Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VIII.EXAMINATION – WINTER 2016

Subject Code: 180903 Date: 21/10/2016

Subject Name: Power System Practice and Design

Time: 02:30 PM to 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Design a transmission line to transmit three phase, 95000 kW at 0.95 power factor lag over a distance of 180 km. Hence find the line regulation. Refer to tables given at the end of the paper.	**14**
Q.2	**(a)**	Discuss classification of distribution systems with neat diagrams. What are the advantages and dis-advantages of each?	**07**
	(b)	What is meant by stringing of line conductors? What is a stringing chart? How is it prepared and what is its use?	**07**
		OR	
	(b)	What methods are adopted to reduce the tower footing resistance.	**07**
Q.3	**(a)**	Discuss the procedure to design the transmission line tower.	**07**
	(b)	The following data refers to a transmission line whose span length is 250 m, effective conductor diameter=1.88 cm, weight of conductor= 0.87 kg/m run of conductor, ultimate strength=8100 kg, radial thickness of ice=1.2 cm, wind pressure=38 kg/m^2 of the projected area, safety factor=2, density of ice=913 kg/m^3. Calculate the maximum sag.	**07**
		OR	
Q.3	**(a)**	State and explain Kelvin's law for the most economical cross section of conductor.	**07**
	(b)	A three phase overhead line supplies a constant load of 6 MW at 33 kV and 0.8 power factor lag throughout the year. The cost of the line is Rs.(80000a+3500) per km where 'a' is the cross sectional area of each conductor in cm^2. The cost of energy is 25 paise per kWh and the interest and depreciation total 10 % per annum. Assuming specific resistance of conductor as 1.8 x 10^{-6}, find the most economical size of conductor.	**07**
Q.4	**(a)**	What is lamp flicker? Discuss its classification. What are the remedies for reducing lamp flicker.	**07**
	(b)	Discuss why earth wire is required for overhead transmission lines. Where is it located on the transmission line towers?	**07**
		OR	
Q.4	**(a)**	Discuss various considerations in location of substations.	**07**
	(b)	Write a brief note on Gas Insulated Substation.	**07**
Q.5	**(a)**	What are the steps to be followed in the design of an earthing grid.	**07**
	(b)	Discuss tolerable step and touch voltage with circuit diagrams and equations. What is transferred potential.	**07**

OR

Q.5 **(a)** Draw the single line diagram of HVDC scheme and discuss the importance of each equipment. **07**

(b) Write a note on insulation co-ordination and basic insulation levels adopted for EHV lines and equipments. **07**

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Table-1

Line to line voltage (kV)	Line loading (kW-km)
11	24×10^3
33	200×10^3
66	600×10^3
110	11×10^6
132	20×10^6
166	35×10^6
230	90×10^6

Table-2

Line to line voltage (kV)	Equivalent spacing (m)
11	1
33	1.3
66	2.6
110	5
132	6
166	8
230	10.2

Table-3

Copper equivalent cross sectional area (cm^2)	Safe current carrying capacity in Amp.	
	Copper conductors.	ACSR conductors.
0.1935	82	100
0.2580	102	127
0.3225	118	148
0.3870	135	170
0.4515	153	190
0.5160	170	210
0.5805	185	230
0.6450	200	255
0.9675	275	350
1.2900	340	425
1.6125	400	505
1.9350	460	580
2.2575	520	655
2.5800	570	715
2.9025	625	775
3.2250	670	825

Table-4

Nominal copper area	Number of strands and wire diameter.		Approx. overall diameter.	Calculated resistance per km at 20°C.	Approx. total weight per km.	Calculated breaking load of composite conductor
	Aluminium	Steel				
cm^2	cm	cm	cm	Ω	kg	kg
0.161	6/0.236	1/0.236	0.708	1.0891	106.2	954.8
0.322	6/0.335	1/0.335	1.005	0.5400	214.0	1864.3
0.387	6/0.365	1/0.365	1.097	0.4550	255.0	2204.5
0.484	6/0.409	1/0.409	1.227	0.3640	318.0	2742.0
0.645	6/0.472	1/0.157	1.417	0.2720	395.0	3311.2
0.645	7/0.439	7/0.193	1.458	0.2700	451.0	4152.6
0.805	30/0.236	7/0.236	1.654	0.2200	605.0	5764.0
0.968	30/0.259	7/0.259	1.814	0.1832	728.0	6883.0
1.125	30/0.279	7/0.279	1.956	0.1572	847.0	7953.0
1.290	30/0.299	7/0.299	2.073	0.1370	975.0	9098.0
1.613	30/0.335	7/0.335	2.347	0.1091	1218.0	11306.0

Table-5

Self GMD or GMR of stranded conductors	
Solid round conductor	0.779R
Full Stranding:	
7 – strands	0.726R
19 – strands	0.758R
37- strands	0.768R
61- strands	0.772R
91- strands	0.774R
127- strands	0.776R