

Code: EE6T1

III B.Tech - II Semester – Regular Examinations – April 2016

**ELECTRICAL MACHINE DESIGN
(ELECTRICAL & ELECTRONICS ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

Answer any FIVE questions. All questions carry equal marks

1)

a) Explain the factors which impose limitations in the design of electrical machines? 7 M

b) Briefly explain different methods of cooling techniques used for electrical machines. 7 M

2)

a) Derive the equation for output voltage and electromagnetic torque of a DC machine. 7 M

b) A shunt field coil has to develop an MMF of 9000AT, the voltage drop in the field coil is 40V and the resistivity of round wire is 0.021 ohm-m/mm^2 . The depth of winding is 35 mm and length of mean turn is 1.4 m. Design a coil so that the power dissipated is 700 watts/m^2 of the total coil surface. Take the diameter of insulated wire to be 0.2 mm greater than bare wire. 7 M

3)

a) Prove that EMF/turn of a transformer is equal on both primary and secondary windings. 7 M

b) A single-phase 400V, 50Hz transformer is built from stampings having a relative permeability of 1000. The length of flux path is 2.5 m. Area of cross section of the core is $2.5 \times 10^{-3} \text{ m}^2$ and the primary winding has 800 turns. Estimate the maximum flux and no load current of the transformer. Iron loss at the working flux density is 2.6 W/Kg. Iron weight $7.8 \times 10^3 \text{ kg/m}^3$. Stacking factor=0.9

7 M

4)

a) Derive the expression for the no load current of a 3-phase transformer. 7 M

b) A 250 KVA, 6600/400 V, 3-phase core type transformer has a total loss of 4800W at full load. The transformer tank is 125 cm in height and 100X50 cm in plan. Design a suitable scheme for tubes if the average temperature rise is to be limited to 35°C . The diameter of tubes is 5cm and spaced 7.5 cm from each other. The average height of tubes is 105 cm. 7 M

5)

a) Discuss various factors which influence the selection of air gap, stator and rotor slots in an induction motor. 7 M

- b) A 3-phase, 4 poles, 50Hz induction motor has 24 stator slots and 28 rotor slots. Prove that it has a tendency to run as synchronous motor at a speed of 214.3 rpm. 7 M
- 6)
- a) Explain the cogging and crawling phenomenon in a 3-phase induction motor. 7 M
- b) Derive the output equation of a 3-phase induction motor. What are the usual values of specific loadings? 7 M
- 7) Write a short note on the following:
- a) How to control the temperature rise in a synchronous machine? 7 M
- b) What are the precautions must be taken while designing the dimensions of a 3-phase synchronous machine? 7 M
- 8) Find the main dimensions of a 100MVA, 11KV, 1500rpm, 3-phase, water wheel generator. Given that $B_{av}=0.65 \text{ wb/m}^2$ and ac/m are 40000. The peripheral speed should not exceed 65m/s at normal running speed in order to limit run away speed. 14 M