ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER – 2007

POWER SYSTEMS

SEMESTER – 5

Time : 3 Hours] [Full Marks : 70

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) The per unit impedance of a synchronous machine is 0·242. If the base voltage is increased by 1·1 times, the per unit value will be

a) 0·266 b) 0·242

c) 0·220 d) 0·200.

ii) The capacitance of a 3-core cable between any two conductors with sheath earthed is 2 micro-farad, then the capacitance per phase will be

a) 1 micro-farad b) 4 micro-farad

c) 0·667 micro-farad d) 1·414 micro-farad.

iii) The insulation resistance of a cable of length 10 km is 1 Meg-ohms. The resistance for 50 km length will be

a) 1 Meg-ohms b) 5 Meg-ohms

c) 0·2 Meg-ohms d) none of these.

iv) The function of steel wire in an ACSR conductor is to

a) compensate skin effect

b) provide additional mechanical strength

c) reduce inductance

d) none of these.

v) A 3-phase 4 wire system is commonly used for

a) primary distribution b) secondary distribution
c) primary transmission d) secondary transmission.

vi) The electric stress in a cable is maximum at

a) centre of conductors b) interface of sheath and conductors
c) lead sheath d) armour.

vii) Transposition of lines is done to

a) reduce line loss b) reduce skin effect
c) balance the line voltage drop d) reduce corona.

viii) The surge impedance of a 400 km long overhead line is 400 ohms. For a line of 200 km of the same line, the surge impedance will be

a) 50 ohms b) 400 ohms
c) 200 ohms d) 800 ohms.

ix) Neutral shifting may occur in

a) grounded system b) ungrounded system
c) delta system d) none of these.

x) Stringing chart is useful for

a) finding the sag in the conductor
b) in the design of tower
c) in the design of insulator string
d) finding the distance between the towers.

xi) Skin effect in a conductor becomes more pronounced at

a) higher frequency b) lower frequency
c) d.c. d) none of these.

xii) If the distance between the conductors increases then the line capacitance will

a) increase
b) decrease
c) remain unchanged.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following questions. 3 × 5 = 15

2. State the advantage of bundle conductor for power transmission in EHV system. What do you mean by 30/7 A.C.S.R. conductor ? 3 + 2

3. a) Why is capacitance effect more predominant in a short cable than in a short overhead line of same length ? 2

   b) The capacitance per km of a three phase belted cable is 0·18 μF between two cores with the third core connected to sheath. Calculate the kVA taken by 20 km long cable when connected to a 3 phase 3300 V supply. 3

4. Explain Kelvin's law for the determination of conductor size.

5. An industrial consumer has a maximum demand of 120 kW and maintains a load factor of 80%. The tariff in force is Rs. 100 per kVA of maximum demand plus Rs. 2·50 per unit. If the average p.f. is 0·8 lagging, calculate the total energy consumed per annum and the annual bill. 5

6. Explain different methods adopted for power factor correction. 5

GROUP – C

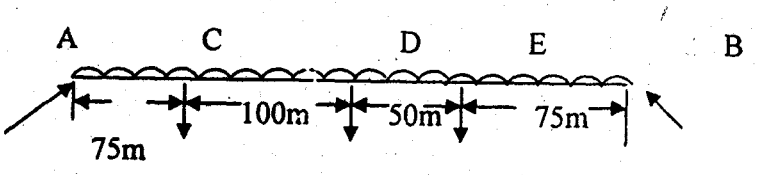
(Long Answer Type Questions)

Answer any *three* questions. 3 × 15 = 45

7. a) What is load curve ? What are the informations we can get from load curve ? 4

   b) A d.c. two wire distributor *AB*, 300 m long is feed from both ends and supplies a uniformly distributed load of 0·15 A per metre together with the following concentrated loads :

   50 A at *C*, 60A at *B* and 40A at *E*. The supply voltages at *A* and *B* are 206 volt and 200 volt respectively and the resistance of each conductor is 0·00015 Ω per metre. If *AC* = 75 metre, *CB* = 100 metre and *DE* = 50 metre, calculate the current supplied at each end. 7



c) Derive the relation between the conductor radius and inside sheath radius of a single core cable so that the electric stress of the conductor surface is minimum. 4

8. a) Find *A*, *B*, *C* and *D* constants for nominal π circuit of a medium transmission line. 6

b) Show that for a given voltage V and maximum dielectric stress E_{max} in a single core cable the sheath diameter *D* is maximum when $D/d = e$, where *d* is the conductor diameter and *e* is the base of natural logarithms. 5

c) The maximum and minimum electrostatic stresses in the dielectric of a single core cable are 40 kV per cm (rms) and 10 kV per cm (rms) respectively. If the conductor diameter is 2 cm, find

i) the thickness of insulation and

ii) the operating voltage. 4

9. a) What is corona ? What are its characteristic features ? What are the advantages and disadvantages of corona ? 1 + 3 + ?

b) Two towers of heights 30 m and 90 m respectively support a transmission line conductor at water crossing. The horizontal distance between the towers is 500 m. If the tension in the conductor is 1600 kg, find the maximum clearance of the conductor and the clearance of the conductor midway between the supports. Weight of conductor is 1·5 kg per metre. Bases of the towers can be considered to be at water level. 8

10. Discuss the various methods of controlling reactive power at load end to keep consumer's terminal voltage fixed.

11. Write short notes on any *three* of the following : 3 × 5

i) Synchronous condenser

ii) Proximity effect

iii) String Insulator Efficiency and methods of its improvement

iv) Resistance Grounding

v) Earthing transformer.

END