

National Institute of Technology, Hamirpur (HP)

Name of the Examination: B.Tech.

Branch : Electrical Semester : 7th
Course Name : Electrical Machine Design Course Code : EED-413

Time: 2 Hours

Maximum Marks: 50

Note : Attempt all questions. Assume any missing data.

Q1. (a) Find the effective value of flux density at the pole centre of a revolving machine if, actual flux density at the pole centre = 0.8 wb/m^2 ; length of air gap = 8 mm; width of tooth = 18 mm; width of slot = 13 mm; width of packets = 50 mm; width of duct = 8 mm. Take Carter's coefficient for ducts and slots as 0.25 and 0.3 respectively. Also calculate the mmf for the ducts. [10]

(b) What are the different modes of heat dissipation in electrical machines? Explain all modes in details. [5]

Q2. (a). A 250 V, 1.5 kW, single element resistor is made from 0.25 mm thick nickel chrome strip. The temperature rise of strip is not to exceed 320°C over the ambient temperature of 30°C . Calculate the length and width of the strip for this condition. Assume , emissivity =0.9, radiating efficiency=0.75, resistivity of nickel chrome $1 \times 10^{-6} \Omega\text{m}$. [10]

(b) Determine the design output equation for a single as well as three phase transformers. Also find the condition for optimum design from the cost view point. [5]

Q3 (a) Estimate the main dimensions over all width and height as well as the conductor area of a 3 phase delta/star core type transformer rated at 300 kVA, 6600/440V, 50 Hz. A suitable core with three steps having a circumscribing circle of 0.25m diameter and a leg spacing of 0.4m is available. The emf per turn is 10 V. Assume a current density of 3.5 A/mm^2 , a window space factor of 0.32 and a staking factor of 0.9. [10]

(b) Calculate the equivalent resistance of rotor per phase referred to stator from the following data of a 400V, 3 phase, 4 pole, 50 Hz cage motor. Stator slots = 60 with 30 conductors per slot, rotor slots = 53 with one bar in each slot. The length of each rotor bar is 0.16 m and area 70 mm^2 . The end rings have a mean diameter of 0.18 m and an area of cross section 160 mm^2 . Full pitch winding with 60° phase spread is used for the stator. The material used for bars and the end rings has a resistivity of 0.021 ohm/m and mm^2 . [10]