17510

15116

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

Instructions : *(1)* ***All*** *questions are* ***compulsory****.*
(2) Illustrate your answers with neat sketches ***wherever*** *necessary.*
(3) Figures to the ***right*** *indicate* ***full*** *marks.*
(4) Assume suitable data, if ***necessary****.*
(5) Preferably, write the answers in ***sequential*** *order.*

Marks

1. A) Attempt **any three** : **(3×4=12)**

a) Draw schematic diagram depicting power system structure.

b) Give the difference between AC resistance and DC resistance.

c) Explain the concept of Generalised circuit constants.

d) State the expression for complex power at receiving end of transmission line. Derive the condition for maximum power at receiving end.

B) Attempt **any one**: **(1×6=6)**

a) Describe the phenomenon of flux linkages of an isolated current carrying conductor with necessary expression.

b) A 132 kV, 3-phase line has the following line constants : $A = 0.9 \angle 2.5^\circ$, $B = 100 \angle 70^\circ \Omega$, $C = 0.0006 \angle 80^\circ S$.

Draw the receiving end power circle for a load of 40 MW at 0.8 power factor lagging at receiving end and determine the sending end voltage.

2. Attempt **any two**: **(2×8=16)**

a) i) Describe the influence of skin effect and proximity effect on line conductors.

ii) A single phase overhead transmission line delivers 1100 kW at 33 kV at 0.8 p.f. lagging the total resistance and inductive reactance of the line are $10\,\Omega$ and $15\,\Omega$ respectively. Determine i) sending end voltage ii) transmission efficiency.

b) i) Describe the phenomenon of Inductance of 1-phase line composed of bundled conductor.

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

c) i) Explain the effect of earth field on transmission line capacitance.

ii) Write the stepwise procedure for drawing sending end circle diagram.

P.T.O.

Marks

3. Attempt **any four** : **(4×4=16)**

a) Draw a single line representation of a simple power system.

b) Describe the effect of temperature on transmission line resistance.

c) Determine the receiving end voltage of a 3-phase, 100 km, 50 Hz, transmission line delivering 20 MW at a p.f. of 0.8 lagging and 66 kV to a balanced load. The conductors are of copper, each having resistance 0.1 ohm per km, 1.5 cm outside diameter, spaced equilaterally 2 meters between centres. Neglect leakage. Use nominal T method.

d) A 50 Hz, 3-phase, 275 kV, 400 km transmission line has the following parameters :
Resistance = 0.035 Ω /km per phase
Inductance = 1.1 mH/km per phase
Capacitance = 0.012 μ F/km per phase.
If the line is supplied at 275 kV, determine the MVA rating of a shunt reactor having negligible losses that would be required to maintain 275 kV at the receiving end when the line is delivering no load. Use nomimal- π method.

e) A 3-phase transmission line has a resistance 10 Ω per phase and a reactance of 30 Ω per phase. Determine the maximum power which may be transmitted if 132 kV were maintained at each end.

4. A) Attempt **any three** : **(3×4=12)**

a) Draw an equivalent circuit representation of short transmission line.

b) Explain the concept of self GMD and mutual GMD.

c) Derive the generalised circuit constants of two network connected in series.

d) Describe series compensation. State the advantages of same.

B) Attempt **any one** : **(1×6=6)**

a) Prove that AD – BC = 1 for medium transmission line.

b) A 275 kV, 3-phase line has the following line parameters : A = $0.93 \angle 1.5^\circ$, B = $115 \angle 77^\circ$.
If the receiving end voltage is 275 kV, determine the sending end voltage required if a load of 250 MW at 0.85 lagging p.f. is being delivered at the receiving end.

5. Attempt **any two** : **(2×8=16)**

a) Describe the phenomenon of inductance of 3-phase line, single circuit, composed of solid conductor with asymmetrical spacing.

b) Calculate the inductance and capacitance per km of a line consisting of solid conductors of 30 mm diameter placed at the corners of a triangle with sides 3, 4 and 5 meters. The conductors are adequately transposed.

c) i) Derive the genaralised circuit constants of two network connected in parallel.

ii) Describe the stepwise procedure for drawing receiving end circle diagram.

Marks

6. Attempt **any four** : **(4×4=16)**

a) Describe the role of power system engineer.

b) A 3-phase, 50 Hz, transmission line consists of three equal conductors of radi ir, placed in a horizontal plane, with a spacing of 6 m between the middle and each outer conductor, as shown in Fig. 1. Determine the inductive reactance per phase per km of the transposed line if the radius of each conductor is 12.5 mm.

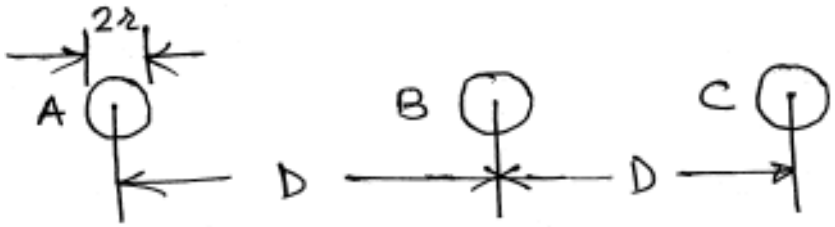

Fig. 1

c) A two-conductor, single-phase line operates at 50 Hz. The diameter of each conductor is 2 cm and are spaced 3 m apart. Calculate :

a) The capacitance of each conductor to neutral per km

b) Line-to-line capacitance

d) A single circuit 50 Hz, 3-phase transmission line has the following parameters per km : R = 0.2 ohm, L = 1.3 mH and C = 0.01 μF. The voltage at the receiving end is 132 kV. If the line is open at the receiving end, find the rms value of the incident voltage to neutral at the receiving end as reference.

e) Explain the advantages of generalised circuit representation.