17510

21415

3 Hours/100 Marks

Seat No. | | | | | | | | |

Instructions : *(1) Answer **each** next main question on a **new page**.*
*(2) Illustrate your answers with **neat** sketches **wherever** necessary.*
*(3) Figures to the **right** indicate **full** marks.*
*(4) Assume **suitable data**, if necessary.*
*(5) **Use** of Non-programmable Electronic Pocket Calculator is **permissible**.*

MARKS

1. A) Attempt **any three** of the following : **12**

   a) Draw a single-line diagram of modern power system indicating essential components.

   b) State the expression for Complex power, Real power and Reactive power at sending end of transmission line.

   c) State the difference between 'A-C. resistance' and 'D.C. resistance' of a conductor.

   d) For a generalised two port π (pi) network. Prove that AD – BC = 1 where A, B, C, D are GCC.

   B) Attempt **any one** of the following : **6**

   a) Explain the procedure to measure GCC of a erected to line.

   b) Define 'self GMD' and 'Mutual GMD' with an example.

2. Attempt **any two** of the following : **16**

   a) i) List out the advantages of generalised circuit representation in power system analysis.

   ii) Write expression for co-ordinates of centre and radius for sending end and receiving end circle diagram.

MARKS

b) A three phase line with equilateral spacing of 3 mt. is to be rebuilt with horizontal spacing such that $D_{13} = 2D_{12} = 2D_{23}$. The line conductors are fully transposed. Determine the spacing between adjacent conductors so that the new tr. line has the same inductance as the original line.

c) In a three phase line with 132 kV at receiving end has A = D = 0.98 $\angle 3^\circ$, B = 110 $\angle 75^\circ$ Ω . Find the sending end power if load of 200 MW at 0.8 p.f. lagging p.f. is being delivered at receiving end. Calculate the max. power demand for $V_R = V_S = 275$ kV.

3. Attempt **any four** of the following : **16**

a) Draw reactance diagram for given power system as shown in Fig.1. considering generator rating as common base values.

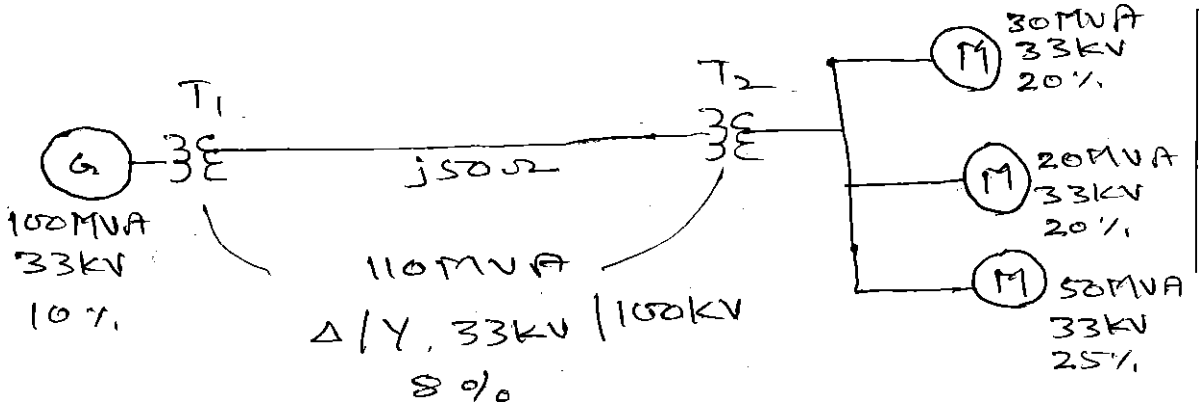


Fig. 1.

b) Explain the stepwise procedure to draw sending end circle diagram.

c) Determine the loop inductance of single phase tr. line comprised of solid conductors of diameter 1.5 cm. and spacing between two conductors as 7 mt.

d) A 200 kV tr. line base GCC A = 0.86 $\angle 7^\circ$ B = 300 $\angle 75^\circ$ Ω . Determine real power at unity p.f. that can be received if voltage at both end are maintained at 200 kV.

e) Derive an expression for capacitance of single phase tr. line comprised of solid conductors.

MARKS

4. A) Attempt **any three** of the following : **12**

   i) Define skin effect. State the factors on which skin effect depends ?

   ii) A 50 Hz, 3ϕ, 27 kV line has following GCC A = 0.896 $\angle 0.7^\circ$, B = 138.7 $\angle 84.2^\circ$. If line is supplied at 275 kV determine the MVA rating of shunt reactor that would be required to maintain 275 kV at receiving end when line is delivering no load.

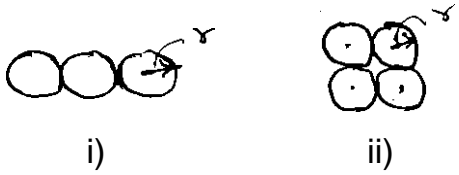
   iii) State advantages of p.v. system in power system analysis.

   iv) State the necessity of reactive power compensation. Explain any one method of the reactive power compensation.

   B) Attempt **any one** of the following : **6**

   a) A 3ϕ, 50 Hz line has resistance of 20 Ω , inductance 0.2 H and capacitance 1 μ F. All parameters are per km. Length of line is 150 km and delivers a load of 50 MW at 132 kV, 0.8 lag. p.f. Determine ABCD constants of the line (considering π model).

   b) Determine the self G.M.D. of conductors shown in Fig. 2. Assume r = 0.1 cm :



i) ii)

Fig. 2.

5. Attempt **any two** of the following : **16**

   a) Two transmission line networks are connected in series. Determine A, B, C, D constants of overall network.

   b) A 3ϕ, 132 kV tr. line delivers 40 MVA at 0.8 p.f. laging. Determine sending end voltage with the help of circle diagram. Given that A = 0.98 $\angle 3^\circ$ B = 110 $\angle 72^\circ$ Ω . Also find max. power delivered at receiving end.

MARKS

c) Determine inductive reactance of 1 ϕ tr. line with the arrangement as shown in fig. 3. The diameter of each conductor is 1 cm. and current is equally shared by two parallel conductors.

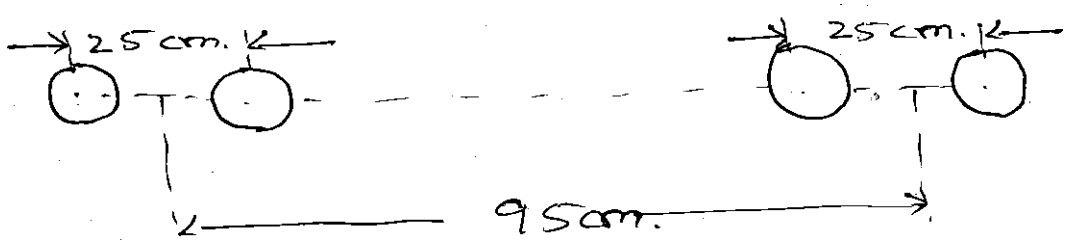


Fig. 3.

6. Attempt **any four** : **16**

a) Derive the expression for complex power at receiving end of the line with generalised circuit.

b) Prove that p.u. reactance of transformer remains same refer to both side of the transformer.

c) Give significance of inductance, resistance and capacitance parameters of tr. line.

d) State the field of applications of following reactive power compensators :

i) Shunt capacitor bank

ii) Series inductor bank

iii) Synchronous condenser

iv) Auto transformer.

e) A 3 phase, 50 Hz, line is 250 km long. It has series impedance 35 + j 40 Ω and shunt admittance 930×10^{-4} $\mho$. It delivers 40 MW at 220 kV with 0.9 lag. p.f. Determine ABCD constant considering medium line having nominal T circuit.
