Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V • EXAMINATION – WINTER • 2014

Subject Code: 152001 **Date: 26-11-2014**

Subject Name: Electro mechanical Energy Conversion

Time: 10.30 am - 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 how magnetic field is established in a long solenoid when a dc current is passes though it using suitable diagrams and expressions. **07**

(b) State and explain Biot-Savart's law for magnetic field due to a current element in free space. **07**

Q.2 **(a)** State and explain different approximation made while analyzing electromagnetic devices. **07**

(b) A steel ring has a mean diameter of 20cm, a cross section of 25cm² and a radial air-gap of 0.8 mm cut across it. When excited by a direct current of 1A though a coil of 1000 turns wound on the ring core, it produces an air-gap flux of 1 mWb. Neglecting leakage and fringing, calculate **07**

(i) relative permeability of steel

(ii) total reluctance of the magnetic circuit.

OR

(b) When and under what conditions can we ignore the reluctance of ferromagnetic core part of a magnetic circuit? What is the order of error introduced by such an assumption? What are its consequences upon magnetic circuit of electric machines? **07**

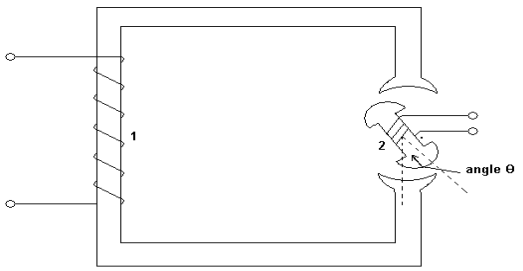
Q.3 **(a)** Write a detailed note about eddy current loss in ferromagnetic cores. Also explain the different methods to reduce eddy current loss. **07**

(b) In the rotary device of figure , when the rotor is in the region of Θ = 45˚, the coil inductances can be approximated as **07**

$$L_{11} = L_{22} = 2 + \frac{\pi}{2}\left(1 - \frac{\theta}{45}\right)$$

$$L_m = \frac{\pi}{2}\left(1 - \frac{\theta}{90}\right)$$

Find the time-average torque if coil 1 carries a current of i = 5 sin 314t while coil 2 short-circuited.



OR

Q.3 **(a)** Explain energy balance in a nonlinear magnetic system when excited by a **07**

single source of ac supply.

	(b)	Explain linear magnetic system excited by two sources and also derive the torque equation for the same.	**07**
Q.4	**(a)**	Explain construction of DC machines. Also give classification of DC machines.	**07**
	(b)	A 460 V dc series motor runs at 500 RPM taking a current of 40A. Calculate the speed and percentage change in torque if the load is reduced so that the motor is taking 30A. Total resistance of the armature and field circuits is 0.8Ω. Assume flux is proportional to the field current.	**07**

OR

Q.4	**(a)**	Draw and explain following characteristics for dc shunt motor (i) Torque and armature current (ii) Speed and armature current (iii) Speed and torque.	**07**
	(b)	Explain various power stages in dc generator with suitable diagram.	**07**
Q.5	**(a)**	Write detail note about 'Hysteresis Motor'.	**07**
	(b)	Explain working of 3-phase induction motor. How electrical energy is converted into mechanical energy in 3-phase induction motor?	**07**

OR

Q.5	**(a)**	Explain capacitor start and run single phase induction motor.	**07**
	(b)	Give the detailed classification of AC motors.	**07**

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