either individually or in groups and prepare comprehensive reports of approximately five pages for each activity. Additionally, students should gather and document physical evidences for their portfolios, which could be beneficial during placement interviews:

A) Visit and prepare a report of cables manufacturing company.

B) Project Model / Seminar Presentations: Demonstrate project models or deliver seminars on various topics covered in the course content.

C) Numerical Problems Solving: Work on numerical problems provided in tutorial problems.

D) Arrange group discussion on various topics on course content.

Assignments /Tutorial problems should be distributed unit-wise, and students should seek progressive assessment from the concerned course facilitators throughout the term. At the end of the term, the entire body of work should be submitted to the respective course facilitators for evaluation.

These activities will not only reinforce the theoretical understanding but also provide practical exposure and critical thinking opportunities essential for professional growth.

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