Ex/EE/5/T/312/2018

B. ELECTRICAL ENGINEERING (PART TIME) 3RD YEAR 1ST SEM. EXAMINATION, 2018

POWER SYSTEM PLANNING AND DESIGN

Time: Three hours | (50 marks for this part) | Full Marks: 100

Use a separate Answer-Script for each part

PART -I

Answer any three questions

Two marks allotted for neat and to the point answers

1) a) What are the functions of transmission line towers? Why stays are necessary? (5)

b) A transmission line having the copper conductor of 7/0.295 cm size, weight 428kg/km and breaking strength 1973kg. Assume factor of safety 2, span 200m and supports at the same height. Calculate maximum sag of the conductor. (7)

c) What are the factors that affect sag? (4)

2) a) Prove that the dielectric stress at any point within the insulation of a cable is inversely proportional to the distance of the point from the centre of the core. Also derive the expressions for maximum and minimum dielectric stresses of the cable. (9)

b) The test results for 1 km of 3-phase metal sheathed belted cable gave a measured capacitance of 0.7μF between one conductor and other two bunched together with the sheath and 1.2 μF between three bunched conductor and sheath. Find (a) capacitance pair of conductor (b) the charging current when the cable is connected to 11kV, 50Hz supply. (7)

3) a) Discuss Murray loop test with proper circuit diagram. (8)

b) What are the features of PVC insulation? (4)

c) Briefly explain the pin type insulators. (4)

4) a) What are the desirable characteristics of insulators for a transmission line? (5)

b) Discuss sag template. (7)

c) Discuss the advantages of AAC conductor over cadmium copper conductor. (4)

5) a) Explain load factor and diversity factor. (4)

b) What are the criteria for suggesting a tariff? (8)

c) Discuss two part tariff. (4)

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No. of Questions		PART -II Answer any Three (Two marks reserved for well organized answers)	Marks
6)	a)	A two conductor single phase line operates at 50 Hz. The diameter of each conductor is 25 mm and the spacing between the conductors is 3 m. Calculate (a) the inductance of each conductor per km,(b) the loop inductance of the line per km, (c) the inductive reactance per km, and (d) the loop inductance per km of the line when the conductor material is steel of relative permeability 50.	(8)
	b)	Derive the expression for inductance of three phase unsymmetrical spaced but transposed transmission lines.	(8)
7)	a)	Derive the inductance per unit length of an overhead transmission line due to internal flux.	(6)
	b)	Derive the GMD and GMR expressions for a single phase two wire line composed of two conductors where the two conductors are having p and q number of segments respectively and both the conductors are carrying the same current but in opposite directions.	(10)
8)	a)	Derive the expression for capacitance of an overhead three phase unsymmetrically spaced but transposed transmission line.	(8)
	b)	A three-phase 50 Hz transmission line has flat horizontal spacing with 3.5 m between adjacent conductors. The conductors have outer diameter of 1.05 cm. The voltage of the line is 110 kV. Find the capacitance to neutral and the charging current per kilometer of line.	(8)
9)	a)	Draw and explain the operation of short transmission lines with proper phasor diagram for lagging p.f.. Also determine the ABCD parameters of the short transmission line.	(8)
	b)	A 3-phase , 50 Hz, transmission line , 40 km long delivers 36 MW at 0.8 power factor lagging at 60 KV (phase). The line constants per conductor are, R=2.5Ω, L=0.1 H, C=0.25μF. Shunt leakage may be neglected. Use the nominal **pi** method to determine voltage, current,	(8)

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	power factor, active power and reactive volt-amperes at the sending end.	
10)	Write short notes on:**(any two)** i) ABCD parameters of a long transmission line. ii) Effect of earth on transmission line capacitance. iii)Incident voltage and reflected voltage of a long transmission line. iv)Skin effect and proximity effect.	(2×8)