# 17510

**16172**

**3 Hours / 100 Marks** Seat No. | | | | | | | | |

***Instructions*** : *(1)* ***All*** *questions are* ***compulsory****.*

*(2) Answer* ***each*** *next main question on a* ***new*** *page.*

*(3) Illustrate your answers with* ***neat*** *sketches* ***wherever*** *necessary.*

*(4) Figures to the* ***right*** *indicate* ***full*** *marks.*

*(5) Assume suitable data, if* ***necessary****.*

*(6) Mobile Phone, Pager and any other Electronic Communication devices are* ***not permissible*** *in Examination Hall.*

**Marks**

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

a) State the role of power system engineer.

b) Give expression for complex power, active power and reactive power at receiving end of a transmission line.

c) Justify "AC resistance is always higher than DC resistance".

d) Describe stepwise procedure for measurement of generalised circuit constants.

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

a) Prove that AD – BC = 1 for a generalised circuit with $\pi$ and T network.

b) Give significance of inductance and resistance on performance of transmission line.

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

a) i) Derive generalised circuit constants of two networks connected in series.

ii) Describe the procedure for sending end circle diagram.

b) A, 3 $\phi$, 50 Hz, OH line has regularly transposed conductors equilaterally spaced 4 m apart. Calculate the capacitance line to neutral for this arrangement. Recalculate the capacitance/km to neutral when conductors are in same horizontal plane with successive spacing of 4 m, and are regularly transposed.

c) A line has following parameters $A = D = 0.9 \angle 0.4^{\circ}$, $B = 99 \angle 76.96^{\circ}$. The sending end and receiving end voltages are maintained at 220 KV. Calculate the maximum power supplied by sending end. Also calculate sending end complex power for a load of 100 MW at unity P.F. and $V_S = V_R = 220$ KV.

**P.T.O.**

**Marks**

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

a) Prove that p.u. reactance of transformer remains same referred to both sides of transformer.

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

c) Determine the inductance of 3-phase line operating at 50 Hz and conductors are arranged at corners of symmetrical triangle with side 3.4 m and diameter of each conductor is 0.8 cm.

d) A 132 KV, 3 phase line has constants $A = 0.89 \angle 3^\circ$, $B = 100 \angle 75^\circ$ ohm/ph. The line is to be operated with both end voltages at 132 KV. Draw receiving end power circle diagram for a load of 200 M W at 0.8 p. f. lagging.

e) Derive an expression for capacitance of 3-ph, transmission line with equal spacing.

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

a) Define self GMD and mutual GMD.

b) A 275 KV, 3 ph, transmission line has following parameters.

$A = 0.93 \angle 1.5^\circ$, $B = 115 \angle 77^\circ$, if receiving end voltage is 275 KV. Draw receiving end circle diagram and determine sending end voltage required if load of 250 MW at 0.85 lag p.f. is being delivered at receiving end.

c) Draw a basic structure of modern power system showing different voltage levels.

d) State the field of application of reactive power compensation equipment given below :

i) Shunt capacitor bank ii) Series inductance reactor

iii) Synchronous condenser iv) Auto transformer

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

a) A balanced load of 50 MVA is supplied at 132 KV, 50 Hz, 0.8 p.f. lag by means of transmission line. The series impedance is $180 \angle 75^\circ \Omega$ / ph and total shunt admittance is $1 \times 10^{-3} \angle 90^\circ$ Siemens/ph. Calculate A, B, C, D constants using nominal $\pi$ method.

b) Find self GMD for following arrangement

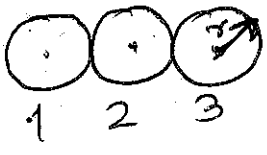



Fig. i

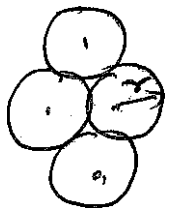


Fig. ii

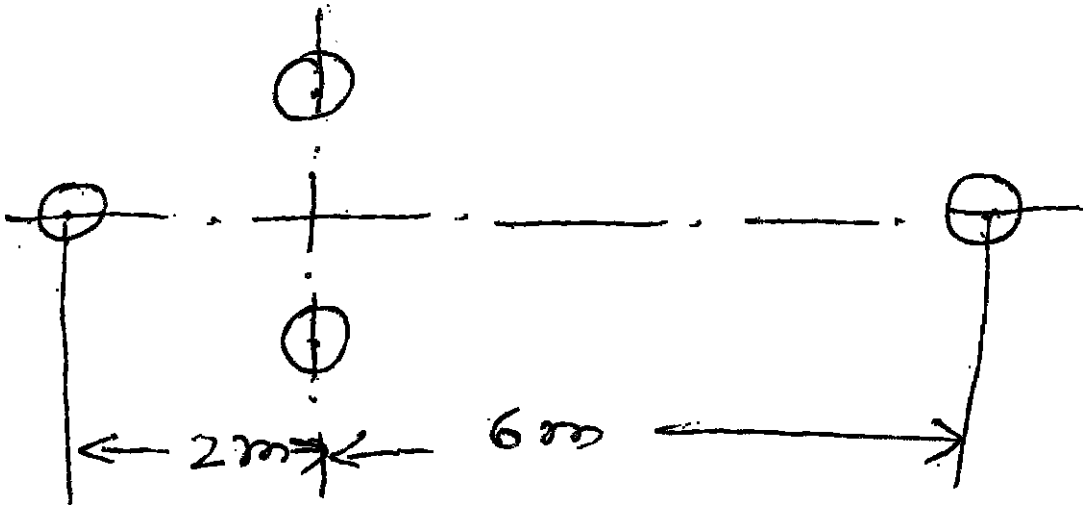
**Marks**

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

a) A 132 KV, 50 Hz, 3-phase line delivers load at 40 MW, 0.8 p.f. lag, at receiving end. The GCC of line are, $A = 0.95 \angle 1.4^\circ$, $B = 96 \angle 78^\circ$, $C = 0.0015 \angle 90^\circ$. Calculate sending end voltage, sending end current and voltage regulation. Use nominal T-method.

b) With the help of receiving end circle diagram, determine complex power delivered at unity p.f. if voltage at each end of line is maintained at 275 KV. Given that $A = 0.85 \angle 5^\circ$, $B = 200 \angle 75^\circ$.

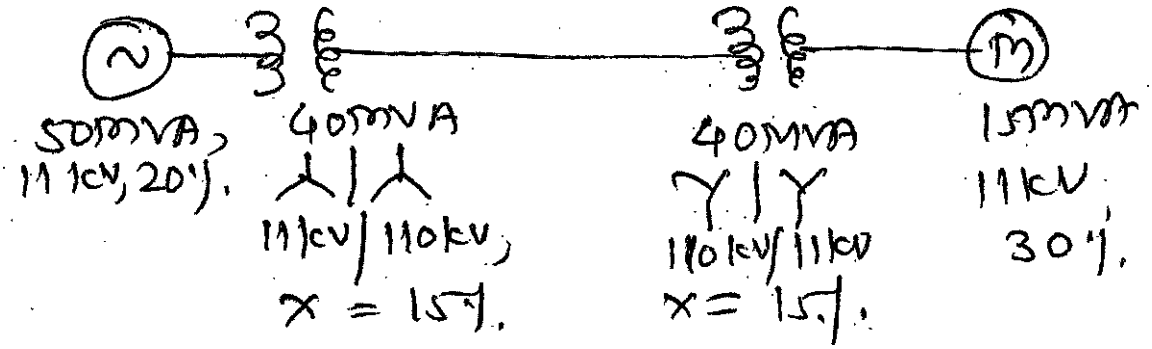
c) Determine inductance of line for arrangement shown in figure. Diameter of each conductor is 1 cm.




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

a) Derive the expression for complex power at sending end of transmission line.

b) Draw reactance diagram for following power system.




c) What is transposition of 3 ph line, state its advantages.

d) Prove that complex power in power system is $S = VI^*$.

e) A 50 Hz, 3 $\phi$ transmission line is 250 km. long. It has a total series impedance of $35 + j40\ \Omega$ and shunt admittance of $930 \times 10^{-4}\ \mho$. It delivers 40000 KW at 220 KV with 0.9 p.f. lagging. Find ABCD constants considering nominal T-circuit.