GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– III (New) EXAMINATION – WINTER 2019

Subject Code: 3132407   **Date: 3/12/2019**

Subject Name: Electrical Machines and Applications

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)**	Derive expression for the r.m.s. values of the induced voltages in the two windings of a single phase transformer connected to a sinusoidal supply.	**03**
	(b)	Derive the condition for maximum efficiency for a single phase transformer.	**04**
	(c)	The connected instrument readings obtained from open and short circuit tests on 10 kVA, 450/120 V, 50 Hz transformer are: O.C. test: $V_1 = 120$ V; $I_1 = 4.2$ A, $W_1 = 80$ W; (test conducted on l.v. side) S.C. test: $V_1 = 9.65$ V; $I_1 = 22.2$ V; $W_1 = 120$ W; (l.v. side short circuited) Compute the equivalent circuit constants and draw it.	**07**
Q.2	**(a)**	Compare cage and wound three phase induction motor with reference to construction, performance and application.	**03**
	(b)	A 4-pole, 3-phase induction motor operates from a supply whose frequency is 50 Hz. Calculate: (i) The speed at which the magnetic field of the stator is rotating (ii) The speed of the rotor when the slip is 0.04 (iii) The frequency of the rotor currents when the slip of 0.03 (iv) The frequency of the rotor currents at standstill	**04**
	(c)	Why starters are necessary for starting induction motors? Name different starting methods for 3-phase induction motors and explain any one briefly.	**07**
		OR	
	(c)	Draw a typical torque slip characteristic and derive the condition for maximum torque.	**07**
Q.3	**(a)**	State the principle of operation of dc generator and derive the expression for the emf generated.	**03**
	(b)	What do you mean by demagnetizing effect of armature reaction in dc machine?	**04**
	(c)	A 4-pole, 240 V, wave connected shunt motor gives 1119 kW when running at 1000 rpm and drawing armature and field currents of 50 A and 1.0 A respectively. It has 540 conductors. Its resistance is 0.1 ohm. Assuming a drop of 1 volt per brush, find (i) total torque (ii) useful torque (iii) useful flux/pole (iv) rotational losses and (v) efficiency.	**07**

OR

Q.3 **(a)** Draw the power flow diagram of a d.c. motor. **03**

(b) What is the function of interpole in dc machine? **04**

(c) A shunt generator delivers 195 A at terminal p.d. of 250 V. the armature resistance and shunt field resistance are 0.02 ohm and 50 ohm respectively. The iron and friction losses equal 950 W. Find **07**

   (i)   Emf generated
   (ii) Cu losses
   (iii) Output of the prime mover
   (iv) Commercial, mechanical and electrical efficiencies.

Q.4 **(a)** What is an auto-transformer? State its merits and demerits over the two winding transformer. **03**

(b) Explain the principle of operation of a 3-phase synchronous motor. **04**

(c) Explain synchronous impedance method of determining the voltage regulation of an alternator. Comment on the merits and limitations of this method. **07**

OR

Q.4 **(a)** Explain how Scott connections are used to obtain two-phase supply form 3-phase supply mains. **03**

(b) State the necessary conditions for parallel operation of alternators. **04**

(c) Why is synchronous motor not self-starting? What methods are generally used to start the synchronous motors? Explain any one. **07**

Q.5 **(a)** What type of motor would you use in the following applications: (i) washing machine (ii) sewing machine (iii) dishwasher (iv) portable electric drill (v) food mixer and (vi) ceiling fan **03**

(b) Describe working and application of reluctance motor. **04**

(c) What are the main differences in the behavior of variable reluctance type stepper motor and permanent magnet type stepper motor? **07**

OR

Q.5 **(a)** State some important application of brushless dc motor. **03**

(b) Explain the operating principle of linear induction motor. **04**

(c) What is an amplidyne? Draw its connection diagram and explain its working. **07**

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