

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI EXAMINATION – SUMMER 2025****Subject Code: 3160918****Date: 28-05-2025****Subject Name: Element of Electrical 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) State properties of good insulating materials. **03**
- (b) Derive the equation of gap contraction factor for slots. **04**
- (c) Define real and apparent flux densities in the tooth of d.c. machine armature and give the difference between them. Also derive the relation between them. **07**
- Q.2** (a) Define the following terms used in armature winding design: **03**
(1) Front pitch (2) Back pitch (3) Commutator pitch
- (b) Justify the use of dummy coils and equalizer connections in DC armature windings. **04**
- (c) Find the Front pitch, back pitch, winding pitch and commutator pitch for a simplex wave wound 13 slots, 4-pole d.c armature with 13 commutator segments. Draw the winding diagram in developed form. Also draw the sequence diagram to indicate the position of brushes. Assume number of coil sides per slot = 2. **07**
- OR**
- (c) Design a mush winding for 3-phase, 4-pole and 24 slots stator. Also show winding diagram for phase R only. **07**
- Q.3** (a) Describe how to calculate the magnetizing current in a machine with distributed winding. **03**
- (b) Write short note on use of field regulator in case of DC motor and DC generator. **04**
- (c) Determine the MMF required for the airgap of a machine with open slots from the following particulars: **07**
Slot pitch= 4.3 cm, Slot opening= 2.1 cm, Gross length of core= 48 cm, Pole arc= 18 cm, Airgap length= 0.6 cm, Flux per pole= 0.056 wb, No. of ventilating ducts= 8, Width of each ventilating ducts= 1.2 cm.

Slot opening/Gap length	1	2	3	3.4	4
Carter's coefficient	0.15	0.28	0.37	0.41	0.43

OR

- Q.3** (a) Give the definition of the following terms with respect to load assessment: **03**
(1) demand factor (2) load factor (3) diversity factor
- (b) Compare mush winding and double layer winding for three phase AC machine. **04**
- (c) Calculate the steps in a 4-section rotor resistance starter for a 3-phase slip ring induction motor having full load slip 2.5%. Maximum starting current = full load current and rotor resistance/phase=0.02Ω. Neglect rotor reactance. **07**

- Q.4** (a) Explain working of three-point starter for DC motor. **03**
 (b) Discuss briefly the different types of loads with examples. **04**
 (c) Give design steps for small single-phase transformer. **07**
- OR**
- Q.4** (a) Discuss the necessity of starter in DC motors and Induction motors. **03**
 (b) Explain the working of auto transformer starter with neat sketch for squirrel cage induction motor. **04**
 (c) Give the design steps for three phase variable chock coil. **07**
- Q.5** (a) List any three guidelines for estimation of internal wiring. **03**
 (b) Discuss types of electrical wiring. **04**
 (c) Explain the grading of starting resistance for DC shunt motor starters. **07**
- OR**
- Q.5** (a) List various methods for calculating mmf required for the tapered teeth and explain any one method in detail. **03**
 (b) Compare simplex lap winding with simplex wave winding. **04**
 (c) Explain the grading of starting resistance for DC Series motor starters. **07**
