

Code : 031404

B.Tech 4th Semester Exam., 2016

POWER SYSTEM—I

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose and write the correct option (any seven) :  $2 \times 7 = 14$

(a) The angle of A, constant of the transmission line normally lies between

- (i)  $90^\circ - 70^\circ$
- (ii)  $70^\circ - 40^\circ$
- (iii)  $40^\circ - 10^\circ$
- (iv)  $10^\circ - 0^\circ$

AK16/635

( Turn Over )

( 2 )

(b) By increasing the transmission voltage to double of its original value, the same power can be despatched keeping the line loss

- (i) equal to original value
- (ii) half the original value
- (iii) double the original value
- (iv) one-fourth of original value

(c) Power transmission by cable is generally adopted for line lengths

- (i) above 100 km
- (ii) up to 200 km
- (iii) less than 50 km
- (iv) less than 10 km

(d) Reactive power is

- (i) rate of energy transfer
- (ii) the product of r.m.s. volt and quadrature component of r.m.s. current
- (iii) the product of r.m.s. volt and r.m.s. current
- (iv) the product of r.m.s. volt and in phase component of r.m.s. current
- (v) None of the above

AK16/635

( Continued )

( 3 )

- (e) In a long transmission line under no-load condition
- (i) the receiving end voltage is less than the sending end voltage
  - (ii) the sending end voltage is less than the receiving end voltage
  - (iii) the sending end voltage is equal to the receiving end voltage
  - (iv) None of the above
- (f) The presence of earth in case of overhead lines
- ✓ (i) increases the capacitance
  - (ii) increases the inductance
  - (iii) decreases the capacitance
  - (iv) decreases the inductance
- (g) The effect of bonding the cable is
- (i) to increase the effective resistance and resistance
  - ✓ (ii) to increase the effective resistance but reduce inductance
  - (iii) to reduce the effective resistance and inductance
  - (iv) to reduce the effective resistance but increase the inductance

AK16/635

( Turn Over )

( 4 )

- (h) Effect of increase in temperature in overhead line is to
- (i) increase the stress and the length
  - ✓ (ii) decrease the stress but increase in length
  - (iii) decrease the stress and length
  - (iv) Any of the above
- (i) The capacitance between any two conductors of a 3-core cable with sheath earthed is  $3 \mu\text{F}$ . The capacitance per phase will be
- (i)  $1.5 \mu\text{F}$
  - (ii)  $6 \mu\text{F}$
  - ✓ (iii)  $1 \mu\text{F}$
  - (iv) None of the above
- (j) To obtain the minimum value of stress in cable  $R/r$  ratio should be
- (i) 2.13
  - (ii) 3.14
  - ✓ (iii) 2.718
  - (iv) 1.96

AK16/635

( 5 )

2. Compare the volume of copper required for the distributor cable in a low-voltage distribution network in a DC 3-wire system, with a 3- $\phi$ , 4-wire system. Assume the same consumer voltage, same percentage loss, unity power factor and balanced load. The neutrals of half the X-section of corresponding outer. 14
3. (a) Write a short note on 'choice of transmission voltage'. 5
- (b) A 2-core, 11 kV cable is to supply 1 MW at 0.8 p.f. lag for 3000 hours in a year. Capital cost of the cable is ₹ (20+400a) per meter, where  $a$  is the X-sectional area of core in  $\text{cm}^2$ . Interest and depreciation total 10% and cost per unit of energy is 15 P. If the length of cable is 1 km, calculate the most economical X-section of the conductor. The specific resistance of copper is  $1.75 \mu\Omega/\text{cm}$ . 9
4. A 1- $\phi$  distributor, one km long has resistance and reactance  $0.4 \Omega$  and  $0.6 \Omega$  (go and return) respectively. At the far end, the voltage  $V_B = 240 \text{ V}$  and the current is 100 A at a p.f. of 0.8 lag. At the mid-point  $B$  of the distributor current of 100 A is tapped at a power factor of 0.6 lag with reference to the voltage  $V_B$  at the mid-point. Calculate the supply voltage  $V_S$  for the distributor and the phase angle between supply end and receiving end. 14

( Turn Over )

( ( 6 ) )

5. Derive from first principles, the capacitance per km to neutral of a 3- $\phi$  overhead transmission line with unsymmetrical spacing of conductors assuming transposition. 14
6. (a) Discuss the effect of wind and ice on sag. 7
- (b) What is a stringing chart? What is its utility? 7
7. Explain the physical significance of the generalized ABCD constants of a transmission line. State the units of these constants. Determine these constants for a medium transmission line with nominal-T configuration. Draw neatly corresponding vector diagram. 14
8. Explain in detail how the receiving end power circle diagram can be drawn. Obtain the condition for maximum power. 14
9. (a) Find expression for the capacitance of a cable per km length. 7
- (b) Write a short note on 'Thermal resistance of cables'. 7

\*\*\*