M 25886

Reg. No. : .....

Name : .....

# VIII Semester B.Tech. Degree (Supplementary – Including Part Time) Examination, October 2014
## (2007 Admn. Onwards)
## PT 2K6/2K6 EE 803 : ELECTRICAL MACHINE DESIGN

Time: 3 Hours Max. Marks : 100

### PART – A

I. a) Derive the condition for maximum efficiency of a DC machine.

b) Derive PITCHEL MAYERS equation.

c) Explain the design of transformer for minimum loss or maximum efficiency.

d) Explain the calculation of core area of a transformer.

e) Define Short Circuit Ratio (SCR).

f) Describe the armature winding system of a salient pole machine.

g) Explain the methods to reduce harmonic torques in Induction Machine.

h) Describe CRAWLING in induction motor. **(8×5=40)**

### PART – B

II. a) Calculate the mmf required for air gap of a machine having core length = 0.32 m including 4 ducts of 10 mm each. Pole arc = 0.19 m, slot pitch = 65.4 mm slot opening = 5 mm ; air gap length = 5 mm, flux per pole = 52 m wb. Given Carters Coefficient = 0.18 for a opening/gap = 1 and is 0.28 for opening/gap = 2. **15**

OR

b) A shunt field coil has to develop an mmf of 9000 A. The voltage drop in the coil is 40 V, and the resistivity of round wire used is 0.021 $\Omega$/m and $mm^2$. The depth of winding is 35 mm, approximately and the length of mean turn is 1.4 m. Design a coil so that the power dissipated is 70 $w/m^2$ of the total surface. Take the diameter of the insulated wire 0.2 mm greater than that of bore wire. **15**

P.T.O.

III. a) Derive the output equation of 3$\phi$ transformer. **15**

OR

b) Determine the dimensions of core and yoke for a 200 KVa, 50 Hz 1$\phi$ core type transformer. A cruciform core is used with distance between adjoint limbs equal to 1.6 times the width of core laminations. Assume voltage per turn 14V, maximum flux density = 1.1 Wb/m$^2$ window space factor 0.32, current density 3A/mm$^2$, stacking factor = 0.9. The net iron area is 0.56d$^2$ in a cruciform core where 'd' is the diameter of circumscribing circle. Also width of largest stamping is 0.85 d. **15**

IV. a) A 1000 KVA, 3300 V, 50 Hz, 300 rpm 3$\phi$ alternator has 180 slots with 5 conductors per slot. Single layer winding with full pitch coil is used. The winding is star connected with one circuit per phase. Determine specific Electric loading and specific Magnetic loading if the stator bore is 2.0 m and the core length is 0.4 m. Using the same loadings determine the corresponding data for a 1250 KVA, 3300 V, 50 Hz, 250 rpm, 3$\phi$ star connected alternator having 2 circuits per phase. The machine has 60° phase spread. **15**

OR

b) Explain the design of damper windings for synchronous machines. **15**

V. a) A 3$\phi$ 2 pole, 50 Hz squirrel cage induction motor has a rotor diameter 0.20 m and core length of 0.12 m. The peak flux density in the air gap is 0.55 Wb/m$^2$. The rotor has 33 bars each of resistance 125 $\mu\Omega$, and leakage inductance 2 $\mu$H. The slip is 6% calculate :

i) Peak valve of current in each bar ii) Rotor I$^2$R loss

iii) Rotor output iv) Torque exerted.

Neglect resistance of end rings. **15**

OR

b) Calculate the equivalent resistance of rotor per phase in terms of stator current in each bar and end ring, also total I$^2$R loss for the following :

4 pole 3$\phi$ 50 Hz, 400 V cage induction motor has 48 slots in stator with 35 conductors per slot. Each conductor carries a current of 10 A. The rotor has 57 slots each slot has a bar of 0.12 m length and 50 mm$^2$ area. The mean diameter of each ring is 0.2 m and area is 175 mm$^2$. Resistivity is 0.02$\Omega$/m and mm$^2$ and the power factor is 0.8. The stator winding is full pitched coils with a phase spread of 60° ? **15**

**(15×4=60)**

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