Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(New) • EXAMINATION – WINTER 2016

Subject Code:2150904 Date:02/12/2016

Subject Name:Elements 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.**

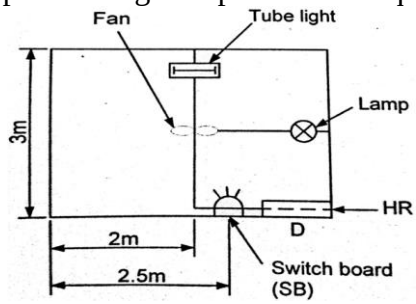
Q.1		**Short Questions**	**14**
	1	Explain stacking factor in short.	01
	2	Maximum distortion of flux occurs at which portion of the teeth?	01
	3	Define: Space factor	01
	4	What is the Importance of air gap in choke coil design?	01
	5	Define: Starter related to motor.	01
	6	Write the function of NVC (No Volt Coil) for three point starter.	01
	7	Equalizer connection is used to balance _____.	01
	8	Dummy coils are used to _____ balance.	01
	9	What is electric load?	01
	10	Size of conductor is decided based on _____ capacity.	01
	11	The permissible voltage drop in lightning circuit is _____% of supply voltage plus _____ volt.	01
	12	3-pin, 15 Amp socket output are to be used in _____ sub circuits.	01
	13	Switch board is to be installed at a height of _____ meter from the floor.	01
	14	In any building _____ and _____ wiring are to be kept separate.	01
Q.2	**(a)**	Explain the working of Star Delta Starter with neat sketch for squirrel cage induction motor.	**03**
	(b)	Derive an expression for "Gap contraction factor" in electrical machines.	**04**
	(c)	Give complete procedural steps for designing single phase variable choke coil with all assumptions. Also draw the complete layout of single phase variable choke coil.	**07**
		OR	
	(c)	Calculate the apparent flux density at a particular section of a tooth from the following data: Tooth width = 12 mm; slot width = 10 mm; gross core length = 0.32 m; number of ventilating ducts = 4, each of 10 mm wide; real flux density = 2.2 Wb/m^2; permeability of teeth corresponding to real flux density = 31.4×10^{-6} H/m; stacking factor = 0.9.	**07**
Q.3	**(a)**	Define the following terms used in armature winding design: (i) Back pitch (ii) Front pitch (iii) Winding pitch	**03**
	(b)	Design a double layer fractional slot lap winding for a stator of a 3-phase AC machine having 4 poles and 18 slots. Prepare the table for allotment of slots for various phases. Do not show the winding diagram.	**04**
	(c)	Calculate the front pitch, back pitch and winding pitch for a simplex lap wound 16 slots, 4 pole DC armature. Make the winding table and draw the winding diagram in developed form. Assume 2 coil sides/slot.	**07**
		OR	
Q.3	**(a)**	Explain the conditions under which short pitch winding is used?	**03**
	(b)	Explain the following terms related to AC winding: (i) Distribution factor (ii) Pitch factor	**04**
	(c)	Design a Mush winding for a stator of a 3-phase AC machine having 4 poles and	**07**

36 slots. Also show the winding diagram for R-phase only.

Q.4 **(a)** How can you determine the number of sub circuits, rating of main switch and distribution board? **03**

(b) Discuss in brief points to be considered while determination the size of conductor. **04**

(c) Figure shows the plan of a single room of size 4 m x 3 m. The room is provided with lamp, fan tube light. Draw the wiring and schematic diagram. Calculate the length of PVC conduit pipe and length of phase wire required. **07**



OR

Q.4 **(a)** How will you classify the electric loads? Give examples. **03**

(b) State the rules for electrical wiring as per IS. **04**

(c) The domestic load in residential building is used in the following manner: Fluorescent lamps 55 W each, 4 Nos., 6 Hrs./day ; Fans 70 W each, 4 Nos., 8 Hrs./day ; Refrigerator of 300 W, 12 Hrs./day ; Heater of 1000 W, 2 Hrs./day ; Television of 150 W, 8 Hrs./day. **07**

Calculate: (a) Connected load and (b) Daily load factor.

Q.5 **(a)** Give the definition of the following terms with respect to load assessment: **03**

(i) Demand factor (ii) Load factor (iii) Diversity factor.

(b) Discuss the factors should be considered while selecting type of a wiring system. **04**

(c) Determine the size of cable required to carry the maximum current of 40 amperes. It is given that the length of cable is 300 meter and the allowable voltage drop is 5% of declared supply voltage. Declared voltage is (i) 400 volt DC & (ii)3-phase 400 volt AC. Use only the given table in the question paper. **07**

OR

Q.5 **(a)** Describe how to calculate the magnetizing current in a machine with distributed winding. **03**

(b) Compare progressive and retrogressive winding. **04**

(c) Derive the steps for calculate the starter resistance for D.C shunt motor. **07**

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Table: Current rating of Aluminium conductor 2-core, 3-core or 4-core cables

Size of Conductor		One twin core cable D.C. or single phase A.C.		One three core or four core cable balance 3-phase	
Nominal area (mm2)	Number and diameter of wire (mm)	Current rating (Amp.)	Approximate length of run for one volt drop (meter)	Current rating (Amp.)	Approximate length of run for one volt drop (meter)
1.5	1/1.40	10	2.3	7	3.7
2.5	1/1.80	15	2.5	11	3.9
4.0	1/2.24	20	2.9	14	4.8
6.0	½.80	277	3.4	19	5.5
10.0	1/3.55	34	4.2	24	6.8
16.0	7/1.70	43	5.3	30	8.7
25.0	7/2.24	59	6.6	42	10.8
35.0	7/2.50	69	7.1	48	11.7
50.0	7/3.00	91	7.7	62	13.1