July - 2017 Transmission and Distribution Semester - IV (EEE)	VTU Solved Paper CBCS Scheme

Time : 3 Hours] **[Maximum Marks : 80**

Note : ***Answer any FIVE full questions, choosing one full question from each module.***

MODULE - I

Q.1 a) *With a neat diagram, explain feeders, distributor and service main of a distribution system.* **(Refer section 1.2.1)** **[6]**

b) *A transmission line conductor at a river crossing is supported from two towers at height of 50 and 80 meter above water level. The horizontal distance between the tower is 300 meters. If the tension in the conductor is 2000 kg. Find the clearance between the conductor and water at a point midway between the towers. Weight of conductor per meter = 0.844 kg. Assume that the conductor take the shape of parabolic curve.* **(Refer example 2.5.5)** **[10]**

OR

Q.2 a) *Disucss the advantage of high voltage transmission.* **(Refer section 1.3)** **[6]**

b) *Each line of a 3 - phase system is suspended by a string of 3 similar insulation. If the voltage across the line unit is 17.5 kV. Calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is* $\frac{1}{8}$ *th of the capacitance of the insulator itself. Also find the string efficiency.*
(Refer example 3.6.1) **[10]**

MODULE - 2

Q.3 a) *Derive an expression for the inductance of a single phase two wire line.*
(Refer section 4.7) **[6]**

b) *Explain the concept of self GMD and mutual GMD.* **(Refer section 4.9)** **[4]**

c) *A 3 - phase, 50 Hz, 132 kV overhead line has conductor placed in a horizontal plane 4 meter apart. Conductor diameter is 2 cm. If the line length is 100 km. Calculate the charging current per phase. Assume complete transposition.*
(Refer example 4.24.4) **[6]**

OR

Q.4 a) *Derive a expression for the capacitance of a 3 - phase overhead line for symmetrical spacing and unsymmetrical spacing.* **(Refer sections 4.24 and 4.25)** **[10]**

b) *Two conductors of a single phase line each of 1 cm diameter are arranged in a vertical plane with one conductor mounted 1 m above the other. A second identical line is mounted at the same height as the first and spaced horizontally 0.25 m apart from it. The two upper and the two lower conductors are connected in parallel. Determine the inductance per km of the resulting double circuit line.*
(Refer example 4.14.6) **[6]**

MODULE - 3

Q.5 a) *Two transmission lines having generalized circuit constants A_1, B_1, C_1, D_1 and A_2, B_2, C_2, D_2 are connected in series. Develop expressions for the overall constants ABCD of the combination in terms of A_1, B_1, C_1, D_1 and A_2, B_2, C_2, D_2.*
(Refer example 5.13.1) **[6]**

b) *Derive an expression for sending end voltage and current for long transmission line using rigorous solution.* **(Refer section 5.11)** **[10]**

OR

Q.6 a) *Explain with vector diagram the nominal π method for obtaining the performance of medium transmission line.* **(Refer section 5.8.3)** **[8]**

b) *An overhead 3 - phase transmission line deliver 5000 kW at 22 kV at 0.8 pf lagging. The resistance and reactance of each conductor is 4Ω and 6Ω respectively. Determine sending end voltage and transmission efficiency.*
(Refer example 5.7.2) **[8]**

MODULE - 4

Q.7 a) *Discuss different factors affecting corona and corona loss.* **(Refer section 6.3)** **[6]**

b) *A single core lead sheathed cable has a conductor diameter of 3 cm. The diameter of the cable being 9 cm. The cable is graded by using two dielectrics of relative permittivity 5 and 4 respectively with corresponding safe working stresses of 30 kV/cm and 20 kV/cm. Calculate the radial thickness of each insulation and the safe working voltage of the cable.* **(Refer example 7.8.3)** **[6]**

c) *A single core cable has a conductor diameter of 1 cm and insulation thickness of 0.4 cm. If the specific resistance of insulation is 5×10^{14} Ω cm. Calculate the insulation resistance for a 2 km length of the cable.* **(Refer example 7.6.3)** **[4]**

OR

Q.8 a) *Derive the expression for the capacitance of a single core cable.* **(Refer section 7.7)** **[6]**

b) *A 33 kV, 50 Hz, 3 - phase underground cable 4 km long uses three single core cables. Each of the conductor has a diameter of 2.5 cm and the radial thickness of insulation is 0.5 cm. Determine : i) capacitance of the cable / phase, ii) Charging current / phase, iii) Total charging kVAR. The relative permittivity of insulation is 3.* **(Refer example 7.7.2)** **[6]**

c) *Explain the following terms with reference to corona :*

i) Critical disruptive voltage **(Refer section 6.2.1)**

ii) Critical visual disruptive voltage. **(Refer section 6.2.2)** **[4]**

MODULE - 5

Q.9 a) *Explain radial feeders for AC distribution system. Mention the characteristics of radial feeders.* **(Refer section 8.3)** **[6]**

b) *A 3 - phase 4 wire system supplies power at 400 V and lighting at 230 V. If the lamps in use require 70, 84 and 33 ampere in each of the three lines. What shuld be the current in the neutral wire ? If a 3 - phase motor is now taking 200 A from the lines at a pf of 0.2 lagging. What should be the total current in each line and the neutral wire ? Find also the total power supplied to the lamps and the motor.* **(Refer example 8.15.8)** **[10]**

OR

Q.10 a) *Explain 3 - phase 4 wire star connected unbalanced loads for AC distribution system.* **(Refer section 8.6.2)** **[6]**

b) *A single phase AC distributor AB 300 meter long is fed from end A and is loaded as under,*

i) 100 A at 0.707 pf lagging 200 m from point A.

ii) 200 A at 0.8 pf lagging 300 m from point A.

The load resistance and reactance of the distributor is 0.2 Ω and 0.1 Ω per kilometer. Calculate the total voltage drop in the distributor. The power factors refer to the voltage at the far end. **(Refer example 8.15.1)** **[10]**

January - 2018
Transmission and Distribution
Semester - IV (EEE)
(15EE43)

VTU Solved Paper CBCS Scheme

Time : 3 Hours] [Maximum Marks : 80

Answer any FIVE full questions, choosing ONE full question from each module.

MODULE - 1

Q.1 a) *With usual notations derive an expression for the sag of a transmission line when the supports are at equal levels.* **(Refer section 2.5)** [6]

b) *Draw the line diagram of a typical transmission and distribution system indicating the standard voltage.* **(Refer section 1.2)** [5]

c) *Explain the various supporting structures used for the overhead transmission lines.* **(Refer sectrion 2.1)** [5]

OR

Q.2 a) *Derive an expression for string efficiency of a 3 disc string.* **(Refer section 3.6)** [6]

b) *What are the advantages of high voltage AC transmission line ?* **(Refer section 1.3)** [4]

c) *The towers of height 30 m and 90 m respectively support a transmission line conductor at water crossing. The horizontal distance between the towers is 500 m. If the tension in the conductor is 1600 kg, find the minimum clearance of the conductor and water and also clearance midway between the supports. Weight of conductor is 1.5 kg/m. Base of the towers can be considered to be at water level.* **(Refer example 2.5.8)** [6]

MODULE - 2

Q.3 a) *Derive an expression for the inductance of a single phase two wire line.* **(Refer section 4.7)** [6]

b) *The three conductors of a 3-phase line are arranged at the three corners of a triangle of sides 2 m, 2.5 m and 4.5 m. Calculate the inductance per km of the line when conductors are regularly transposed. The diameter of each line conductor is 1.24 cm.* **(Refer example 4.14.4)** [5]

c) *Explain the process of transportation of transmission lines and its advantages.* **(Refer section 4.14)** [5]

OR

Q.4 a) *Obtain an expression for potential difference between two conductors a and b in a system of m conductors.* **(Refer section 4.21)** **[6]**

b) *Calculate capacitance of 100 km long 3-ϕ, 50 Hz, overhead transmission line consisting of 3 conductors each of diameter 2 cm and spaced 2.5 cm at the corners of an equilateral triangle.* **(Refer example 4.24.1)** **[5]**

c) *Describe composite conductors.* **(Refer section 4.9)** **[5]**

MODULE - 3

Q.5 a) *Discuss the nominal T. Model of a medium transmission line with appropriate circuit diagram and phasor diagram and hence obtain the expression for regulation and ABCD constant for the same.* **(Refer section 5.9)** **[10]**

b) *A 110 kV, 50 Hz, 3-phase transmission line delivers a load of 40 MW at 0.85 lagging pf at the receiving end. The generalized constants of the transmission line are* $A = D = 0.95 \angle 1.4°$, $B = 96 \angle 78°$ *ohm,* $C = 0.0015 \angle 90°$ *mho. Find the regulation of the line and charging current use nominal T method.*
(Refer example 5.9.1) **[6]**

OR

Q.6 a) *A 3-phase short transmission line delivers 3 MW at a pf of 0.8 lagging to a load. If the sending ends voltage is 33k V. Determine : i) Receiving end voltage ii) Line current iii) Transmission efficiency iv) Regulation. The resistance and reactance of each conductor are* 5 Ω *and* 8 Ω *respectively.* **(Refer example 5.5.2)** **[10]**

b) *Explain Ferranti effect.* **(Refer section 5.14)** **[6]**

MODULE - 4

Q.7 a) *What is meant by grading of cable ? Explain capacitance grading.*
(Refer section 7.8.2) **[8]**

b) *A single core lead covered cable has a conductor diameter of 3 cm with insulation diameter of 8.5 cm. The cable is insulated with two dielectrics with permittivities 5 and 3 respectively. The maximum stresses in the two dielectrics are 38 kV/cm and 26 kV/cm respectively then calculate radial thickness of insulating layers and the working voltage of the cable.* **(Refer example 7.8.3)** **[8]**

OR

Q.8 a) *Explain the phenomenon of corona in overhead transmission line.*
(Refer section 6.1) **[5]**

b) *Find the most economical diameter of a single core cable to be used on 66 kV, 3-phase system, if the peak permissible stress is not to exceed 50 kV/cm. Also, find the overall diameter.* **(Refer example 7.7.4)** **[5]**

c) *Draw the cross sectional view of a single core cable and explain its construction.* **(Refer section 7.3)** **[6]**

MODULE - 5

Q.9 a) *Explain with neat sketch different failure modes of bath tub curves.* **(Refer section 9.12)** **[5]**

b) *Briefly explain radial and ring main distributors.* **(Refer sections 8.3 and 8.4)** **[5]**

c) *Four lines A,B,C and D are connected to a common point O. Resistance of AO, BO, CO and DO are respectively 1,2,3 and 4 Ω both g and return and feeding points A,B,C and D are maintained at 230,250,240 and 230 V respectively. Find the potential of common point O assuming no load is tapped from there.* **(Refer example 8.10.5)** **[6]**

OR

Q.10 a) *What is power quality ? What are different power quality problems ?* **(Refer section 9.12)** **[5]**

b) *Explain the term MTTF and MTBF.* **(Refer section 9.12)** **[3]**

c) *An electric train taking a constant current of 500 A moves between the two substations 6 kms apart. The two substations are maintained at 580 V and 600 V respectively. The track resistance is 0.05 Ω per km both 90 and return. Calculate :*
i) The point of minimum potential
ii) The currents supplied by each substation at the point of minimum potential.
(Refer example 8.10.7) **[8]**

January - 2019
Transmission and Distribution
Semester - IV (EEE)
(15EE43)

VTU
Solved Paper
CBCS Scheme

Time : 3 Hours] **[Maximum Marks : 80**

Answer any FIVE full questions, choosing one full question from each module.

MODULE - 1

Q.1 a) *Explain with the help of a neat diagram and typical transmission and distribution system scheme indicating the standard voltages.* **(Refer section 1.2)** **[5]**

b) *With neat diagram, explain feeders. Distribution and service mains.* **(Refer section 1.2)** **[3]**

c) *The towers of height 30 m and 90 m respectively support transmission line conductors at water crossing. The horizontal distance between the tower is 500 m. If the tension in the conductor is 1600 kg, find the minimum clearance of the conductor and water and clearance midway between the support weight of conductor is 1.5 kg/m. Bases of the towers can be considered to be at water level.* **(Refer example 2.5.8)** **[8]**

OR

Q.2 a) *Explain the advantages of i) ACSR ii) AAAC iii) ZTAI iv) GTACSR v) GZTACSR* **(Refer section 2.2)** **[5]**

b) *With neat diagram derive a expression for the sag when the supports are at equal heights.* **(Refer section 2.5)** **[5]**

c) *Explain the classification of insulator ? Define string efficiency ? Methods of improving string efficiency.* **(Refer sections 3.4 and 3.7)** **[6]**

MODULE - 2

Q.3 a) *With neat diagram. Develop an expression for inductance of a 3 phase over head line with unsymmetrical spacing.* **(Refer section 4.14)** **[6]**

b) *Explain the concept of i) Self GMD ii) Mutual GMD.* **(Refer section 4.9)** **[4]**

c) *Calculate the inductance of each conductor in a 3 phase 3 wire system when the conductors are arranged in a horizontal plane with spacing such that* $D_{31} = 4m$ $D_{12} = D_{23} = 2$ *m the conductors are transposed and have a diameter of 2.5 cm.* **(Refer example 4.14.3)** **[6]**

OR

Q.4 a) *With neat diagram develop an expression for capacitance of a 3 phase over head line with symmetrical and unsymmetrical spacing.* **(Refer section 4.25)** **[10]**

b) *A 3-phase 50 Hz, 66 kV overhead line conductors are placed in horizontal plane as shown in Fig. 1. The conductor diameter is 1.25 cm, if the line length is 100 km. Calculate : i) Capacitance per phase ii) Charging current per phase. Assuming complete transposition of the line.* **(Refer example 4.24.2)** **[6]**

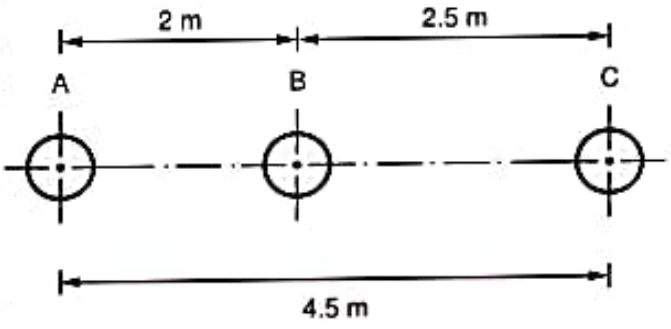

Fig. 1

MODULE - 3

Q.5 a) *Show how regulation and transmission efficiency are determined for medium transmission line using nominal T method. Illustrate your answer with suitable vector diagram.* **(Refer section 5.8)** **[5]**

b) *A 3 phase, 50 Hz, 150 km line has a resistance inductive reactance and capacitive shunt admittance of 0.1 Ω 0.5 Ω and 3×10^{-6} S per km per phase. If the line delivers 50 mW at 110 kV and 0.8 pf lagging. Determine the sending end voltage and current. Assume a nominal π circuit of the line.* **(Refer example 5.8.2)** **[8]**

c) *Differentiate the types of over head transmission lines.* **(Refer section 5.2)** **[3]**

OR

Q.6 a) *Develop the generalized circuit constants for i) short transmission line ii) medium line- nominal T method.* **(Refer section 5.9)** **[8]**

b) *Find the following for a single circuit transmission line delivering a load of 50 MVA at 110 kV and p.f. 0.8 lagging:*
i) Sending end voltage ii) Sending end current iii) Sending end power
iv) Efficiency of transmission
Given $A = D = 0.98\angle3°$ $B = 110\angle75°\ \Omega$ $C = 0.0005\angle80°$ *Siemen.*
(Refer example 5.9.3) **[8]**

MODULE - 4

Q.7 a) *What is Corona ? What are the factors which affect Corona ?*
(Refer sections 6.1 and 6.2) **[4]**

b) *Explain the following terms with reference to corona.*
i) Critical disruptive voltage ii) Visual critical voltage **(Refer section 6.2)** **[6]**

c) *Describe the various methods of reducing corona effect in an overhead transmission line.* **(Refer section 6.3)** **[6]**

OR

Q.8 a) *With neat diagram show the various parts of high voltage single core cable.*
(Refer section 7.3) **[4]**

b) *Define grading of cables. Analyze capacitance grading.* **(Refer section 7.8.2)** **[8]**

c) *Write the comparison between ac and dc cables.* **(Refer section 7.13)** **[4]**

MODULE - 5

Q.9 a) *With neat diagram explain the concept of AC distributor with concentrated loads.*
(Refer section 8.14) **[8]**

b) *A single phase ac distributor AB 300 meters long is fed from End A and is loaded as under*

i) 100 A 0.707 pf lagging 200 m from point A
ii) 200 A at 0.8 pf lagging 300 m from point A
The load resistance and reactance of the distributor is 0.2 Ω and 0.1 Ω per kilometer. Calculate the total voltage drop in the distributor. The load power factor refer to the voltage at the far end. **(Refer example 8.15.1)** **[8]**

OR

Q.10 a) *Define reliability, power quality.* **(Refer section 9.12)** **[6]**

b) *Limitations of distribution systems.* **(Refer section 9.12)** **[7]**

c) *Explain the effect of disconnection of natural in a 3 phase four wire system.* **(Refer section 8.16)** **[3]**

July - 2019 **Transmission and Distribution** **Semester - IV (EEE)** **(17EE43)**	**VTU** **Solved Paper** **CBCS Scheme**

Time : 3 Hours] **[Maximum Marks : 100**

Answer any FIVE full questions, choosing one full question from each module.

MODULE - 1

Q.1 a) *List the advantages to transmit power at high voltage with explanation.* **(Refer section 1.3)** **[7]**

b) *The towers of height 30 m and 90 m respectively support a transmission line conductor at water crossing. The horizontal distance between the towers is 500 m. If the tension in the conductor is 1600 kg, find the minimum clearance of conductor and water and clearance mid-way between the supports. Weight of conductor is 1.5 kg/m. Bases of the towers can be considered to be at water level.* **(Refer example 2.5.8)** **[7]**

c) *List the methods of improving string efficiency and explain any one method with a neat sketch.* **(Refer section 3.7)** **[6]**

OR

Q.2 a) *With a neat diagram, explain feeders, distributor and service main of a distribution system.* **(Refer section 1.2)** **[6]**

b) *A transmission line conductor having a diameter of 19.5 mm weighs 0.85 kg/m. The span is 275 meters. The wind pressure is 39 kg/m^2 of projected area with ice coating of 13 mm. The ultimate strength of the conductor is 8000 kg. Calculate the maximum sag if the factor of safety is 2 and ice weighs 910 kg/m^3.* **(Refer example 2.6.2)** **[7]**

c) *A string has 3 units and each unit has a capacitance C. The pin to earth capactitance is C/9. Determine the values of voltage across each unit of the string efficiency.* **(Refer example 3.6.8)** **[7]**

MODULE-2

Q.3 a) *Derive an expression for the inductance of a conductor due to internal flux.* **(Refer section 4.6)** **[8]**

b) *The three conductors of a 3-phase transmission line are arranged in a horizontal plane and are 3 meters apart. The diameter of each conductor is 4 cm. Determine the inductance per km of each phase. Assume balanced load and R, Y, B phase sequence.* **(Refer example 4.13.1)** **[7]**

c) *The three conductors of a 3-phase line are arranged at the corners of a triangle of sides 2 m, 2.5 m and 4.5 m. Calculate the inductance per km of the line when the conductors are regularly transposed. The diameter of each conductor is 1.24 cm.* **(Refer section 4.14.4)** **[5]**

OR

Q.4 a) *Derive an expression for the line to neutral capacitance for a 3-phase overhead transmission line when the conductors are unsymmetrically spaced.* **(Refer section 4.25)** **[10]**

b) *A single-phase transmission line has two parallel conductors 3 meters apart, radius of each conductor being 1 cm. Calculate the capacitance of the line per km. Given that* $\epsilon_0 = 8.854 \times 10^{-12}$ *F/m.* **(Refer example 4.22.2)** **[4]**

c) *A 3-ϕ, 50 Hz, 66 kV overhead line conductors are placed in a horizontal plane as shown in Fig. 1. The conductor diameter is 1.25 cm. If the line length is 100 km, Calculate : i) Capacitance per phase ii) Charging current per phase, assuming complete transposition of the line, Given* $\epsilon_0 = 8.854 \times 10^{-12}$.

(Refer example 4.24.2) **[6]**

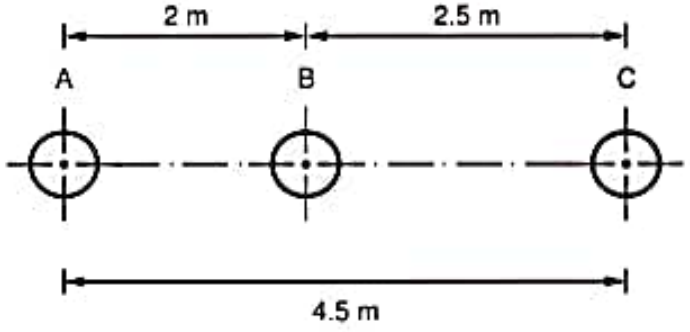

Fig. 1

MODULE-3

Q.5 a) *Explain the nominal π method for obtaining the performance calculations of medium transmission line. Draw the corresponding vector diagram.* **(Refer section 5.8)** **[10]**

b) *A 3-ϕ line delivers 3600 kW at a pf 0.8 lagging to a load. If the sending end voltage is 33 kV, determine : i) The receiving end voltage ii) Line current iii) Transmission efficiency. The resistance and reactance of each conductor are 5.31 Ω and 5.54 Ω respectively.* **(Refer similar example 5.5.2)** **[7]**

c) *Define voltage regulation.* **(Refer section 5.4)** **[3]**

OR

Q.6 a) *Derive an expression for sending end voltage and current for long transmission line using rigorous solution.* **(Refer section 5.11)** **[10]**

b) *Two transmission lines having generalized circuit constants A_1, B_1, C_1, D_1 and A_2, B_2, C_2, D_2 are connected in series. Develop expressions for the overall constants ABCD of the combination in terms of A_1, B_1, C_1, D_1 and A_2, B_2, C_2, D_2 .* **(Refer example 5.13.1)** **[6]**

c) *Explain Ferranti effect.* **(Refer section 5.14)** **[4]**

MODULE - 4

Q.7 a) *Explain the phenomenon of corona in overhead transmission line.* **(Refer section 6.1)** **[6]**

b) *A 132 kV line with 1.956 cm diameter conductors is built so that corona takes place if the line voltage exceeds 210 kV(rms). If the value of potential gradient at which ionization occurs can be taken as 30 kV per cm, find the spacing between the conductors. Assume 3-ϕ.* **(Refer example 6.2.7)** **[6]**

c) *Derive the expression for the potential difference between core and earthed sheath in capacitance grading.* **(Refer section 7.8)** **[8]**

OR

Q.8 a) *List the advanatages and disadvantages of corona.* **(Refer section 6.5)** **[5]**

b) *A single core cable of conductor diameter 2 cm and lead sheath of diameter 5.3 cm is to be used on a 66 kV, 3-phase system. Two inter sheaths of diameter 3.1 cm and 4.2 cm are introduced between the core and lead sheath. If the maximum stress in the layers is the same. Find the voltages on inter sheaths.* **(Refer example 7.8.12)** **[10]**

c) *Write a note on inter sheath grading.* **(Refer section 7.8.1)** **[5]**

MODULE - 5

Q.9 a) *Explain the radial feeders used in distribution system.* **(Refer setion 8.3)** **[5]**

b) *Explain the secondary distribution system : i) 3-ϕ distribution ii) Single phase two wire system* **(Refer section 8.6)** **[10]**

c) *Write a note on power quality.* **(Refer section 9.11)** **[5]**

OR

Q.10 a) *Explain the ring main or loop feeders is distribution system.* **(Refer section 8.4)** **[6]**

b) *Define : i) Reliability ii) Availability iii) Adequancy iv) Security* **(Refer section 9.2)** **[8]**

Ans. : ii) Availability : Availability can be defined as probability that a repairable system or system element is operational at a given point in time under a given set of environmental conditions.

Availability is mainly affected by power interruptions due to utility outages or electrical faults.

It depends on reliability and maintainability.

c) *Write a note on limitations of distribution systems.* **(Refer section 9.12)** **[6]**

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SOLVED MODEL QUESTION PAPER

[As per 2018 Pattern]

Transmission and Distribution

Semester - IV (EEE)

Time : 3 Hours] **[Maximum Marks : 100**

Note : ***Answer any FIVE full questions, choosing one full question from each module.***

MODULE - 1

Q.1 a) *Draw the line diagram of a typical transmission and distribution system indicating the standard voltages.* **(Refer section 1.2)** **[6]**

b) *With usual notations derive an expression for the sag of a transmission line when the supports are at different levels.* **(Refer section 2.5)** **[7]**

c) *Each line of a three phase system is suspended by a string of three similar insulators. If the voltage across the line unit is 17.5 kV, calculate the line to neutral voltage and the string efficiency. Assume that the shunt capacitance between each insulator and earthed metal work of tower to be $1/8^{th}$ of the capacitance of the insulator.* **(Refer example 3.6.1)** **[7]**

OR

Q.2 a) *What are bundled conductors ? State its advantages.* **(Refer section 2.2)** **[5]**

b) *Explain the methods of improving the string efficiency.* **(Refer section 3.7)** **[7]**

c) *The towers of height 30 m and 90 m respectively support a transmission line conductor at water crossing. The horizontal distance between the towers is 500 m. If the tension in the conductor is 1600 kg, find the minimum clearance of the conductor and water and also clearance midway between the supports. Weight of conductor is 1.5 kg/m. Bases of the towers can be considered to be at water level.* **(Refer example 2.5.8)** **[8]**

MODULE - 2

Q.3 a) *Calculate the inductance of single phase two wire line starting from fundamentals.* **(Refer section 4.7)** **[6]**

b) *Explain the terms of self GMD and mutual GMD.* **(Refer section 4.9)** **[6]**

c) *Calculate the inductance of each conductor in a 3 phase - 3 wire system. Conductors are arranged in a horizontal plane with spacing d_{31} = 4 m, $d_{12} = d_{23}$ = 2 m. The conductors are transposed and have a diameter of 2.5 cm.* **(Refer example 4.14.3)** **[8]**

OR

Q.4 a) *A 3 - phase, 50 Hz, 132 kV overhead line has conductor placed in a horizontal plane 4 meter apart. Conductor diameter is 2 cm. If the line length is 100 km. Calculate the charging current per phase. Assume complete transposition.* **(Refer example 4.24.4)** **[6]**

b) *Derive the expression for capacitance of a 3 phase line with unsymmetrical spacing but transposed.* **(Refer section 4.25)** **[8]**

c) *Give an expression for potential difference between two conductors a and b in a system of n conductors.* **(Refer section 4.21)** **[6]**

MODULE - 3

Q.5 a) *Write short note on classification of transmission lines.* **(Refer section 5.2)** **[5]**

b) *A 3-phase short transmission line delivers 3 MW at a p.f. of 0.8 lagging to a load. If the sending end voltage is 33 kV, determine : (i) Receiving end voltage; (ii) Line current; (iii) Transmission efficiency; (iv) Regulation. The resistance and reactance of each conductor are 5 Ω and 8 Ω respectively.* **(Refer example 5.5.2)** **[9]**

c) *Determine the sending end voltage and sending end current for medium transmission lines, assuming nominal π method.* **(Refer section 5.8)** **[6]**

OR

Q.6 a) *A 110 kV, 50 Hz, 3 phase transmission line delivers a load of 40 MW at 0.85 lagging p.f. at the receiving end. The generalised constants of the transmission line are A = D = 0.95∠ 1.4°, B = 96 ∠ 78° ohm, C = 0.0015 ∠ 90° mho*
Find the regulation of the line and charging current use nominal T method.
(Refer example 5.9.1) **[6]**

b) *Two transmission lines having generalised circuit constants A_1, B_1, C_1, D_1 and A_2, B_2, C_2, D_2 are connected in a) series b) parallel.*
Derive expression for overall ABCD constants of the resulting network.
(Refer example 5.13.1) **[6]**

c) *A 3 phase, 50 Hz, 150 km transmission line has the following constants.*
Resistance / phase / km = 0.1 Ω
Reactance / phase / km = 0.5 Ω
Capacitive shunt admittance / phase / km = 3×10^{-6} mho
If the line supplies a load of 50 MW at 0.8 p.f. lagging at 110 kV at the receiving end calculate by using nominal π method.
i) Sending end current ii) Sending end voltage
iii) Sending end power factor **(Refer example 5.8.2)** **[8]**

MODULE - 4

Q.7 a) *Explain the basic phenomenon of corona.* **(Refer section 6.1)** **[4]**

b) *Determine the critical disruptive voltage and the critical visual disruptive voltage for a 3 phase, 50 Hz, 132 kV line situated in a temperature of 30 °C and at a barometric pressure of 74 cm. The conductor diameter is 1.5 cm while the equilateral spacing between the conductors is 2.75 m. The surface irregularity factor is 0.9 while $m_v = 0.75$.* **(Refer example 6.2.2)** **[8]**

c) *Which are the important insulating materials used for the cables ?* **(Refer section 7.5)** **[8]**

OR

Q.8 a) *Write a note on factors affecting the corona and methods to reduce it.* **(Refer section 6.3)** **[6]**

b) *A single core lead covered cable has a conductor diameter of 3 cm with insulation diameter of 8.5 cm. The cable is insulated with two dielectrics with permittivities 5 and 3 respectively. The maximum stresses in the two dielectrics are 38 kV/cm and 26 kV/cm respectively then calculate radial thickness of insulating layers and the working voltage of the cable.* **(Refer example 7.8.3)** **[8]**

c) *Derive an expression for the capacitance of a three core cable and the charging current.* **(Refer section 7.9)** **[6]**

MODULE - 5

Q.9 a) *Explain 3 - phase 4 wire star connected unbalanced loads for AC distribution system.* **(Refer section 8.6)** **[6]**

b) *A two wire d.c. distributor system is 3 km long and it supplies loads of 200 A, 100 A, 75 A and 50 A at 800 m, 1200 m, 2000 m and 3000 m from the feeding point A. Each conductor has go and return resistance of 0.004 Ω per 100 m. Calculate the voltage at each load point if voltage at feeding point is 250 V.* **(Refer example 8.10.1)** **[8]**

c) *Explain with neat sketch different failure modes of bath tub curve.* **(Refer section 9.12)** **[6]**

OR

Q.10 a) *Explain radial distribution system. State its merits and demerits.* **(Refer section 8.3)** **[5]**

b) *A single phase AC distributor AB 300 meter long is fed from end A and is loaded as under,*

i) 100 A at 0.707 pf lagging 200 m from point A.

ii) 200 A at 0.8 pf lagging 300 m from point A.
The load resistance and reactance of the distributor is 0.2 Ω and 0.1 Ω per kilometer. Calculate the total voltage drop in the distributor. The power factors refer to the voltage at the far end. **(Refer example 8.15.1)** **[10]**

c) *Define : i) Reliability ii) Availability iii) Adequacy iv) Security.*
(Refer section 9.2) **[5]**

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