

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2150904

Dates:12/05/2017

Subject Name: ELEMENTS 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.

MARKS

Q.1	Short Questions	14
1	Compare between closed winding and open winding	01
2	Why excessive insulation is harmful to coil?	01
3	Define: field form factor	01
4	Differentiate between front pitch and back pitch	01
5	Is it possible to have an integral slot winding with 3-phase, 6-pole & 48 slots ? Justify the answer with explanation.	01
6	What do you mean by carter's gap co-efficient in magnetic circuit.	01
7	When will you recommend radial ventilating duct?	01
8	Define the term Demand factor	01
9	What do you mean by notation NO & NC in starter Panels ?	01
10	Define : stacking factor	01
11	Why A.C system is preferred over D.C system for transmission and distribution of electrical energy.	01
12	In any building -----and-----wiring are to be kept separate.	01
13	Why equalizer connection is necessary for armature winding of D.C machine with lap winding?	01
14	Explain gap contraction factor in short	01
Q.2	(a) In residential house, the following are the loads connected i)55W fluorescent tubes- 4 Nos., switched on for 4 hours in a day ,ii) 60W incandescent lamps-2 Nos., switched on for 2 hours in a day , iii) 70W ceiling fan- 3 Nos., switched on for 12 hours a day, iv)225W refrigerator, switched on for 10 hours a day , v) 200W washing machine, switched on for 1 hours a day ,vi)150W T.V., switched on for 6 hours a day,If the cost of electricity is Rs.4/unit, what will be the monthly charges?	03
	(b) Define 'Real' and 'Apparent' flux densities in tooth of D.C machine armature and give difference between them. Also derive relation between them	04
	(c) Draw a developed diagram of a 4-pole, 15 slot double layer simplex wave winding for a D.C generator, also indicate the position of brushes. OR	07
	(c) The class room of engineering college of size 9 m X 7m X 4m is to be provided with electrical installation suitably in PVC conduit system of wiring. The entry of the circuit is from the adjoining room. You are required to , a) Prepare an installation plan. b)Draw the wiring diagram, c)Decide the number of sub-circuits.	07
Q.3	(a) Explain that for a given frequency and max flux density , the hysteresis loss in soft magnetic material is less than in hard magnetic material	03
	(b) Write short note on field regulator.	04
	(c) Deduce an expression for Eddy current loss in a thin lamination and show that it depends upon the thickness of lamination and resistivity of material. OR	07
Q.3	(a) Explain why the MMF per pole of 3-phase induction motor is not estimated, considering the magnetic path through pole centers.	03

- (b) Calculate the core loss per kg in a specimen of alloy sheet steel subjected to a max flux density of 0.78 wb/m^2 at frequency of 50Hz using 0.5mm thick plates. Resistivity $0.25 \mu\Omega\text{-m}$, specific gravity 7.8, hysteresis loss $400 \text{ J/m}^3\text{- cycle}$ at the given flux density. **04**
- (c) List procedural steps for designing single phase variable choke with all assumptions. Also draw layout of single phase variable choke coil. **07**
- Q.4** (a) Discuss the advantages and disadvantages of short pitch winding. **03**
- (b) State the rules for Electrical Wiring as per IS. **04**
- (c) Calculate the MMF required for the air gap of a machine having core length = 0.32m including 4 ducts of 10mm each, pole arc = 0.19m, slot pitch = 65.4 mm, slot opening = 5mm, air gap length = 5mm, flux per pole = 52 mwb. Given carter's co-efficient is 0.18, for opening/gap = 1 and 0.28 for opening/gap = 2 **07**
- OR
- Q.4** (a) Calculate the steps in a 5-section rotor starter for a 3-phase induction motor max starting current = full load current, full load slip = 1.8% with ring shorted, rotor resistance per phase = 0.015. **03**
- (b) Write a short note on types of A.C armature windings. **04**
- (c) Explain mush winding for 3-phase A.C machine and design it for 4 poles, 36 slot 3-phase A.C machine. Also show winding diagram for R-phase only **07**
- Q.5** (a) Explain the working of star delta starter with neat sketch for squirrel cage induction motor. **03**
- (b) A laminated iron cylinder is rotated in a given magnetic field, the iron loss is 240W at 600 RPM and 300 W at 700 RPM. Find the loss if the laminations are made twice as thick and the flux density increased by 20% at a speed of 800 RPM. Assume Steinmetz co-efficient as 1.6. **04**
- (c) Discuss design procedure of single phase small transformer **07**
- OR
- Q.5** (a) What are different systems of wiring used for domestic installation? **03**
- (b) A 3-phase, 3 wire connection is to be given to a premises in which an induction motor of 20 H.P is to be installed. For this purpose, a wire of 30 meters run from the main switch is required. Determine the size of the wire to be used, if supply voltage is 415 volts. **04**
- (c) What is control panel? State and explain the various components/devices used in the control panel. **07**

Table: Current rating of Aluminum 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 (mm ²)	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	27	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