Enrolment No./Seat No_____

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: (1) Front pitch (2) Back pitch (3) Commutator pitch	**03**
	(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: 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.	**07**

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: (1) demand factor (2) load factor (3) diversity factor	**03**		
	(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**

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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: Maximum starting torque = 1.5 times the full load torque Armature circuit resistance = 0.5 Ω 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**

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

OR

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

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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GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2023

Subject Code:3160918 Date:12-07-2023

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)**	Explain working of No Volt Coil and Overload Release coil in terms of three point starters for DC motor	**03**
	(b)	Why is starter required in case in DC motors? Explain construction of three point starter in details.	**04**
	(c)	Describe design procedure for core and windings of a small single-phase transformer.	**07**
Q.2	**(a)**	Discuss the factors to be consider for exact calculation of MMF for Teeth.	**03**
	(b)	Write a Short Note on: Real and apparent flux density.	**04**
	(c)	Calculate the air gap length of a dc machine from the following particulars: gross length of core = 0.12 m; number of ducts = one and is 10 mm wide ; slot pitch = 25 mm ; slot width = 10 mm carter's coefficient for the slots and ducts = 0.32 ; gap density at pole center = 0.7 wb/m^2 , field mmf per pole = 3900 A, mmf required for iron parts of magnetic circuit = 800 A.	**07**
		OR	
	(c)	Classify the different insulating materials on the basis of operating temperature	**07**
Q.3	**(a)**	Define: 1) Front Pitch 2) Back Pitch 3)Commutator Pitch	**03**
	(b)	Give the comparison between Lap winding and Wave winding.	**04**
	(c)	Write a detailed note on various types of AC armature winding and explain any one with example	**07**
		OR	
Q.3	**(a)**	What is difference between Full pitch winding and chorded winding.	**03**
	(b)	Explain the use of dummy coils and equalizer connections in d.c. armature windings. Also explain why equalizer connections are not necessary in case of wave windings?	**04**
	(c)	Find and give comments whether the following lap windings are symmetrical or not: (i) 4-pole, 22-slots, 22 coils (ii) 6-pole, 19-slots, 19 coils	**07**
Q.4	**(a)**	Define: 1) Connected load 2) Demand factor 3) Load factor	**03**
	(b)	Explain the selection of permissible voltage drop and conductor size during design of an electric wiring.	**04**

	(c)	A Domestic building has (i) 10 light points of 40 W each, burning 4 hours a day;(ii) 04 fan points of 70 W each, running 2 hours a day;(iii) a plug point for a 1500 W heater, used 1 hours a day;(iv) One television of 120 W, used 6 hours a day; and (v) 0.5 hp pump, running 1 hours a day. Calculate (a) total connected load in KW (b) maximum possible current (c) daily consumption of energy (d) monthly bill if one unit cost is Rs. 5.00	**07**
		OR	
Q.4	**(a)**	Which materials are required for installation of service connection?	**03**
	(b)	What is electric load? Give examples and classify different types of loads.	**04**
	(c)	Explain types of wiring.	**07**
Q.5	**(a)**	Discuss in brief points to be considered while determination of the size of conductor.	**03**
	(b)	Draw a wring diagram and schematic for light and fan circuit.	**04**
	(c)	Explain the installation plan, wiring diagram and single line diagram for electric wiring based on a given load. Also give the rules for deciding the number of sub circuits and power circuit.	**07**
		OR	
Q.5	**(a)**	How can you determine the number of sub circuits, rating of main switch and distribution board?	**03**
	(b)	List out the essential elements of estimating and costing before starting any electrical project.	**04**
	(c)	Explain the factors to be considered while selecting the type of wiring.	**07**

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022

Subject Code:3160918 Date:08/06/2022

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)**	Give the comparison between Lap winding and Wave winding.	**03**
	(b)	Explain the use of dummy coils and equalizer connections in d.c. armature windings. Also explain why equalizer connections are not necessary in case of wave 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**
Q.2	**(a)**	Define the real and apparent flux densities in the tooth of d.c machine armature.	**03**
	(b)	Give the classification of insulating materials used in electrical machines based on their thermal stability as per IS along with examples.	**04**
	(c)	Explain various methods for calculating the mmf required for tapered teeth.	**07**
		OR	
	(c)	Determine the air gap length of a D.C. machine for following data. gross core length=0.10m, no of ducts=01, width of duct=10mm, slot pitch=24mm, slot width=12mm, caters coefficient for slot and ducts=0.3, gap flux density at pole centre=0.65wb/m^2, field MMF per pole=3800A, mmf required for iron part of magnetic circuit=600A.	**07**
Q.3	**(a)**	Write a short note on field regulator.	**03**
	(b)	Explain the working of star delta starter with neat sketch for squirrel cage induction motor.	**04**
	(c)	Prove that the section resistances of d.c. shunt motor starters are in geometrical progression.	**07**
		OR	
Q.3	**(a)**	Draw different types of stampings used for making the core of 1-Ø transformer.	**03**
	(b)	What is choke coil? State the function of chokes used in Tube-lights.	**04**
	(c)	Give the design steps for designing the single phase transformer.	**07**
Q.4	**(a)**	Explain the factors to be considered while selecting the type of wiring.	**03**

	(b)	Explain the load assessment and permissible voltage drop for electrical installation.	**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**
		OR	
Q.4	**(a)**	Discuss in brief points to be considered while determination of the size of conductor.	**03**
	(b)	Discuss the rules for electrical wiring as per IS standard.	**04**
	(c)	Explain the installation plan, wiring diagram and single line diagram for electric wiring based on a given load. Also give the rules for deciding the number of sub circuits and power circuit.	**07**
Q.5	**(a)**	Why AC system is preferred over DC system for transmission and distribution of electrical energy?	**03**
	(b)	What is control panel? State and explain the various components/devices used in the control panel.	**04**
	(c)	Find the diversity factor of a power station which supplies the following loads: Load A : Motor load of 150 KW between 10 a.m. to 7 p.m. Load B : Lighting load of 50 KW between 7 p.m. to 11 p.m. Load C : Pumping load of 60 KW between 3 p.m. to 10 a.m.	**07**
		OR	
Q.5	**(a)**	Define load factor, demand factor and diversity factor	**03**
	(b)	What is electric load? Giving examples classify different types of load.	**04**
	(c)	Explain with neat sketches, the different systems of wiring used for domestic installations.	**07**

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