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 stating 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**
		OR	
	(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**
		OR	
Q.3	**(a)**	For what size of motors, D.O.L. starter is generally used? Is there any devise 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: (1) Luminous flux (2) Lumens (3) Illumination (4) Lux	03
	(b)	State the rules for electrical wiring as per IS.	04
	(c)	A residential building has following load connected in it. 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**.	07

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

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GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2024

Subject Code:3160918   **Date:02-12-2024**
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)**	List the properties of good insulating materials?	03
	(b)	Differentiate single layer and double layer winding.	04
	(c)	Explain step by step design procedure of a small single-phase transformer.	07
Q.2	**(a)**	Define: (1) back pitch (2) pole pitch (3) winding pitch	03
	(b)	Discuss function & necessity of field regulator in case of DC shunt motor.	04
	(c)	Design and develop a mush winding for a 6-pole, 36 slots, 3-phase stator of ac machine.	07
		OR	
	(c)	Find the Front pitch, back pitch, winding pitch and commutator pitch for a simplex wave wound 15 slots, 4-pole d.c armature with 15 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.3	**(a)**	Discuss function & necessity of field regulator in case of DC series motor.	03
	(b)	Explain the use of dummy coils and equalizer connections in d.c. armature windings.	04
	(c)	Design a suitable 8 section starter for a 3.7 KW, 250 V, 1000 rpm D.C. shunt motor from the following data: Maximum starting torque = 1.5 times Full load torque, Armature circuit resistance = 1Ω, Full load efficiency = 0.82, Field current=1.2A	07
		OR	
Q.3	**(a)**	Discuss B-H curve in magnetic circuit	03
	(b)	Write comparison between simplex lap and simplex wave winding applied to dc armature.	04
	(c)	Design a suitable 4 section rotor resistance starter for a 3-phase induction motor having full load slip 2.5%. Maximum starting current=full load current and rotor resistance/phase=0.025Ω	07
Q.4	**(a)**	List the factors that should be considered while selecting the type of wiring system?	03
	(b)	State and explain methods for calculating MMF required for tooth in DC machine.	04
	(c)	Explain steps for design of single-phase variable chock coil.	07
		OR	
Q.4	**(a)**	State the rules for electrical wiring as per IS.	03
	(b)	What is Carter's fringing curve? Why it is used.	04
	(c)	Discuss the different types of loads with examples.	07
Q.5	**(a)**	List the benefits and advantages of soft starter?	03

	(b)	State and explain the various components/devices used in the control panel.	**04**
	(c)	Explain with neat sketches, the different systems of wiring used for domestic installations.	**07**

OR

Q.5	**(a)**	Define: (1) maximum demand (2) load factor (3) diversity factor	**03**
	(b)	Explain the importance of (a) current carrying capacity and (b) voltage drop while determining the size of conductor.	**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**

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GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI (NEW) EXAMINATION – WINTER 2023

Subject Code:3160918   **Date:11-12-2023**
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)**	Write comparison between simplex lap and simplex wave winding applied to dc armature.	**03**
	(b)	Give classification of insulating material used in electrical machines	**04**
	(c)	Explain steps for design of single phase variable chock coil.	**07**
Q.2	**(a)**	Define the following terms used in armature winding design: (1) back pitch (2) Commutator pitch (3) winding pitch	**03**
	(b)	Discuss B-H curve in magnetic circuit	**04**
	(c)	Determine the air gap length of DC Machine from the following data: Gross core length=0.1 meter, Number of ducts=1, Width of duct=10 mm, Slot pitch= 24 mm, Slot Width= 12mm, Carter's coefficient for slots and ducts=0.3, Gap flux density at pole center=0.65 T, Field MMF per pole=3800 A, MMF required for iron parts of magnetic circuit= 600 A.	**07**

OR

	(c)	What is real and apparent flux density in the tooth of DC machine armature? Give difference between them & also derive relation between them.	**07**
Q.3	**(a)**	Discuss function & necessity of field regulator in case of DC shunt motor.	**03**
	(b)	Why starter is necessary for starting 3- phase induction motor?	**04**
	(c)	Design a suitable 8 section starter for a 14.92 KW, 250 V, 1000 rpm, DC shunt motor from following data. Maximum starting torque= Full load torque, Armature circuit resistance=0.4 Ω, Full load efficiency= 0.85	**07**

OR

Q.3	**(a)**	Differentiate single layer and double layer winding.	**03**
	(b)	Explain the significance of dummy coils and equalizer connections in DC armature windings.	**04**
	(c)	Write steps for designing small single phase Transformer.	**07**
Q.4	**(a)**	What are the factors that should be considered while selecting the type of wiring system?	**03**
	(b)	What is electric load? How will you classify loads?	**04**
	(c)	The domestic load in residential building is used in following manner: Fluorescent lamps, 55W each, 4 Nos. 6 Hrs/day Fans 70W each, 4 Nos. 8 Hrs/day Refrigerator of 3000W, 12 Hrs./day Heater of 1000W, 2 Hrs./day Television of 150W, 8 Hrs./day Calculate : (a) connected load (b) daily load factor (c) total cost of energy for 30 days, at the rate of Rs. 3/Unit	**07**

OR

Q.4	**(a)**	State the rules for electrical wiring as per IS.	**03**
	(b)	What is control panel? State and explain the various components/devices used in the control panel.	**04**
	(c)	Explain with neat sketches, the different systems of wiring used for domestic installations.	**07**
Q.5	**(a)**	What is soft starter? What are the benefits and advantages of soft starter?	**03**
	(b)	Discuss Leakage reactance calculation for various types of slots for DC machines.	**04**
	(c)	What is finite element method (FEM) and finite element analysis (FEA)? Give advantages of FEA.	**07**

OR

Q.5	**(a)**	Give the definition of the following terms with respect to load assessment: (1) maximum demand (2) load factor (3) diversity factor	**03**
	(b)	State various methods for calculating MMF required for teeth in DC machine & describe any one method for calculating MMF required for teeth in DC machine.	**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**

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GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI(NEW) EXAMINATION – WINTER 2022

Subject Code:3160918   **Date:16-12-2022**
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)**	List the properties of good insulating materials?	**03**
	(b)	Write short note on field regulator.	**04**
	(c)	Explain steps for design of single phase variable chock coil.	**07**
Q.2	**(a)**	Define the following terms used in armature winding design: (1) back pitch (2) Commutator pitch (3) winding pitch	**03**
	(b)	Explain the importance of (a) current carrying capacity and (b) voltage drop while determining the size of conductor.	**04**
	(c)	Design and develop a mush winding for a 4-pole, 24 slots, 3-phase stator of ac machine.	**07**
		OR	
	(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.3	**(a)**	Compare closed windings and open windings.	**03**
	(b)	Explain the use of dummy coils and equalizer connections in d.c. armature windings.	**04**
	(c)	Design a suitable 4 section rotor resistance starter for a 3-phase induction motor having full load slip 2.5%. Maximum starting current=full load current and rotor resistance/phase=0.025Ω	**07**
		OR	
Q.3	**(a)**	Differentiate single layer and double layer winding.	**03**
	(b)	What are the various types of starter used for stating squirrel cage Induction motor? Explain one of starter in brief.	**04**
	(c)	Design a suitable 8 section starter for a 14.92 KW, 250 V, 1000 rpm D.C. shunt motor from the following data: Maximum starting torque = Full load torque, Armature circuit resistance = 0.4 ohm, Full load efficiency = 0.85	**07**
Q.4	**(a)**	Define and clearly explain the terms: (1) Stacking Factor (2) Gap contraction factor for slots and ducts	**03**
	(b)	Discuss the necessity of starter in DC motors and Induction motors.	**04**
	(c)	Define real and apparent flux densities in the tooth of DC machine armature and give the difference between them. Also derive the relation between them.	**07**
		OR	
Q.4	**(a)**	What is Carter's fringing curve? Why it is used.	**03**

(b)	State and explain methods for calculating MMF required for tooth in DC machine.	**04**
(c)	Explain design procedure of a small single phase transformer.	**07**

Q.5 (a)	Draw different types of stampings used for making core of small transformer.	**03**
(b)	Generating station has connected load of 50 MW and maximum demand of 35 MW. The units generated 75×10^6 per annum. Calculate (1) Demand factor (2) Load factor.	**04**
(c)	Discuss the different types of loads with examples.	**07**

OR

Q.5 (a)	State the rules for electrical wiring as per IS.	**03**
(b)	Discuss the significance of (i) Space to height ratio (ii) Utilization factor and (iii) Depreciation factor in the design of lighting system.	**04**
(c)	A residential building has following load connected in it : Incandescent lamps 100W each, 02 Nos. 5hrs/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,	**07**

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