

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER- V • EXAMINATION – WINTER 2016**

**Subject Code: 150904****Date: 17/11/2016****Subject Name: Elements of Electrical Design****Time: 10:30AM – 01:00PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) With neat sketch explain power and control circuit diagram of a star delta starter. **07**  
 (b) Design a suitable 7 section starter for a 16 kW, 220 volt, 1000 rpm d.c. shunt motor. **07**  
 Given:  
 Max torque = Full load torque.  
 Armature resistance 0.48 ohm.  
 Efficiency = 87%.  
 Also determine the speeds at which notching takes place.

- Q.2** (a) Prepare winding layout for a d.c. machine having 24 armature slots, 4 pole simplex lap winding. **07**  
 (b) For a d.c. series motor starter, with usual notations prove that: **07**

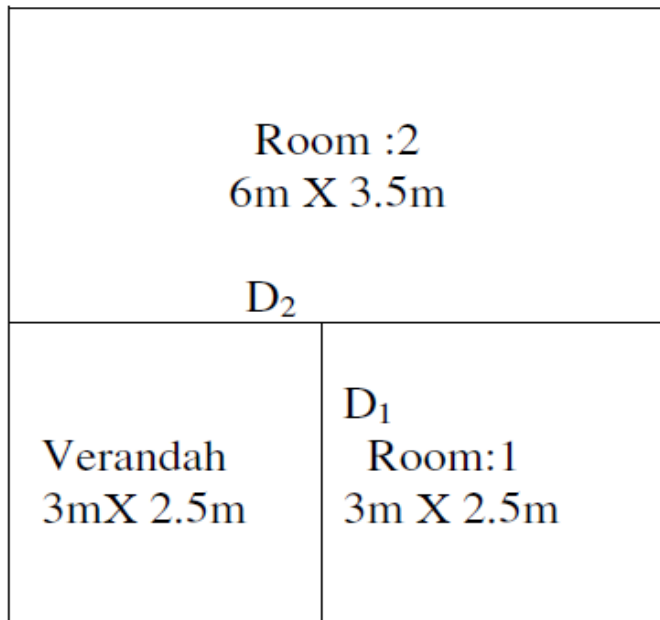
$$r_m = R_1 \left[ 1 - \left( \frac{1 - \delta^n}{1 - \delta} \right) (\beta - \delta) \right]$$

**OR**

- (b) With suitable diagram explain the terms with respect to a.c. armature winding. **07**  
 (1) Phase spread  
 (2) Fractional slot winding  
 (3) Coil span  
 (4) Short pitch coils.
- Q.3** (a) What is electric power supply system? With the help of a single line diagram explain typical ac power supply system. **07**  
 (b) An illumination of 200 lumens/square meter is required in a seminar hall of 30 meter x 25 meter size. Determine no. of lamps of 100 watts are required and their positions. **07**  
 Given:  
 Depreciation factor = 0.75  
 Co efficient of utilization = 0.5  
 Waste light factor = 1.3  
 Efficiency of lamp = 16 lumens/watt

**OR**

- Q.3** (a) Briefly explain Load factor and diversity factor. **04**  
 (b) A small office of size 6m x 6m is required to be provided with electrical connections in PVC wiring system suitable for 230 V, 50 Hz, 1-phase ac supply. The details of electrical points to be installed are given below. **10**  
 Room 1 – 1 fluorescent lamp, 1 fan and 2 plug socket outlet.  
 Room -2 – 2 fluorescent lamp, 2 fan, 3 socket outlet.  
 Verndah: 1 fan 1 lamp



**D<sub>1</sub>,D<sub>2</sub>-Doors**

Determine following:

- (1) Mark location of electrical points and draw installation plan.
- (2) Estimate load and decide number of sub circuits.
- (3) Calculate length of PVC conduit.
- (4) Draw wiring diagram.

- Q.4** (a) Explain design procedure of a small single phase transformer. **07**  
 (b) Explain four fundamental equation used in design of electromagnet. **07**

**OR**

- Q.4** (a) Explain how the design procedure of a Welding transformer differs from a normal transformer. **07**  
 (b) Explain design process electromagnet coil of a small circular magnet. **07**

- Q.5** (a) Write note on “Real and apparent flux densities.” **07**  
 (b) Explain following terms clearly: **07**  
     (1) Stacking factor  
     (2) Field form factor  
     (3) Carter’s Coefficient

**OR**

- Q.5** (a) Determine the mmf required for the air gap of a machine having following data: **07**  
 core length= 300 mm including three ducts of 10 mm width each,  
 pole arc = 200 mm,  
 slot pitch = 66 mm,  
 slot opening = 5 mm,  
 flux per pole = 0.05 Wb,  
 length of air gap = 5 mm,  
 Assume Carter’s co efficient of 0.18 and 0.28 for opening/gap of 1 and 2 respectively.  
 (b) Explain how MMF for tapered teeth can be calculated? **07**

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