Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII (OLD) EXAMINATION – SUMMER 2019

Subject Code: 180904 Date: 20/05/2019

Subject Name:Electrical Machine Design -II

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)** Define dispersion co-efficient and discuss its effect on maximum power factor and overload capacity for 3-ph induction motor. **07**

(b) Define Short Circuit Ratio (SCR) and discuss its effect on the performance of synchronous machine. **07**

Q.2 **(a)** Derive the equation for relationship between rating and size of the machine for 3-ph induction motor. **07**

(b) State and explain the steps for an auxiliary winding design of a resistance split 1-ph induction motor. **07**

OR

(b) What is the role of damper winding synchronous machine? Derive the equation of MMF of damper winding. **07**

Q.3 **(a)** Explain how selection of L\τ ratio, peripheral speed and ventilating duct affects the main dimension of 3-ph induction motor design. **07**

(b) Calculate the values of (i)) Current in rotor bar and end ring (ii) Area of rotor bar and end ring for 11 kW, 3-ph, 6 pole 50 Hz, 415 V, star connected induction motor having an efficiency of 0.86 and full load power factor of 0.85(lag). Assume number of stator slots = 54, conductor per stator slots = 9, stator slots = 57, rotor mmf = 85 percent of stator mmf, current density = 5.5 A/mm^2. **07**

OR

Q.3 **(a)** Explain the factors that affects the selection of number of stator slots for 3-ph induction motor design. **07**

(b) Calculate the main dimensions of 15 kW, 3-ph, 415 V, 50 Hz, 2850 RPM, squirrel cage induction motor having an efficiency of 0.85 and full load power factor of 0.89(lag). Assume winding factor = 0.955, specific magnetic loading = 0.55 Wb/m^2, specific electric loading = 25,000 A/m and peripheral speed = 25 m/s. **07**

Q.4 **(a)** Explain the factors that effects the choice of specific magnetic loading for synchronous machine design. **07**

(b) A 1200 kVA, 3-phase, 50 Hz, 3.3 kV, star connected, 300 RPM synchronous generator with a concentric winding has B_{av} = 0.60 Wb/m^2, ac = 35,000 A/m, gap length = 5 mm, field turns per pole = 60, short circuit ratio = 1.2, effective gap area = 0.6 times the actual area, peripheral speed = 30 m/s. Find the stator core length, stator bore diameter, turns per phase **07**

and armature mmf per pole.

OR

Q.4 **(a)** Explain the factors that effects the choice of air-gap length for synchronous machine design. **07**

(b) Estimate the diameter, core length, size and number of conductors of a 10 MVA, 11 kV, 3 phase, 50 Hz, 3000 RPM, star connected cylindrical rotor alternator with the armature winding having a 60° phase spread. Assume B_{av} = 0.55 Wb/m^2, ac = 36,000 A/m, δ = 5 A/mm^2, peripheral speed = 160 m/s. **07**

Q.5 **(a)** Prove that the output of 1-ph induction motor is two third of that of 3-ph induction motor for same loadings, number of poles, power factor and efficiency. **07**

(b) State and explain the steps for rotor design of a 1-ph induction motor. **07**

OR

Q.5 **(a)** Derive the equation of capacitance to get maximum starting torque for capacitor start 1-ph induction motor. **07**

(b) Derive the equation of leakage reactance of 1-ph induction motor. **07**

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