

Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-VII EXAMINATION – WINTER 2025

Subject Code:3170909

Date:28-11-2025

Subject Name:AC Machine Design

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.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Why circular coils are preferred in transformer winding?	03
	(b) Explain the terms “critical speed” and “runaway speed” with reference to synchronous	04
	(c) Derive the output equation of a 3-phase Induction Motor	07
Q.2	(a) Discuss the effect of “skewing” on the performance of three phase induction motor. .	03
	(b) Explain effect of change in frequency on losses of transformer.	04
	(c) List out diff. Transformer windings. Explain helical & disc type winding with application.	07
	OR	
	(c) Determine the main dimensions of a 30 kW, 3-phase, 400 V, 50 Hz, 2810 r.p.m squirrel cage induction motor having an efficiency of 0.88 and a full load power factor of 0.9. Assume: Specific magnetic loading = 0.5 Wb/m ² , specific electric loading = 25000 A/m, winding factor = 0.955. Take the rotor peripheral speed as approximately 20 m/s at synchronous speed	07
Q.3	(a) Justify the statement “Area of Yoke in a transformer is generally 15- 20% more than area of core”.	03
	(b) Explain Cogging and Crawling effect on performance of 3 phase Induction Motor	04
	(c) Calculate approximate overall dimensions for a 200 kVA, 6600/440V, 50 Hz, 3 phase core type transformer. The following data may be assumed: emf per turn=10 V maximum flux density=1.3 Wb/m ² , current density=2.5 A/mm ² , window space factor=0.3, overall height=overall width, window area = 5/4 times core area(net area of iron core), stacking factor=0.9. Use a 3 stepped core having Width of largest stamping=0.9d and Net iron area= 0.6d ² , where d=diameter of circumscribing circle.	07
	OR	
Q.3	(a) Define dispersion co-efficient of induction motor. List out effect on performance of I.M. for change of value of it.	03
	(b) Describe hunting in synchronous machine.	04
	(c) A 11kW,3 phase,6 pole 50 Hz, 220 V star connected induction motor has 54 stator slots each containing 9 conductors. Calculate the values of bar and end ring currents. The number of rotor bars is 64. The machine efficiency of 0.86 and a power factor of 0.85. The rotor mmf may be assumed of 85 percent of stator mmf. If current density is 5 A/mm ² find area of rotor bar and end ring.	07

- Q.4** (a) Explain design considerations to eliminate harmonics in synchronous machines.. **03**
- (b) Write a note on computer aided design of Induction motor. **04**
- (c) A 1250 KVA, 3-ph, 6.6 KV, salient pole alternator has the following data: **07**
 Air gap diameter = 1.6 meter, length of core = 0.45 meter, number of poles = 20,
 armature ac per meter = 28000, ratio of pole arc to pole pitch = 0.68, stator slot pitch =
 28 mm, current density in damper bars = 3amp/mm².
 Design a suitable damper winding for the machine.

OR

- Q.4** (a) Explain mitred joint in transformer design. **03**
- (b) Explain the factors that affect the choice of specific magnetic loading in case of a induction motor **04**
- (c) Find the main dimensions of a 2500 KVA, 187.5 r.p.m. , 50 Hz, 3 KV, 3-ph, **07**
 Salient pole Sy. Generator. The generator is to be vertical, water wheel type. The
 specific magnetic loading is 0.6 wb / m² , ampere conductors per meter is 34000
 A/m .
 Use circular poles with ratio of core length to pole pitch is 0.65.
 Specify the type of pole construction used if the runaway speed is about 2 times the
 normal speed.

- Q.5** (a) .Briefly discuss factors affecting determining air gap length in induction motor design. **03**
- (b) Explain significance of FEM in design problem. **04**
- (c) Explain steps for field winding design in case of salient pole synchronous machine. **07**

OR

- Q.5** (a) Explain the difference between turbo and hydro alternator in a point of view of design. **03**
- (b) Explain the factors affecting the choice of specific magnetic loading in Synchronous **04**
 Generator
- (c) List out different cooling methods of Power Transformer . also explain any two in **07**
 detail..
