

Enrolment No./Seat No \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-VI EXAMINATION – WINTER 2025

Subject Code:3160918

Date:21-11-2025

Subject Name:Element of Electrical 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) Give analogy between Magnetic circuit and Electrical circuit.	03
	(b) Define and clearly explain the terms: (1) Stacking Factor (2) Gap contraction factor for slots and ducts	04
	(c) Explain design procedure of a small single phase transformer.	07
Q.2	(a) Why the starting current of 3-phase induction motor is so high? What are consequences of it?	03
	(b) What are the various types of starter used for starting squirrel cage Induction motor? Explain one of starter in brief.	04
	(c) The power input to the rotor of 415 volt, 3 phase slip ring induction motor is 39 KW. The total full load copper losses are 1200 Watt. The rotor resistance per phase is 0.18 ohm. Assume maximum starting current is not to exceeding 1.2 times full load current. Workout the steps of a 4 section rotor resistance starter.	07
	<b>OR</b>	
	(c) Design a suitable 8 section starter for a 10 kw, 250 v, 1000 rpm dc shunt motor from the following data: Armature circuit resistance = 0.5 ohm Full load efficiency = 0.8	07
Q.3	(a) What is Carter's fringing curve? Why it is used.	03
	(b) Define real and apparent flux densities in the tooth of d.c. machine armature and give difference between them.	04
	(c) Derive an expression for the mmf required for the airgap in the case of slotted armature.	07
	<b>OR</b>	
Q.3	(a) For what size of motors, D.O.L. starter is generally used? Is there any device provided in D.O.L. starter to reduce starting current?	03
	(b) Explain the function and necessity of field regulator in case of d.c. shunt generator.	04
	(c) Discuss the design procedure of 3-phase variable choke coil. Also draw the sketch of whole arrangement.	07

- Q.4 (a)** Define the following terms in illumination scheme: **03**  
 (1) Luminous flux (2) Lumens (3) Illumination (4) Lux
- (b)** State the rules for electrical wiring as per IS. **04**
- (c)** A residential building has following load connected in it. **07**  
 Incandescent lamps 60W each, 02 Nos. 6hrs/day Fluorescent lamps 40W each, 04 Nos. 6hrs/day Fans 60W each, 06 Nos. 5hrs/day Electric cooker 1.5 KW each, 01 Nos. 4hrs/day Electric geyser 1.5 KW each, 01 Nos. 3hrs/day.  
**Calculate the total cost of electrical energy for 30 days, at the rate of Rs. 7 per unit.**

**OR**

- Q.4 (a)** State the material used for loading rheostat and give its desirable properties. **03**
- (b)** Give the classification of electrical loads with examples. **04**
- (c)** A room of size 4 m X 3 m is required to be provided with lamp, fan, tube light and one 5A 3-pin socket outlet. Each of the points is controlled with their respective switches installed in one switch board. Assumes in PVC wiring system. No main switch is to be provided as the entry of the sub-circuit is from nearby room. Do the following: (1) Mark the location of electrical points and draw the installation plan. (2) Draw the wiring and schematic diagram. (3) Calculate the length of PVC conduit. **07**

- Q.5 (a)** Differentiate between single layer and double layer winding. **03**
- (b)** Why equalizer connections are not necessary in case of wave winding. **04**
- (c)** Calculate the front pitch, back pitch and winding pitch for a simplex lap wound 24 slots, 4 pole d.c. armature. Make the winding table and draw the winding diagram in developed form. **07**

**OR**

- Q.5 (a)** Define the following terms used in armature winding design: (1) back pitch (2) Commutator pitch (3) winding pitch **03**
- (b)** Compare lap and wave winding. **04**
- (c)** Develop a mush winding for a 3-phase, 4 pole, 16 slots armature. **07**

\*\*\*\*\*