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324455(24)

B. E. (Fourth Semester) Examination, Nov.-Dec. 2016

(New Scheme)

(Elect. Branch)

ELECTRICAL POWER SYSTEM

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : All questions are compulsory. Part (a) of each question is compulsory and carry 2 marks. Attempt any two parts from (b), (c) and (d) of each unit and carries 7 marks.

Unit - I

1. (a) Write two advantages of ACSR conductor when used for overhead line. 2

(b) Show that the inductance per unit length of an overhead line due to internal flux linkage is constant and independent of size of conductor. 7

(c) A three phase overhead line is designed with an equilateral spacing of 3.5 m with a conductor diameter of 1.2 cm. If the line is constructed with horizontal spacing with suitably transposed conductors, find spacing between adjacent conductors which would give the same value of inductance as in the equilateral arrangement. 7

(d) Derive an expression to show the effect of earth on capacitance of a single phase transmission line. 7

Unit - II

2. (a) Define Surge impedance loading. 2

(b) Draw and explain the phasor diagram for a transmission line assuming that half the line capacitance is connected at each end of the line. Also determine ABCD constant. 7

(c) A single circuit 50 Hz, 3-phase transmission line has the following parameters per km :

R = 0·20 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 and phase angle of the following :

(i) The incident voltage to neutral at the receiving end (reference).

(ii) The reflected voltage to neutral at the receiving end.

(iii) The incident and reflected voltages to neutral at 120 km from the receiving end. 7

(d) A transmission line has a span of 214 meters between level supports. The conductors have a cross-sectional area of 3·225 cm^2. Calculate the factor of safety under the following conditions :

Vertical sag = 2·35 m; wind pressure = 1·5 kg/m run

Breaking stress = 2540 kg/cm^2; wt. of conductor = 1·125 kg/m run. 7

Unit - III

3. (a) What are the different insulating material used for cable? 2

(b) Derive the condition for most economical power factor when kW demand is constant. 7

(c) A single phase 50 Hz motor takes 20A at 0·75 power factor lagging from a 230 V sinusoidal supply. Calculate the kVAr and capacitance of a capacitor to be connected in parallel to raise the p.f. to 0·9 lagging. What is the new supply current? 7

(d) Determine the overall diameter of a single-core cable and its most economical diameter when working on a three-phase 275 kV system. The maximum permissible stress in the dielectric is not to exceed 15 kV/mm. 7

Unit - IV

4. (a) State whether the tap changer in a transformer is provided on H.V. side or L.V. side. Give reasons. 2

(b) Show with the help of phasor diagram, how the voltage at receiving end is maintained constant by synchronous phase modifier. 7

(c) Explain why series compensation leads to improvement in system stability. Compare the performance of series and shunt capacitor in power system.

(d) A 250 m, 2-wire d.c. distributor fed from one end is loaded uniformly at the rate of 1.6 A/meter. The resistance of each conductor is 0.0002 Ω per meter. Find the voltage necessary at feed point to maintain 250 V :

(i) at the far end of distributor

(ii) at the-point of distributor 7

Unit - V

5. (a) What is Bewley's lattice diagram? 2

(b) Derive the expression for reflection coefficient and refraction coefficient for a transmission line of characteristics impedance Z_c terminated in an impedance of Z_l. 7

(c) Describe the wave equation in transmission line and also prove that the characteristics impedance

$$Z_0 = \sqrt{\frac{L}{C}}$$ 7

(d) An overhead transmission line with a surge impedance of 500 Ω has a load comparising of 10

kΩ resistor in parallel with a 0·005 μF capacitor connected across the far end. A surge voltage of 10 kV magnitude and unit function travels along the line. Determine an expression for the time variation of the voltage across the load and calculate this voltage 5 μ sec after the arrival of the wave front of the surge. 7