

GUJARAT TECHNOLOGICAL UNIVERSITY**B.E. Sem-Vth Examination December 2010****Subject code: 150904****Subject Name: Elements of Electrical Design****Date: 18 /12 /2010****Time: 03.00 pm - 05.30 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** (a) A DC series motor operates at 250 Volts. It has an armature resistance including series field winding resistance 0.5 ohm. If the maximum starting current is limited to 50 amps and the first and the third resistance sections are 1.35 ohm and 0.98 ohm respectively, calculate the starter design constants alpha, beta and gamma. Also calculate the last resistance section. **07**
- (b) Explain the design procedure to design a field regulator to change the Emf generated in a self excited dc generator. **07**

- Q.2** (a) What is Carter's coefficient? How does it help in estimation of mmf in case of a slotted armature? What are the expressions to be used for estimation? **07**
- (b) A salient pole dc machine has a core length including four ducts of 10 mm width 0.32m, Pole arc 0.19 m, slot pitch 65.4 mm, slot opening 5 mm, airgap length 5 mm, and a flux per pole 0.052 Wb. Assume Carter's coefficient of 0.18 and 0.28 for opening/gap ratio of 1 and 2 respectively, calculate the mmf required for the airgap. **07**

OR

- (b) A laminated iron cylinder is rotated in a uniform magnetic field. The iron loss is 240 watt at 600 rpm and 300 watt at 700 rpm. Separate hysteresis and eddy current loss at both the speeds. Also calculate the hysteresis loss at 700 rpm and 25% more stronger field. **07**
- Q.3** (a) Give at least three differences between a flat faced armature type electromagnet and a horse shoe type electromagnet. **07**
- (b) A horse shoe type electromagnet is produced from a bar of wrought iron 50 cms long having a cross section area of 5 cm². Exciting coil of 250 turns are placed on each limb and are connected in series. Find the exciting current to lift a load of 50 kg. assuming that the load has negligible reluctance and makes a close contact with the coil. Assume relative permeability 740 for iron. **07**

OR

- Q.3** (a) An E-I pair of laminations is used to construct a small single phase transformer with the following standard dimensions. **07**
A=20 mm, B=60 mm, C=50 mm, D=E=10 mm, The lamination thickness is 0.33 mm. If the transformer is to be operated at 230 volts, 50 hertz, single phase ac supply with the maximum flux density 1.0 Wb/m², calculate the number of primary winding turns if the gross area of the central limb is 400 mm². Assume stacking factor 0.95.

- (b) Derive expressions for the weight of active iron and copper in case of a single phase transformer in terms of core dimensions and winding diameters. 07
- Q.4** (a) Explain the design procedure for electrification of a small industry having a load of about 50 KW and a shade area of about 1000 metre². 07
- (b) A middle class gentleman has following in his newly built single storey house. 07
 Drawing Room, Bed room, Kitchen, Warandah, Reading room, Kitchen Bathroom, Toilet and some open space at the back. Carry out the approximate load assessment and determine the number of power and control circuits..
- OR**
- Q.4** (a) Differentiate clearly between a mush winding and a double layer winding for three phase ac machines. 07
- (b) Describe at least two important components of a simple control panel for a three phase induction motor. 07
- Q.5** (a) Design a rector to drop 50 volts at 50 hertz , when carrying a current of 250 amps. Take emf constant 0.6, $B_m = 1.2 \text{ Wb/m}^2$, a square cross section of core ,space factor 0.33, the ratio of height to width of window =2, the current density 3.0 a/mm^2 07
- (b) How does the design procedure differ from a fixed core design to a variable airgap rector design. 07
- OR**
- Q.5** (a) Explain the selection of the flux density in case of a variable airgap reactor from the fundamentals. 07
- (b) Determine the critical value of the flux density and the mmf requirement in a variable airgap choke coil to operate at 240 volts, 50hz. Ac supply and to carry a rated current of 10 amps. The length of the airgap varying from 0 to 50mm. 07
