Enrolment No./Seat No_____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2024**

**Subject Code:3160918 Date:22-05-2024**

**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)** | Compare Simplex lap winding & Simplex wave winding. | **03** |
| | **(b)** | Give the classification of insulating materials on the basis of maximum permissible temperature rise and Physical state. | **04** |
| | **(c)** | Explain design procedure of a small single phase transformer. | **07** |
| **Q.2** | **(a)** | List various methods for calculating the mmf required for tapered teeth & Explain any one. | **03** |
| | **(b)** | Explain the function and necessity of field regulator in case of d.c. shunt generator. | **04** |
| | **(c)** | Design a suitable 5 section starter for a 7.5 kW, 250 V, 1000 rpm DC shunt motor from the following data:<br>Maximum starting torque = 1.5 times the full load torque<br>Armature circuit resistance = 0.5 Ω<br>Full load efficiency = 85% | **07** |
| | | **OR** | |
| | **(c)** | Find the resistance of each section of a rotor resistance starter of a slip-ring induction motor having a full load slips of 3%. Use 9 studs. Assume maximum starting current = full load current. Also determine the slip at various studs. | **07** |
| **Q.3** | **(a)** | Differentiate between single layer and double layer winding. | **03** |
| | **(b)** | Define and explain the progressive and retrogressive lap windings. | **04** |
| | **(c)** | A salient pole dc machine has a core length of 0.32 m including four ducts of 10mm each, pole arc 0.19 m, slot pitch 65.4 mm, slot opening 5 mm and a flux per pole 52 mWb. Assume Carter's coefficient of 0.18 for opening /gap = 1 and 0.28 for opening/gap = 2, Calculate the mmf required for the air gap. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Define the following terms used in armature winding design: (1) back pitch (2) Commutator pitch (3) winding pitch | **03** |
| | **(b)** | Classify various types of AC armature windings. | **04** |
| | **(c)** | Discuss the design procedure of 3-phase variable choke coil. Also draw the sketch of whole arrangement. | **07** |
| **Q.4** | **(a)** | Explain importance of estimation. | **03** |
| | **(b)** | What are the types of wiring system? Explain any one in brief | **04** |

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| | **(c)** | Develop a mush winding for a 3-phase, 4 pole, 24 slots armature. | **07** |

**OR**

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| **Q.4** | **(a)** | Write steps to estimate the cost of electrical wiring installation for building. | **03** |
| | **(b)** | Define wiring diagram and schematic diagram. Explain using suitable example. | **04** |
| | **(c)** | Calculate 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** |
| **Q.5** | **(a)** | State the rules for electrical wiring as per IS. | **03** |
| | **(b)** | Discuss briefly the different types of loads with examples | **04** |
| | **(c)** | A residential building has following load connected in it. Incandescent lamps 100W 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 KW each, 01 Nos. 3hrs/day Calculate the total cost of electrical energy for 30 days, at the rate of Rs. 5 per unit. | **07** |

**OR**

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| **Q.5** | **(a)** | Discuss the factors considered for selection of type of electrical wiring. | **03** |
| | **(b)** | What do you mean by “dummy coil”? What is its application? Also explain the use of equalizer connections in d.c. armature winding. | **04** |
| | **(c)** | Describe and compare the different systems of wiring used for domestic installations | **07** |

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