

# GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2019

Subject Code: 2150908

Date: 03/06/2019

Subject Name: Electrical Power System – I

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.

		MARKS
<b>Q.1</b>	(a) Compare AC and DC supply systems.	<b>03</b>
	(b) What are the advantages of using Suspension type insulators?	<b>04</b>
	(c) Derive formula for calculation of sag in overhead transmission line when the supports are, (i) At equal level (ii) At unequal levels	<b>07</b>
<b>Q.2</b>	(a) Write a short note on economic choice of transmission voltage.	<b>03</b>
	(b) What is the percentage saving in feeder copper if the line voltage in a d.c. two wire system is raised from 250 volts to 500 volts for the same power transmitted over the same distance and having the same power loss?	<b>04</b>
	(c) 30 MW power at 0.8 p.f. lagging is being transmitted over a 220 kV, 3-phase, overhead line. The length of line is 275 km and the efficiency of transmission is 90%. Calculate the weight of copper required. Also calculate the weight of copper required if the power transmission is done over a single phase transmission line for the same line voltage and losses. Assume that the resistance of 1 km long conductor of 1 sq. cm. cross section is 0.173 ohm. Take specific gravity of copper to be 8.9	<b>07</b>
<b>OR</b>		
	(c) An insulator string consists of three units, each having safe working voltage of 15 kV. The ratio of self capacitance to shunt capacitance of each unit is 8:1. Find the maximum safe working voltage of the string. Also find the string efficiency.	<b>07</b>
<b>Q.3</b>	(a) Discuss Skin effect and Proximity effect.	<b>03</b>
	(b) Derive formula for flux linkages of a current carrying conductor in a group of parallel current carrying conductors.	<b>04</b>
	(c) Calculate the inductance per phase per metre for a three-phase double circuit line whose phase conductors have a radius of 5.3 cm each with all the six conductors arranged in a horizontal plane as shown in fig. (1) below and having a distance of 8 metre between two adjacent conductors. Assume regular transposition of conductors.	<b>07</b>



Figure 1

OR

- Q.3 (a) Derive formula for capacitance of a single phase two wire line. **03**  
 (b) A conductor is composed of seven identical copper strands, each having radius  $r$ . Find the self G.M.D. of the conductor. **04**  
 (c) A three phase, 50 Hz, 132 kV overhead line has conductors placed in a horizontal plane 4 m apart. Conductor diameter is 2 cm. If the line length is 100 km, calculate the charging current per phase assuming complete transposition. **07**
- Q.4 (a) What is the effect of unsymmetrical spacing of conductors in a three phase transmission line? What is the remedy? **03**  
 (b) Show how effect of earth can be taken into account while calculating capacitance of transmission lines? **04**  
 (c) A 2-wire d.c. distributor AB is 300 metres long. It is fed at point A. Various loads and their positions are given below. **07**

Point	Distance from Point A (metre)	Concentrated load in Ampere
C	40	30
D	100	40
E	150	100
F	250	50

If the maximum permissible voltage drop is not to exceed 10 V, find the cross sectional area of the distributor. Take resistivity of conductor material =  $1.78 \times 10^{-8}$  ohm-metre.

**OR**

- Q.4 (a) Describe various connection schemes for distribution systems. **03**  
 (b) Show how a.c. distribution system calculations differ from d.c. system calculations? **04**  
 (c) Show that the per unit impedance of a two winding transformer remains the same either referred to HV side or LV side when base voltages are in proportion with the transformation ratio. **07**
- Q.5 (a) Write advantages and drawbacks of per unit system. **03**  
 (b) Draw steady state equivalent circuit of a synchronous machine and explain working of a synchronous generator connected to infinite bus. **04**  
 (c) What do you understand by grading of underground cables? List the methods of grading and explain any one of them in detail. **07**

**OR**

- Q.5 (a) What are the requirements of a well designed distribution system? **03**  
 (b) A single phase ring distributor ABC is fed at point A. Impedances of sections AB, BC and AC are  $(2+j1)$  ohm,  $(2+j3)$  ohm and  $(1+j2)$  ohm respectively. Load at B is 40 A at 0.8 p.f. lagging while load at point C is 60 A at 0.6 p.f. lagging, both with respect to voltage at point A. Find the current in each of the sections. **04**  
 (c) Derive condition for most economic size of conductor in an underground cable. **07**

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