

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER- VII EXAMINATION – SUMMER 2026****Subject Code:3170909****Date:05-06-2026****Subject Name: AC Machine Design****Time: 02:30 PM TO 05:00 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) Enlist various methods of Cooling of Transformer and rotating machines.	03
	(b) Write a short note on classification of insulating materials	04
	(c) What is Electrical and Magnetic Loading? Describe factors affecting Electrical and magnetic loading in electrical machines.	07
Q.2	(a) Explain: (1) Window space factor (2) Stacking factor(3) mitred joints	03
	(b) Give reasons for following: 1) Why are tapping provided on HV winding ? 2) Why cores of transformers are stepped?	04
	(c) For a transformer show that e.m.f. per turn $E_t = k\sqrt{Q}$ where $Q = \text{kVA rating}$. Explain how service condition of transformer affect the value of K	07
	OR	
	(c) Design a 250KVA, 2000/400 Volt, 50 HZ, single phase, core type oil immersed self-cooled transformer with following data: Induced emf per turn = 15 Volt Max flux density $B_m = 1.2 \text{ wb/m}^2$ Current density = 2.75 A/mm^2 Window space factor = 0.3 Height of the window H_w / width of window $W_w = 3$ Assume 3 stepped core and $A_i = 0.6d^2$, width of largest stamping $a = 0.9d$ Determine the main dimensions of the core and yoke	07
Q.3	(a) State why a turbo alternator has smaller diameter and large length but hydro alternator has larger diameter and small length	03
	(b) Explain the terms “critical speed” and “run away speed” with reference to synchronous machine	04
	(c) Define SCR applied to synchronous machine and prove that it is reciprocal of synchronous reactance.	07
	OR	
Q.3	(a) Why semi-enclosed slots are usually preferred for induction motors?	03
	(b) Explain the difference between turbo and hydro alternator in a point of view of design.	04
	(c) Determine the main dimensions of a 12 MVA, 13.8KV, 50Hz, 1500 rpm, 3 star connected synchronous generator. The additional data is given as: $B_{av} = 0.6 \text{ wb/m}^2$, $a_c = 42000 \text{ ac/m}$ and peripheral speed = 80 m/sec . Find also the maximum flux, the number of turns per phase and the number of conductors/slots if one conductor per slot is used, and. Assume $k_w = 0.955$	07

- Q.4 (a)** Discuss factors affecting the length of air gap on performance of a three phase induction motor. **03**
- (b)** Explain the effect of harmonic induction torque and harmonic synchronous torque on the performance of 3-ph induction motor. **04**
- (c)** Briefly discuss factors affecting determining air gap length in induction motor design. **07**
- OR**
- Q.4 (a)** Discuss the effect of “skewing” on the performance of three phase induction motor. **03**
- (b)** State the rules for the selection of rotor slots in 3-phase squirrel cage induction motor. **04**
- (c)** What is Dispersion coefficient? Explain the effect of Dispersion coefficient on maximum output power factor. **07**
- Q.5 (a)** Explain significance of FEM in design problem. **03**
- (b)** Explain application of FEM technique for design problems. **04**
- (c)** Write a note on computer aided design of Induction motor. Explain flowchart to find main dimensions of induction motor. **07**
- OR**
- Q.5 (a)** Explain effect of change in frequency on losses of transformer. **03**
- (b)** Explain steps for design of field winding of synchronous machine. **04**
- (c)** Draw the flowchart for finding main dimensions of core and yoke in design of a transformer **07**
