CENTRE FOR ENERGY STUDIES

ESL – 718 Power System: Generation, Transmission & Distribution
Major Test (M Tech Morn.) Venue: LH 517 Time: 6.00 PM to 8.00 PM

Date: 09.05.2016   MM: 40

All questions carry equal marks.

1. Use the data given in the table below for four groups of L_1, L_2, L_3 & L_4 loads (averaged over an interval of two hours) and determine the following :
   a) the class contribution factors for each of the four loads
   b) the diversity factor for the primary feeder
   c) the diversified maximum demand of the load group
   d) the coincidence factor of the load group
   e) the load factor   – System –
   f) the average power loss
   g) select the transformer rating for the primary feeder if the power factor of the loads are 0.85 lagging. Transformers of following capacity are available 650 kVA, 950 kVA, 1250 kVA, 1550 kVA and 2000 kVA.

Table : Data of primary feeder (Loads : L_1, L_2, L_3, L_4 are in kW and the copper losses are 45 kW at peak load and loss factor is 0.2)

Time	L_1	L_2	L_3	L_4	Time	L_1	L_2	L_3	L_4
08.0 am	135.0	255.0	470.0	98.0	08.0 pm	163.0	310.0	110.0	78.0
10.0 am	167.0	165.0	510.0	42.0	10.0 pm	055.0	376.0	080.0	70.0
12.0 nn	120.0	155.0	648.0	48.0	12.0 pm	042.0	346.0	055.0	43.0
02.0 pm	133.0	142.0	680.0	55.0	02.0 am	048.0	322.0	055.0	53.0
04.0 pm	170.0	142.0	620.0	47.0	04.0 am	080.0	300.0	055.0	66.0
06.0 pm	175.0	186.0	614.0	62.0	06.0 am	090.0	270.0	055.0	88.0

2. A hexagonally shaped distribution substation is served by three phase four wire 33/11kV grounded – star primary feeders. The feeders are made of ACSR conductors having ampere capacity of 355A. Assume a lagging load power factor of 0.85, 1050 kVA/km² uniformly distributed load density and K = 0.00135 %VD/(kVA km). Calculate the following:

   (a) consider thermally loaded feeder mains and find
       (i)   maximum load per feeder
       (ii) substation size
       (iii) substation spacing both ways
       (iv) total percentage voltage drop from the feed point to the end of the mains
   (b) consider voltage limited feeders which have 4.5% voltage drop and find
       (j)   substation spacing both ways
       (ii) maximum load per feeder
       (iii) substation size
       (iv) ampere loading of the main in per unit of conductor ampere capacity

3. (a) The Figure below shows a 3 - Φ system supplied at 11 kV at A. The load currents are balanced and the power factors (all lagging) are w.r.t. supply voltage at A. The impedances shown are per phase values. Calculate the current in sections BC and DC.
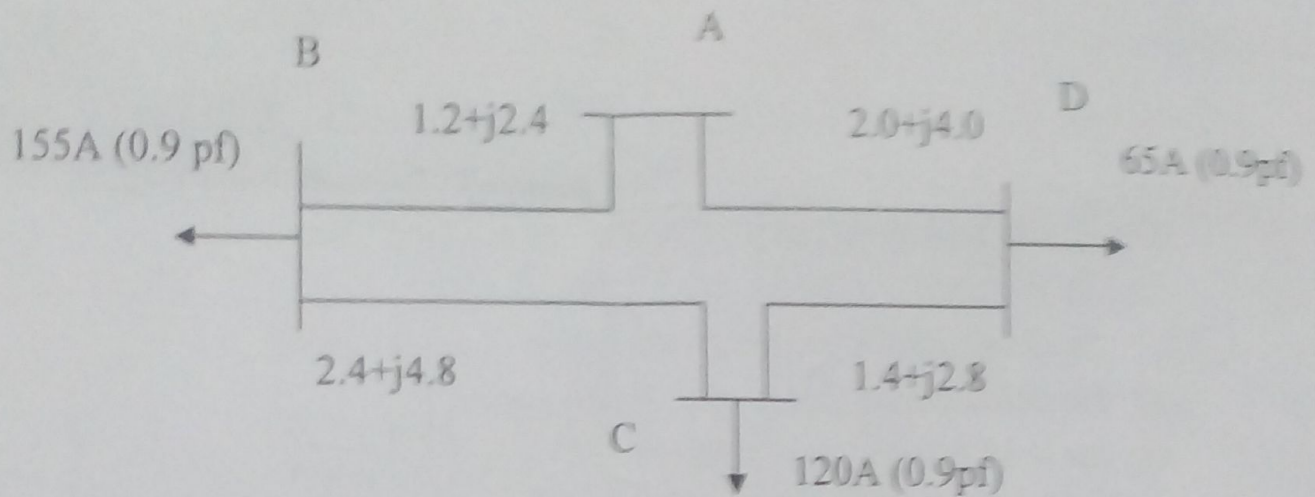
(b) Find the receiving end voltage of a long radial line under no- load in terms of line parameters, sending end voltage etc.

4. (a) During a weather storm, an atmospheric discharge hits a lightening pole. The pole is grounded through a hemisphere and the maximum lightning current through the pole is 25 kA.

(i) A person is playing golf 35 m away from the centre of the hemisphere. The distance between his feet is 0.35 m and his leg-to-leg resistance is 2 kΩ. Assume that the soil is moist, compute the current through the person and his step potential.

(ii) Another person is 17.5 m away from the centre of the hemisphere with same distance between his feet and leg-to-leg resistance as in (i), compute the current through the person and his step potential.

(b) Solve (a) if the pole is grounded through a rod.

(c) Write a short note on electric safety