Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– V (New) EXAMINATION – WINTER 2019

Subject Code: 2152001 **Date: 02/12/2019**

Subject Name: Electro Mechanical Energy Conversion

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)**	Explain various types of magnetic materials and their properties.	**03**
	(b)	Draw and explain hysteresis loop in detail.	**04**
	(c)	Explain magnetic field distribution in a long solenoid while the solenoid coil is carrying dc current. Also derive the equation of magnetic field for the solenoid.	**07**
Q.2	**(a)**	Explain the methods of analysis of ferromagnetic circuits.	**03**
	(b)	List different principles which are involved in electromechanical energy conversion. Explain any one in details.	**04**
	(c)	Define field energy and coenergy. Prove that field energy and coenergy in a linear magnetic system are given by identical expressions.	**07**
		OR	
	(c)	Draw a neat sketch of a DC generator and state the function of each part.	**07**
Q.3	**(a)**	Distinguish between singly-excited and doubly-excited systems.	**03**
	(b)	Explain the speed-current and torque-current characteristics of dc series motor.	**04**
	(c)	An 18.65 kW, 4-pole, 50Hz, 3-phase induction motor has friction and windage losses of 2.5 per cent of the output. The full load slip is 4%. Compute for full load (a) the rotor Cu loss (b) the rotor input (c) the shaft torque (d) the gross electromagnetic torque.	**07**
		OR	
Q.3	**(a)**	Compare cage and wound rotor 3-phase induction motor with reference to construction, performance and applications.	**03**
	(b)	Why is synchronous motor not self-starting? What methods are generally used to start the synchronous motors?	**04**
	(c)	A dc shunt motor drives a centrifugal pump whose torque varies as the square of the speed. The motor is fed from a 200V supply and takes 50A when running at 1000 rpm. What resistance must be inserted in the armature circuit in order to reduce the speed to 800 rpm? The armature and field resistance of the motor are 0.1 Ω and 100 Ω respectively.	**07**
Q.4	**(a)**	Discuss the modifications necessary to operate a d.c. series motor satisfactory on single phase a.c. supply.	**03**
	(b)	A dc shunt generator has a full load output of 10 kW at a terminal voltage of 240 V. The armature and the shunt field winding resistance are 0.6 and 160 ohms respectively. The sum of the mechanical and core-losses is 500 W. calculate the power required in kW at the driving shaft at full load and the corresponding efficiency.	**04**
	(c)	Draw and explain the equivalent circuit of a single phase induction motor.	**07**
		OR	

Q.4	**(a)**	A 4-pole, 3-phase induction motor operates from a supply whose frequency is 50Hz. 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 is 0.03.	**03**
	(b)	Explain the principle of operation of dc servomotors. Draw their torque-speed characteristics.	**04**
	(c)	Give details of four methods of starting small single phase induction motors, and mention typical applications for which these types would be suitable.	**07**
Q.5	**(a)**	What are the main features of stepper motor which are responsible for its wide-spread use?	**03**
	(b)	Write a short note on universal motor.	**04**
	(c)	Discuss hysteresis motor in details.	**07**

OR

Q.5	**(a)**	What types of permanent magnet materials are used for permanent magnet dc motors? State their properties and applications.	**03**
	(b)	Draw and explain a typical torque-speed characteristic of a reluctance motor.	**04**
	(c)	Name the most popular types of stepper motors. Describe the operation of a permanent magnet type stepper motor.	**07**

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