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B.Tech.(P/T) / III   J

Paper III - POWER SYSTEM - I
(EEE - 303)

Time : 3 hours   *Maximum Marks :70*

(Write your Roll No. on the top immediately
*on receipt of this question paper.)*

Answer any five questions.
Question No. 1 is compulsory.
Assume missing data, if any.

1. a) A three-phase line with Equilateral spacing of 3m is to be rebuilt with horizontal spacing ($D_{13} = 2D_{12} = 2D_{23}$). The conductors are to be fully transposed. Find the spacing between adjacent conductors such that the new line has same inductance as the original line.   *06*

   b) Find the capacitance of phase to neutral per kilometer of a 3-phase line having conductors of 2cm diameter placed at the corners of a triangle with sides 5m, 6m & 7m respectively. Assume that the line is fully transposed & carries balanced load.   *05*

   c) What do you mean by 'Natural Loading' of lines ?   *02*

   d) "The total instantaneous 3-phase power in a balanced system is constant and is equal to Three-times the real power per phase". Prove the statement in case of 3 - phase transmission system.   *02*

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e) Differentiate between a 'Nominal -T' & 'Equivalent- T' representation of a Transmission Line.   *02*

f) Explain the utility of 'Vibration Dampers' for the Transmission Lines.   *02*

g) Why is the charging current more in cables than in Transmission Lines?   *02*

h) How is a Sag - Template useful for location of towers and stringing of power conductors?   *03*

(i) List the different equipments used in a substation.   *02*

2 a) The six conductors of a double ckt. 3-phase line are arranged as shown in fig. 1. The dia. of each conductors is 2.5cm. Find the Capacitive Reactance to Neutral & the charging current per km per phase at 132KV and 50Hz assuming that the line is transposed.
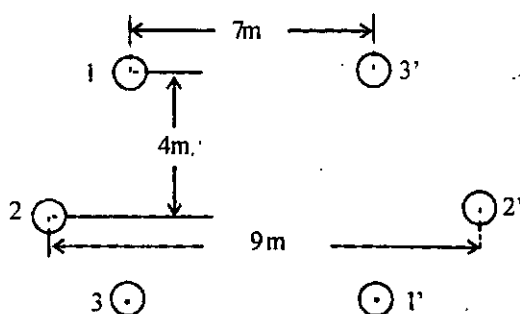
(Fig. 1)

b) Explain briefly the 'Ferronti Effect' with phasor diagram.   *03*

3 a) Calculate the total Inductance of line per km, assuming that current is equally shared by the two parallel conductors, of a single-phase line as shown in Fig. 2. The conductors a and a' in parallel form one conductor while conductors b and b' parallel form return path. *05*

a   a'   b   b'
                                                            2
        20cm ——— 100cm ———   20cm   cm
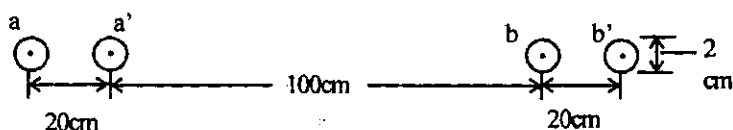
(Fig. 2)

   b) Describe with a neat sketch, the construction of a 3 - core belted type cable. Discuss the limitations of such a cable. *06*

4 a) Determine the voltage across each disc of suspension insulators as a percentage of the line voltage to earth. The self and capacitance to ground of each disc is 1.0C and 0.2C respectively. The capacitance between the link pin and the guard ring is 0.3C. Also determine the string efficiency. *07*

   b) Explain the classification of lines based on their transmission. Also draw neatly the phasor dia. for Nominal - π representation of lines. *04*

5   A 132kV, 3ϕ, 50Hz transmission line 200km long has the following distributed parameters :
      $l = 1.3 \times 10^{-3}$ H/km; c = 9 x 10^{-9} F/km; r = 0.2Ω/km; g = 0. Find the sending end voltage, current, power factor & efficiency when delivering 50MVA at 0.8p.f. lagging. *11*

6 a) An electric train taking a constant current of 600Amps moves on a section of line between two substations 8km apart and maintained at 575 volts & 590 volts respectively. The track resistance is 0.04 ohm per km both 'go' and 'return'. Find the point of minimum potential along the track and currents supplied by two substations at that instat. *06*

b) Distinguish between a feeder, distributor and service main in a distribution scheme. *05*

7 a) An overhead line has the following data :
span length 160meters, conductor dia, 0.95cm, weight per unit length of the conductor 0.65 Kg per metre. Ultimate stress $4250kg/cm^2$, wind pressure $40kg/cm^2$ of projected area. Factor of safety 5. Calculate the sag. *05*

b) Explain briefly the 'Intersheath Grading Method' of insulated cable. *06*

8 a) Derive the expression for the capacitance of a 3-core cable. *05*

b) Write short notes on any three of the following :
   (i) Radial main distributors
   (ii) Ring main distributors
   (iii) Proximity effect
   (iv) Skin effect
   (v) Arcing horn
   (vi) Shunt compensation. *3 x 2*