

Student Exam No:- _____

GANPAT UNIVERSITY
B.TECH SEM-VI (ELECTRICAL)
REGULAR EXAMINATION MAY-JUNE 2014
2EE603:-ELECTRICAL MACHINE DESIGN

Time: 3 Hours

Total Marks:-70

- Instructions: - 1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

SECTION-I

- Que-1 (A) Answer the following questions with respect to transformer design. [06]
(1) Explain the reason for using stepped core construction.
(2) Distinguish between Power and Distribution transformers.
(3) Why tapings are usually provided on the h.v. winding side?
- (B) Estimate the main dimensions of complete core frame, winding conductor areas and no. of turns of a 3-phase core type delta-star transformer which is rated at 300 kVA, 6600/440 volts, 50 Hz. Use three stepped core with the diameter of circumscribing circle of 0.25 m. Assume volts/turn = 8.5, current density of 2.5 A/mm², window space factor of 0.28, stacking factor of 0.9 and height to width ratio for window = 3. [06]
- OR
- Que-1 (A) Explain different types of winding used in Transformer. [06]
(B) Calculate the no-load current of a 220/110V, 1kVA, 50Hz, Single phase transformer with the following data uniform cross-sectional area of the core = 25 cm², effective magnetic core length = 0.4m, core weight = 8 kg, maximum flux density = 1.2 T, magnetizing force = 200 AT/m, specific core loss = 1.0 W/kg [06]
- Que-2 (A) A 250 kVA, 6600/400V, 3 phase core type transformer has a total loss of 4800W at full load. The transformer tank is 1.25m in length and 1m x 0.5m in plan. Design a suitable scheme for tubes if the average temperature rise is to be limited to 35°C. The diameter of the tube is 50mm and is spaced 75mm from each other. The average height of tubes is 1.05m. [07]
(B) Classification of Transformer cooling with neat sketch. [04]
- OR
- Que-2 (A) Define short circuit ratio. Explain how it is determine for an alternator. Also discuss its effects on the performance of alternator. [07]
(B) Calculate the stator dimensions for 5000 kVA, 3 phase, 50 Hz, 2 pole alternator. Take mean gap density of 0.5 wb/m², specific electric loading of 25,000 ac/m, peripheral velocity must not exceed 100 m/s. Air gap may be taken as 2.5 cm. [04]

- Que-3 Attempt following Questions [12]
- (A) Prove the relation between emf per turn and transformer rating.
 - (B) Explain the effects of selection of flux density and current density. Describe various window dimensions of transformer.
 - (C) Write short note on classification of insulating materials.

SECTION-II

- Que-4 (A) Derive the output equation of a three phase induction motor. [06]
- (B) Obtain the following design information for the stator of a 30 kW, 440 V, 3- Φ , 6 pole, 50 Hz delta connected, squirrel cage induction motor, determine the Main dimension of the stator. Assume Specific Magnetic loading = 0.48 Tesla, Specific Electric loading = 26000 ac/m, Full load efficiency = 0.88, Full load power factor = 0.86, Winding factor = 0.955, $L/\tau = 1.5$. [06]

OR

- Que-4 (A) Discuss the factors which govern the selection of stator slots and rotor slots for a cage induction motor. [06]
- (B) A 3 phase 200 kW, 3.3 kV, 50 Hz, 4 pole induction motor has the following dimensions. Internal diameter of the stator = 56.2 cm, outside diameter of the stator = 83cm, length of the stator = 30.5 cm, Number of stator slots = 60, width of stator slot = 1.47 cm, depth of stator slot = 4.3 cm, radial gap = 0.16 cm, number of rotor slots = 72, depth of rotor slot 3.55 cm, width of rotor slots = 0.95 cm. Assuming air gap flux density to be 0.5 Tesla, calculate the flux density in (i) Stator teeth (ii) Rotor teeth (iii) stator core [06]

- Que-5 (A) Explain the step by step procedure for design of field winding of synchronous machine. [07]
- (B) Discuss the factor to be considered while selecting suitable number of armature slot in synchronous machine. [04]

OR

- Que-5 (A) Discuss the factor that affect the choice of air gap in induction motor. [06]
- (B) Explain crawling and Cogging with neat diagram. [05]

- Que-6 Attempt following Questions [12]
- (A) Give the procedure of estimating air gap length in synchronous machine.
 - (B) What is Electrical and Magnetic Loading? Describe factors affecting size of ac machines.

END OF PAPER
Best of Luck