Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2017

Subject Code: 2150908 Date: 13/11/2017

Subject Name: Electrical Power System – I

Time: 10:30 AM TO 01:00 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)**	What is electric power supply system? Draw a single line diagram of a typical a.c. power supply system.	**03**
	(b)	Discuss the advantages and limitations of High Transmission Voltage.	**04**
	(c)	A 50 km long transmission line supplies a load of 5 MVA at 0.8 lagging power factor at 33 kV. The efficiency of line is 90%. Calculate the volume of aluminium conductor required for the line when (a) single-phase, 2-wire system is used and (b) 3-phase, 3-wire system is used. The specific resistance of aluminium is 2.85×10^{-8} Ω m.	**07**
Q.2	**(a)**	List out a) main components of overhead lines b) conductor material used in overhead transmission line c) line supports	**03**
	(b)	Define and explain string efficiency. Can its value be equal to 100%? Justify your answer.	**04**
	(c)	An overhead transmission line conductor having a parabolic configuration weighs 1.925 kg per meter of length. The area of cross section of the conductor is 2.2 cm^2 and the ultimate strength is 8000 kg/cm^2. The supports are 600 m apart having 15 m difference of levels. Calculate the sag from the taller of the two supports which must be allowed so that the factor of safety shall be 5. Assume that ice load is 1 kg per meter run and there is no wind pressure.	**07**
		OR	
	(c)	Each line of a 3-phase system is suspended by a string of 3 similar insulators. If the voltage across the line unit is 17.5 kV, calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is $1/8^{th}$ of the capacitance of the insulator itself. Also find the string efficiency.	**07**
Q.3	**(a)**	What is skin effect? On which factors it depends? Why it is absent in d.c. system?	**03**
	(b)	Calculate the inductance of each conductor in a 3-phase, 3-wire system when the conductors are arranged in a horizontal plane with spacing such that D_{31} = 4 m, $D_{12} = D_{23}$ = 2 m. The conductors are transposed and have a diameter of 2.5 cm.	**04**
	(c)	Derive an expression for the inductance per phase for a 3-phase overhead transmission line when conductors are unsymmetrycally placed but the line is completely transposed.	**07**
		OR	
Q.3	**(a)**	What do you mean by the constants of an overhead transmission line?	**03**
	(b)	What do you understand by electric potential? Derive an expression for electric potential at a charged single conductor.	**04**

(c) A 3-phase, 50 Hz, 66 kV overhead line conductors are placed in a horizontal plane such that D_{31} = 4.5 m, D_{12} = 2 m and D_{23} = 2.5 m. The conductor diameter is 1.25 cm. If the line length is 100 km, calculate (i) capacitance per phase, (ii) charging current per phase, assuming complete transposition of the line. **07**

Q.4 **(a)** What are the advantages of doubly fed distributor over singly fed distributor? **03**

(b) What is the purpose of interconnector in a d.c. ring main distributor? **04**

(c) A d.c. distributor AB is fed at both ends. At feeding point A, the voltage is maintained at 235 V and at B, it is 236 V. The total length of the distributor is 200 meters and loads are tapped off as under: **07**

20 A at 50 m from A
40 A at 75 m from A
25 A at 100 m from A
30 A at 150 m from A

The resistance per kilometer of one conductor is 0.4 ohm. Calculate the minimum voltage and the point at which it occurs.

OR

Q.4 **(a)** What is a ground detector? Give its application. **03**

(b) How does a.c. distribution differ from d.c. distribution? **04**

(c) A single phase distributor 2 kilometers long supplies a load of 120 A at 0.8 p.f. lagging at its far end and a load of 80 A at 0.9 p.f. lagging at its mid-point. Both power factors are referred to the voltage at the far end. The resistance and reactance per km (go and return) are 0.05 ohm and 0.1 ohm respectively. If the voltage at the far end is maintained at 230 V, calculate: (i) voltage at the sending end and (ii) phase angle between voltages at the two ends. **07**

Q.5 **(a)** Give definition of per unit value. List out advantages of per unit system. **03**

(b) Represent per unit model of generator, transformer, transmission line and load. **04**

(c) Explain steady state model of a synchronous machine with necessary diagram. **07**

OR

Q.5 **(a)** With a neat diagram, show the various parts of a high voltage single-core cable. **03**

(b) Compare the merits and demerits of underground system versus overhead system. **04**

(c) What should be the desirable characteristics of insulating materials used in cables? Briefly describe some commonly used insulating materials for cables. **07**

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