

(3Hrs)

Marks: 80

N.B.

1. **Question No.1 is Compulsory.**
2. Answer any three out of remaining five questions
3. Assume any suitable data wherever required but justified the same
4. Illustrate answer with sketches wherever required

Q 1 Answer **any four** from the following questions. (20)

- a. Derive the equation for capacitance of three phase line equilateral
- b. State advantages of Per Unit System.
- c. Describe the significance of transposition of three phase overhead transmission lines.
- d. Illustrate how the concept “**Method of Images**” can be used to analyze the effect of earth on transmission line capacitance
- e. Illustrate the term step potential and touch potential.

Q 2 a) Calculate the inductance of each conductor in a 3-phase, 3-wire system (10)

when the conductors are arranged in a horizontal plane with spacing such that  $D_{31} = 4\text{m}$ ;  $D_{12} = D_{23} = 2\text{m}$ . Assume, conductors are transposed and have a diameter of 2.5 cm.

- b) 3-phase, 50 Hz, 16 km long overhead line supplies 1000 kW at 11kV, 0.8 p.f. lagging. The line resistance is  $0.03 \Omega$  per phase per km and line inductance is 0.7 mH per phase per km. Calculate ABCD parameters, sending end voltage, sending end current and voltage regulation of the transmission line. (10)

Q 3 a) Derive expression for capacitance of 3 phase line with unsymmetrical spacing. (10)

- b) Figure shows one line diagram of a power system. Draw impedance (10)

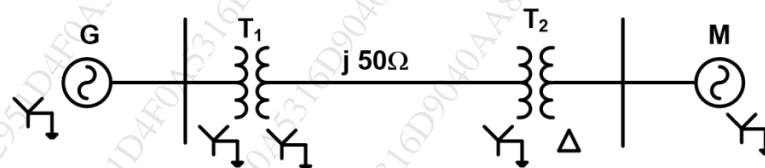
diagram of the network. Choose a base of 100MVA, 220kV in 50Ω line. Ratings of the equipment are:

Generator: 40 MVA, 25kV,  $X'' = 20\%$

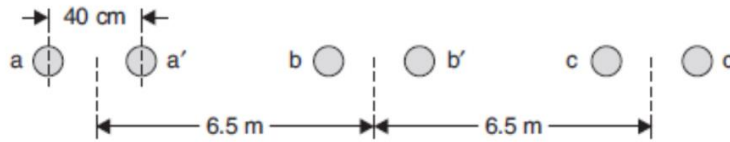
Syn. Motor: 50 MVA, 11kV,  $X'' = 30\%$

Transformer T1: 40 MVA, 33/220kV,  $X = 15\%$

Transformer T2: 30 MVA, 11/220kV,  $X = 15\%$



- Q 4 a) Derive the expressions for A, B, C, D constant and draw phasor diagram for medium transmission line in nominal  $\pi$  method. (10)
- b) A single circuit 460 kV line using two bundle conductors per phase as shown in Fig. The dia of each conductor is 5.0 cm. Calculate (i) capacitance per phase, (ii) charging current per phase, (iii) Charging volt amperes. Assuming complete transposition of the line. (10)



- Q 5 a) Define Neutral grounding. Discuss the advantages of neutral grounding. Illustrate solid grounding in detail. (10)
- b) Name the various components of Power cable. Illustrate the significance of inner sheath (Bedding) in cable. (05)
- c) Derive the expression for flux linkages with the conductor due to internal flux linkage of a conductor itself with ignoring the effect of any other conductor. (05)
- Q 6 a) Derive the expression for inductance of single phase two wire line. (10)
- b) What do you mean by insulation resistance of the cable? Derive the expression for insulation resistance of single core cable. (10)

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