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NATIONAL INSTITUTE OF TECHNOLOGY, DELHI

Name of Examination: B. Tech (Mid-Semester)

Branch: Electrical & Electronics Engineering **Semester: V**

Title of Course: Electrical Machines-II **Course Code: EEB301**

Time: 2 Hrs **Maximum Marks: 25**

Note: (i) Attempt any 5 Questions, (ii) Answers to all the questions should be to the point.

Q1.	Explain with the help of neat phasor diagram the types of torque developed in following conditions: **(5 Marks, 1 mark each)**	
	(i)	Two coils displaced by 120^0 and supplied with two phase supply displaced by 90^0.
	(ii)	Three star connected coils displaced by 120^0 and supplied with dc supply across phase and neutral of each windings.
	(iii)	Three star connected coils displaced by 120^0 and supplied with two phase supply across phase and neutral of each windings.
	(iv)	Two coils displaced by 90^0 and supplied with two phase supply displaced by 90^0.
	(v)	Three star connected coils displaced by 120^0 and supplied with three phase supply displaced by 120^0.
Q2.	(i)	Discuss the similarities and differences between a 3-phase Induction Motor and a 3-Phase Transformer. **(2 Marks)**
	(ii)	Discuss why single phase induction motors are not self-starting. What provisions are generally done to make them self-starting. **(2 Marks)**
	(iii)	Give the expressions for: (i) the relative speed between stator magnetic field and stator, (ii) the relative speed between rotor magnetic field and rotor rotating at 'N_r' speed, and (iii) frequency of rotor emf. **(1 marks)**
Q3.	Derive the relationship between Torque and Slip for a three phase induction motor and then draw its Torque-Slip characteristics. Explain the three modes of operation of induction motor as depicted in the characteristics. **(3+2=5 marks)**	
Q4.	Explain the construction and working principle of a synchronous motor? Why is it called a doubly-fed machines? How is a synchronous motor started and how is it made self-starting. **(3+2=5 marks)**	
Q5.	The following results were obtained on a 3-phase, 75 kW, 3.3 kV, 6-pole squirrel cage induction motor: **(5 Marks, 1 mark each)** No Load Test: f=50 Hz, V_{oc}=3.3 kV (line), I_0=5 Amp and P_0=2500 watts Block Rotor Test: f=15 Hz, V_{BR}=400 V (line), I_{BR}=27 Amp and P_{BR}=15000 watts DC test on stator give resistance/phase = 3.75 ohms. Determine: (i) The parameters of the exact equivalent circuit. (ii) Parameters of the Thevenin equivalent as seen from the rotor circuit (iii) Maximum torque and the slip at which it occours	

	(iv) For a slip of 4%, calculate the stator current, its power factor and motor efficiency. (v) Internal torque developed by the motor.
Q6.	A 60 kW, 400 V, 3-phase, 6-pole, 50 Hz wound rotor induction motor has a full-load slip of 0.04 when operating at rated voltage and frequency with rotor winding short-circuited at slip rings. The slip at maximum torque is 0.2. Stator resistance and rotational losses are neglected. Determine (a) the maximum torque and (b) full-load rotor ohmic losses. Rotor resistance is now doubled by adding external series resistance in each rotor phase. For the rated power output, determine (c) slip at maximum torque, (d) full-load slip and (e) full-load torque. **(5 marks)**

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