GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER
(Code: 3340902)

Diploma Programmes in which this course is offered	Semester in which offered
Electrical Engineering	4th semester

1. RATIONALE

The electricity is generated in bulk at remote places near to coal mines (thermal power plants, dams (hydro power) and transmitted to long distances and then distributed in cities and 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 equipments. Technicians 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 technicians 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 equipments independently in normal and abnormal conditions. Essential efforts are made in this course to develop above skills in the students.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- **Operate and maintain various transmission and distribution system.**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

i Differentiate various types of transmission and distribution systems.
ii Interpret the various transmission concepts
iii Maintain voltage regulation and efficiency of transmission system.
iv Minimize the voltage drop of distribution systems.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
4	0	2	6	70	30	20	30	150

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit **ESE** - End Semester Examination; **PA** - Progressive Assessment.

5.COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT – I Transmission Line Components	1a. State the features of different transmission systems. 1b. State the need for different types of insulators. 1c. State the features of different types of conductors 1d. Explain the criteria for spacing of conductors 1e. Solve simple numerical problems	1.1 Classification of transmission lines. 1.2 Comparison of different types of transmission systems. 1.3 Types of conductors-Copper, Aluminum: Solid, stranded and bundled conductors. 1.4 Line insulators – requirements, types, Failure of insulator. 1.5 String efficiency, methods of improving string efficiency. 1.6 Spacing between conductors, span length and sag calculation.
UNIT– II Performance Of Transmission Lines	2a. Discriminate between skin effect, proximity effect, Ferranti effect and corona 2b. Differentiate between efficiency and regulation of a transmission line 2c. State the effect of low power factor on the performance 2d. Explain the effects of R, L and C on 1-ph and 3-ph transmission line. 2e. Differentiate the features of the short, medium and long transmission lines 2f. Describe the importance and functions of the load dispatch centre. 2g. Solve simple numerical problems	2.1 Skin effect, proximity effect and Ferranti effect. Corona 2.2 Transposition of conductors 2.3 Losses, efficiency and regulation of line. 2.4 Performance of single phase short transmission 2.5 Effect of load power factor on performance. 2.6 Features of short, medium and long transmission lines. 2.7 Load dispatch Centre

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT-III EHV Transmission	3a. State the need for EHV transmission 3b. State the features of HVAC transmission 3c. State the features of HVDC transmission 3d. Describe the impact of wind power and solar power on the transmission system 3e. Describe the impact of other renewable energy on the transmission system 3f. State the need for FACTS devices 3g. State the salient features of FACTS devices	3.1 Requirement of EHV transmission. 3.2 HVAC Transmission 3.3 HVDC Transmission 3.4 Impact of Wind power and solar power on Transmission Systems 3.5 Impact of other renewable energy sources on Transmission Systems 3.6 FACTS devices
UNIT–IV Distribution System Components	4a. State the need for distribution system 4b. With sketches describe the various connection schemes of the distribution system 4c. Describe the Impact of wind power on the distribution system 4d. Describe the measures to be adapted to take of the distributed generation in the distribution system 4e. Solve simple numerical problems	4.1 AC distribution and its Requirements 4.2 Connection schemes of distribution system. 4.3 A.C. distribution calculations. 4.4 Issues of Distributed Generation Integrated to distribution Grid. 4.5 Methods of solving A.C.-1 phase and 3 Ø –phase connected (balanced) distribution system.
UNIT-V Sub-Station And Cables	5a. State the need for electrical substations 5b. Sketch the elevation layout of a typical 11/33/66/110 kV electrical substation with various switchgear and typical spacing between them and the ground level as well. 5c. State the selection of the bus bar and their arrangement. 5d. With sketches describe the various types of earthing adapted for substations. 5e. State the procedures to undertake the earth test and megger test	5.1 Types of substations: 11, 33, 66 and 110 kV 5.2 Selection and location of site 5.3 Main connection schemes 5.4 Substation Equipment 5.5 Busbar arrangement
	5f. State the features of unarmored and armored cables 5g. State the features of different types of cables used in a substation 5h. Select the cables for relevant applications using data sheets/catalogues 5i. Solve simple numerical problems on selecting cables	5.6 Different types of cables: unarmored and armored 5.7 Selection of cables as per IS /data sheet / catalogues

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Transmission Line Components.	12	4	5	6	15
II	Performance of Transmission Lines	12	4	5	6	15
III	EHV Transmission	08	4	3	3	10
IV	Distribution System Components	12	4	4	7	15
V	Sub-Station and Cables	12	4	4	7	15
Total		**56**	**20**	**21**	**29**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes (**as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Tutorial Exercises (outcomes in psychomotor domain)	Approx Hours. required
1	I	Demonstrate cable jointing procedures of unarmored cables	02
2	I	Demonstrate cable jointing procedures of armored cables	02
3	I	Prepare a report on different type of insulators and bushings used in transmission system with their specifications.	04
4	I	Prepare a report about types of cables used in distribution system by visiting nearby cable suppliers/industries or otherwise with the help of internet	04
5	II	Prepare Technical Report after visit to the Load Dispatch Centre.	02
6	I and III	Prepare a report on different type of Transmission Towers used in the industry	04
7		Prepare a report on different types of connectors used in the transmission lines.	04
8	IV	Prepare a report after studying distribution system of a residential colony.	02
9	V	Interpret and explain the given Blue Print of a Sub-Station,	02
10	V	Prepare a report on substation with its layout after visiting a nearby substation	02
11	V	Use crimping tools to fit lugs at cable ends of unarmored cables	02
12	V	Use crimping tools to fit lugs at cable ends of armored cables	02

S. No.	Unit No.	Practical/Tutorial Exercises (outcomes in psychomotor domain)	Approx Hours. required
13	V	Use earth testers	02
14	V	Undertake pipe earthing	02
Total Hours (Perform any practical worth 28 hours from above depending upon the availability of resources so that most units are covered)			**36**

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

i Visit 66 kV distribution sub-station and draw line diagram with equipment specifications

ii Visit 132/220/400kV transmission sub-station and draw line diagram with equipment specifications.

9. SPECIAL INSTRUCTIONAL STRATEGIES (IF ANY)

i Show actual insulators/sample of cables/connectors in the classroom

ii Show charts/slides/photos/video films depicting different types of transmission lines, substations and their components.

iii Give some field-based projects

iv Give some internet based projects.

10. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Book	Author	Publication
1	Electric Power Transmission and Distribution	Sivanagaraju S. Satyanarayana S.	Pearson Learning, New Delhi, Latest edition
2	A Course in electrical Power	Soni-Gupta-Bhatnagar	Dhanpat Rai, New Delhi, Latest edition
3	Principles of power system	Mehta V. K.	S. Chand and Co., New Delhi,
4	Transmission and Distribution of electrical energy	Gupta J. B.	S. K. Khanna, New Delhi, Latest edition
5	Electrical Power System	Wadhwa C. L.	New Age, New Delhi, Latest edition

B) List of Major Equipment/ Instrument with Broad Specifications

i 3-phase transmission line trainer

ii 1-phase transmission line trainer

iii 11 KV pin insulator

iv 11kV string insulator

v 33 KV string insulator

vi Different types of 2 metre length 1-phase and 3-phase aluminum and copper armored cables

vii Different types of 2 metre length 3-phase and 3-phase aluminum and copper armored cables

viii Cable crimping tool

ix Cable end dongles.

x Earth Tester.

xi Megger.

C) List of Software/Learning Websites

i Open source computer simulation software for transmission system
ii http://www.ketraco.co.ke/learn/
iii http://www.gatewaywestproject.com/faq_general_transmission.aspx
iv http://www.gatewaywestproject.com/construction.aspx

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. A. A. Amin**, Lecturer in Electrical Engineering, G.P. Vadnagar.
- **Prof. S. V. Jagani**, Lecturer in Electrical Engineering, G.P. Dahod
- **Prof. V. S. Tejwani**, Lecturer in Electrical Engineering, G.P. Rajkot
- **Prof. N. N. Pandya**, Lecturer in Electrical Engineering, G.P. Ahmedabad

Coordinator and Faculty Members from NITTTR, Bhopal

- **Prof. (Mrs.) C S Rajeshwari**, Head of Department of Electrical and Electronics Engineering.
- **Prof. Joshua Earnest,** Professor, Department of Electrical and Electronics Engineering.