

Seat No.: _____

Enrolment No. _____

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
Q.1	(a) Compare AC and DC supply systems.	03
	(b) What are the advantages of using Suspension type insulators?	04
	(c) Derive formula for calculation of sag in overhead transmission line when the supports are,	07
	(i) At equal level (ii) At unequal levels	
Q.2	(a) Write a short note on economic choice of transmission voltage.	03
	(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?	04
	(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	07
OR		
	(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.	07
Q.3	(a) Discuss Skin effect and Proximity effect.	03
	(b) Derive formula for flux linkages of a current carrying conductor in a group of parallel current carrying conductors.	04
	(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.	07



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 = 1.78×10^{-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**
