

B.Tech. SEM -V Electrical 2014 Course (CBCS) : WINTER - 2018

SUBJECT: ELECTRICAL MACHINE DESIGN

Day: Tuesday
Date: 27/11/2018

W-2018-2399

Time: 02.30 PM TO 05.30 PM
Max Marks. 60

N.B. :

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Assume suitable data, if **NECESSARY**.
- 4) Use of non-programmable calculator is **ALLOWED**.

- Q.1 a)** Derive output equation of three phase induction motor. (05)
- b)** According to BIS: 1968, classify cooling systems of rotating electrical machines. (05)

OR

- Q.1 a)** What are different modes of heat dissipation? What is thermal resistance and state its unit. (04)
- b)** A field coil has a heat dissipating surface of 0.15 m^2 and a length of mean turn of 1m. It dissipates loss of 150 W, the emissivity being $34 \text{ W/m}^2 \text{ } ^\circ\text{C}$. Estimate the final steady temperature rise of the coil and its time constant if the cross section of the coil is $100 \times 50 \text{ mm}^2$. Specific heat of copper is $390 \text{ J/kg } ^\circ\text{C}$. The space factor is 0.56. Copper weighs 8900 kg/m^3 . (06)

- Q.2 a)** Write down the steps to design small single phase transformer. (05)
- b)** Determine the width and height of the core of 200 kVA, 50 Hz, single phase core type transformer. A cruciform core is used with distance between adjacent limbs equal to 1.6 times the width of core laminations. Assume voltage per turn 14 V, maximum flux density 1.1 Wb/m^2 , window space factor 0.32, current density 3 A/mm^2 and stacking factor = 0.9. The net iron area is $0.56d^2$, with the width of largest stamping is $0.85d$. (05)

OR

- Q.2 a)** Determine the main dimensions of the core of three phase 350kVA, 11000/3300 V, star/delta, 50Hz core type transformer. Assume: Volt/turn = 11, maximum flux density = 1.25 T . Net cross-section of core = $0.6 d^2$, window space factor = 0.27, window proportion = 3:1, current density = 250 A/cm^2 . (06)

- b)** How total resistance is calculated of three phase distribution transformer. (04)

- Q.3 a)** How to calculate the dimensions of end ring for three phase squirrel cage induction motor. (05)
- b)** Write detail procedure to calculate iron loss of a designed three phase induction motor (without performing any test). (05)

OR

- Q.3 a)** Which factors should be considered when estimating the length of the airgap of induction motor? (05)
- b)** Calculate overhang and slot leakage reactance for a 75 kW, 3000V, 8 pole 50Hz three phase star connected slip ring induction motor having following data: stator bore = 0.66m, stator core length = 0.5m, number of stator turns/phase = 286, total specific permanence due to stator slot = 4.9μ . The stator has full pitch winding. (05)

P.T.O.

Q.4 Discuss the stator design of single phase induction motor considering running winding turns, number of stator slots, size of slot, teeth and core. (10)

OR

Q.4 Prove that the output for a single phase induction motor is $2/3^{\text{rd}}$ of that for a 3 phase equivalent induction motor for the same D^2L values. (10)

Q.5 a) Calculate the main dimension for a 10MVA, 11kV, 50Hz, 3 phase , 2 pole, turbo-alternator based on the following information (07)
Specific Magnetic Loading = 0.63 Tesla
Specific Electric Loading = 48000 amp-conductor/m.
Peripheral speed = 120 m/sec.
Length of air gap = 2.0 cm
Stator winding factor = 0.955

b) What are the factors to be considered for selection of armature slots of synchronous machine, (03)

OR

Q.5 a) A 1500 kW, 6 pole d. c. generator has a flux per pole of 0.06 wb and its speed is 600 rpm. Determine the armature demagnetizing and cross-magnetizing mmf per pole if the brushes are given an actual lead of 3° . (05)

b) How do you find the total mmf per pole of a d.c. machine at no load and at normal voltage? (05)

Q.6 Discuss the design optimization of PMAC machines. Draw the flow chart of proposed model based machine design optimization. (10)

OR

Q.6 What is design optimization? Discuss the optimization procedure with flow chart and optimization statement. (10)

* * * * *