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Ref No:

Ex / EE/5/T/312/2017(S)

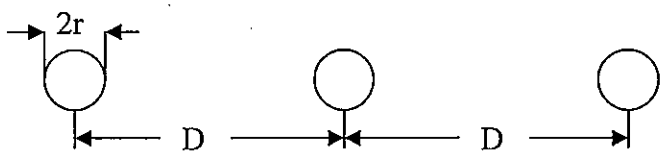
B.ELECTRICAL ENGG. (EVENING) 3RD YEAR 1ST SEMESTER SUPPLE EXAM, 2017

SUBJECT: - POWER SYSTEM PLANNING AND DESIGN

Full Marks: 100

Time: Three hours (50 marks for this part)

Use a separate Answer-Script for each part

No. of Questions		PART -I Answer any Three (Two marks reserved for well organized answers)	Marks
1)	a)	A three phase 50 HZ transmission line consists of three equal conductors of radii r, placed in a horizontal plane, with a spacing of 6 m between the middle and each outer conductor as shown in Fig.Q.1(a) below. Find the capacitance per kilometer to neutral and the capacitive reactance per phase per kilometer if the radius of each conductor is 12.5 mm.  Fig.Q.1 (a)	(8)
	b)	Determine the expression for capacitance per phase of a three phase unsymmetrical spaced but transposed overhead transmission line.	(8)
2)	a)	Calculate the inductive reactance per phase of the transposed line as shown in Fig.Q.1(a) above. All the data remaining same as in Q.1(a), derive its GMD and GMR equations.	(10)
	b)	Derive the inductance per unit length of an overhead transmission line due to internal flux	(6)
3)	a)	Derive the expressions for the ABCD constant for a lossless long transmission line. Assume distributed parameters.	(8)
	b)	Show that voltage and current at any point of a long transmission line can be resolved into two waves travelling in opposite direction.	(8)
4)	a)	A 50 Hz, 160 km long line has series impedance Z= (0.02+j0.25) ohm per km/phase and shunt admittance y = j 2.0×10^{-6} mho/km/phase. Calculate ABCD parameters using nominal –T model of the line.	(8)
	b)	Using ABCD parameters obtained in Q.4(a) above, calculate the sending end voltage, current and power factor if the line delivers at	(8)

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	receiving end a load of 75 MW at 132 kV and 0.95 lagging power factor.	
5)	Write short notes on **any two** of the following: 1. Capacitance calculation of three phase double circuit line. 2. Skin effect and proximity effect. 3. Pi and T equivalent of long transmission line. 4. Effect of earth on transmission line capacitance.	(8×2)

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PART -II

Answer any three questions

Two marks allotted for neat and to the point answers

1)	a)	How to identify open circuit fault in a cable?	(4 x 4)
	b)	What are the factors to be considered to determine the configuration of transmission line towers?	
	c)	Explain the necessity of load forecasting.	
	d)	Expand the following terms : (i) CERC (ii) XLPE insulation (iii) AAAC (iv) ABT (with respect to tariff)	
2)	a)	Why the capacitance of underground cable is much higher than that of an overhead transmission line of same length.	(3)
	b)	Calculate the minimum clearance of the lowest conductor above ground for a 66 KV and 220 KV transmission line.	(4)
	c)	Discuss the advantages of concrete poles over wooden poles.	(3)
	d)	A transmission line having the copper conductor of 7/0.295 cm size, area 0.484 sq. cm, overall diameter 0.889cm, 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.	(6)
3)	a)	What considerations are made while designing an insulator?	(4)
	b)	Show that in a single core cable, $\frac{g_{max}}{g_{min}} = \frac{R}{r}$ where g_{max} and g_{min} are the maximum and minimum potential gradients and r and R are the core radius and overall sheath radius respectively. Find out the condition for most economical size of cable.	(10+2)
4)	a)	Describe different types of vibration in transmission line conductors. How can they be prevented?	(8)
	b)	Explain plant load factor and availability factor.	(4)
	c)	Explain stringing chart	(4)
5)	a)	What are the criteria for suggesting a tariff?	(8)
	b)	Explain Market guided tariff.	(8)