

Course Name : Electrical Engineering Group**Course Code : EE / EP****Semester : Fourth****Subject Title : Transmission & Distribution of Electrical Power****Subject Code : 17417****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	--	03	100	--	--	--	100

NOTE:

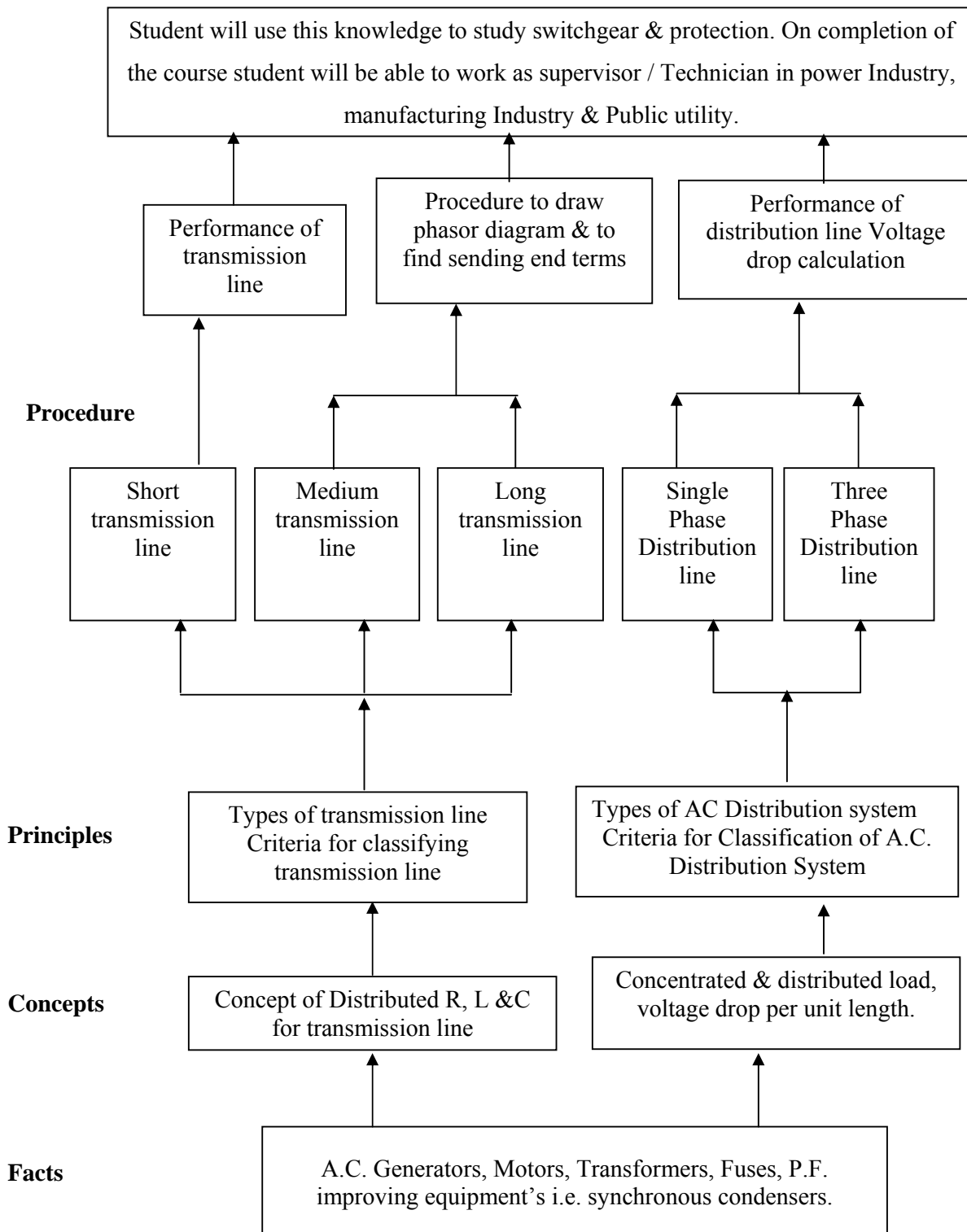
- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).

Rationale:

Electrical Diploma Engineers should know Transmission Voltages, Distribution Voltage. They should be able to identify various components & there functions. They will be able to measure system performance. They will use this knowledge in studying Switchgear & Protection on completing the study of Generation, Transmission, Distribution, Switchgear, Protection & utilization of electrical energy, Students will be work as electrical engineer in power industry.

General Objectives: Student will be able to: -

1. Know various types of Transmission & distribution system.
2. Identify various components & know their functions.
3. Know types of conductors used in transmission and distribution circuits
4. Know the effect of changes in parameters on performance of the lines
5. Draw substation layout as per the requirements.

Learning Structure:**Applications**

Theory:

Topic and Contents	Hours	Marks
Topic 1: Basic Transmission Specific Objectives: <ul style="list-style-type: none"> ➤ Draw single line diagram of a given transmission network ➤ Classify the lines based on their length, voltage rating Contents: <ul style="list-style-type: none"> • Single Line Diagram of Transmission & Distribution of Electric supply system. • Meaning of Primary & Secondary Transmission and its Standard Voltage level used in India. • Classification of Transmission Lines according to voltage level, Length of Transmission line, Type of Supply Voltage & Method of Construction. • Advantage of High Voltage for power transmission 	04	08
Topics 2: Transmission Line Components Specific Objectives: <ul style="list-style-type: none"> ➤ Identify the main Components of Transmission & Distribution Line. ➤ Select size and type of conductor for transmission line based on its rating ➤ Calculate string efficiency Contents: Overhead Conductors: ----- 04 marks <ul style="list-style-type: none"> • Properties of Conducting Material. • Comparison of Copper & Aluminum as a Conducting Material. • Different types of Conductor such as Copper, All Aluminium Conductor (AAC), Alluminium Conductor Steel Reinforced (ACSR), All Aluminium Alloy Conductor (AAAC), Bundled Conductor, Steel Conductor and their applications. • Trade Names of various types of conductors. • Stranded Conductor: Advantages & Disadvantages. Underground Cables: ----- 04 Marks <ul style="list-style-type: none"> • Introduction & requirements. • Classification of cables. • Cable conductors. • Cable construction. • Cable insulation, Metallic sheathing & mechanical protection. • Comparison with overhead lines • Cable laying and Cable Joining Line supports: ----- 06 marks <ul style="list-style-type: none"> • Requirements of Supporting Structures • Types of Supporting Structure: • Poles: RCC Pole, RSJ (Rail Pole), Steel Tubular Pole their specification, method of erection and their comparison based of Cost, Life, Tensile strength, Insulating properties, maintenance, Weight, transportation and handling. • Steel Tower: Specifications, Material used, single circuit, double 	14	24

<p>circuit, Voltage levels.</p> <ul style="list-style-type: none"> Advantages, Disadvantages & Application of Steel Tower. <p>Line Insulators : ----- 10 marks</p> <ul style="list-style-type: none"> Electrical, Mechanical, Chemical, Thermal & General Properties of Insulating Material. Selection of material for line insulators, standard dielectric strengths of insulating materials used. Types of Insulators used in Transmission and Distribution: Pin type, Suspension type, Strain type, Shackle type, Stay Insulator and their Applications. Causes of Insulator failure. String Insulator: Constructional features and applications. Self Capacitance, Shunt Capacitance & Factor 'K' or 'M', Effect of factor 'K': Definition and effect on voltage distribution in the units of the string. Distribution of Potential over a string of Three Suspension Insulator. Define String Efficiency and develop its Mathematical Expression (Simple Numericals) Methods of Improving String efficiency. 		
<p>Topics 3: Transmission Line Parameters</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Use appropriate method for reducing skin effect ➤ Prepare schedule for transposition of line <p>Contents:</p> <ul style="list-style-type: none"> Concept of R, L & C of Transmission Line, State their Effect on performance of Transmission line (No Derivation & Numericals) Skin Effect: Meaning of the term, its dependence on conductor size and configuration and material, Methods used to reduce the skin effect. Proximity Effect: Meaning of the term, its effect on performance of line, methods of reducing the effect. Ferranti Effect Phenomenon of Corona, Disruptive Critical Voltage and Visual Critical Voltage, Conditions affecting Corona, Power loss due to Corona, Methods of reducing Corona, Advantages & Disadvantages of Corona. Concept of Transposition of Conductors and its necessity. 	08	12
<p>Topics 4: Performance of Transmission Line</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Determine performance of the line based on efficiency and regulation ➤ Representation of line based on A, B, C ,D constants <p>Contents:</p> <ul style="list-style-type: none"> Classification of Transmission line according to distance such as Short, Medium & long Transmission Line. Definition of efficiency & Regulation of Transmission line. Effect of Power Factor on Transmission efficiency and Regulation, Draw Vector diagram for Lag, Lead & Unity Power factor. Derivation of Regulation Short Transmission line. Numericals on 1-phase & 3-phase Short Transmission line: 	10	20

<p>Calculate Efficiency & Percentage Regulation.</p> <ul style="list-style-type: none"> • Analysis of Short transmission line: Equivalent Circuit & Vector Diagram (No Mathematical Treatment) • Analysis of Medium transmission line: Equivalent Circuit with Nominal 'T', Nominal 'π', and End Condenser Method, its Phasor diagram (No Mathematical Treatment) • Concept and Basic Equations of generalized circuit constants 'A', 'B', 'C', 'D' (No Derivation and Numericals) 		
<p>Topics 5: Extra High Voltage Transmission</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Understand the concept of HV Transmission ➤ Know the use of HV Lines for Transmission and National Grid ➤ Compare EHV A.C and HV D.C lines for performance <p>Contents:</p> <ul style="list-style-type: none"> • Definition of EHV line, Its necessity and Importance. • Advantages, Limitations and Applications of Extra High Voltage AC (EHVAC) Transmission Line. • Advantages, Limitation & Application of High Voltage DC (HVDC) Transmission Line. • Layout of HVDC Transmission Line: Monopolar, Bi-Polar & Homopolar • HVDC Transmission Line Routes in India, • Comparison of EHVAC & HVDC Transmission line. 	06	08
<p>Topics 6: A.C Distribution System</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Decide type of distributor to be used based on requirements ➤ Determine performance of Distributor with given parameters <p>Contents:</p> <ul style="list-style-type: none"> • Components of Distribution System. • Classification of distribution System • Requirements of an ideal Distribution System. • Meaning of Primary & Secondary Distribution System with their voltage level and Number of conductors. • Comparison between Feeder & Distributor. • Factors to be considered while designing Feeder & Distributor. • Types of different distribution Scheme such as Radial, Ring, and Grid. Layout, Advantages, Disadvantages & Applications. • Numericals on 1-phase A.C Distribution System to Calculate Voltage drop & Voltage at sending end / Receiving end with Power factor referred to Voltage at receiving end. 	12	16
<p>Topics 7: Primary and Secondary Distribution Sub-Station</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Identify components of sub stations with their ratings ➤ Identify components from single line diagram <p>Contents:</p> <ul style="list-style-type: none"> • Definition and Classification of Sub-Station according to Nature of duty, Application (Service), Construction • Site Selection for Sub-Station. • Advantages, Disadvantages & Applications of Indoor & Outdoor Sub-Station. 	10	12

<ul style="list-style-type: none"> • Single Line diagram (layout of) 33/11KV Sub-Station. • Single Line diagram (layout of) 11KV/400V Distribution Transformer. • Symbols & Functions of components of 33/11KV Sub-Station: Incoming Feeder, Busbar, Power Transformer, Lightning Arrester, Earth Switch Insulator (No Load Switch), Circuit Breaker, Horn Gap Fuse, Instrumental Transformer (CT & PT), Control Panel, Control Room and Outgoing Line, • Symbols & Functions of 11KV/400V Distribution Transformer Sub-Station: Functions of Incoming line, AB Switch, Drop down Fuse, Distribution Transformer, Cross Bracing, Anti climbing device, Danger board, Sub Station Earthing and Distribution box. 		
Total	64	100

NOTES:

1. Visit to 33 / 11 KV Substation.
 2. Visit to 11KV/400V Distribution Substation in Campus.
 3. Observe Samples of ACSR Conductors and Insulators.
- These visits may be arranged under Professional Practice.

Learning Resources:**1. Books:**

Sr. No.	Author	Title	Publisher
1.	V.K.Mehta	Principles of Power System	S.Chand
2.	V. Kamraju	Electrical Power Distribution System	Mc.GrawHill
3.	S.Sivanagaraju S.Satyanarayana	Electrical Power Transmission and Distribution	Pearson
4.	Soni,Gupta, Bhatnagar	A Course in Electrical Power	Dhanpat Rai
5.	S.L.Uppal	A Course in Electrical Power	S.K.Khanna
6.	J.B.Gupta	Transmission and Distribution of Electrical Energy	S.K.Khanna

2. IS, BIS and International Codes:

1. IS 2713 (Part I, II, III) – 1980 for Specifications of Tubular Steel poles for Over Head Power Lines.
2. Standard Clearances as per BS: 162-1961 and BS: 159-1957
3. IS 398-1961 – Technical data of AAC and ACSR Conductors.
4. IS 398 (Part -4)-1994 - Technical data of AAAC

3. Websites:

1. Sonaversity _ org
2. www.animations.physics.unsw.edu.au
3. phy-clips