Code No: 155BB

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, September - 2021
ELECTRICAL MACHINE DESIGN
(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

1.a) Briefly discuss the factors those limit the design of the machine.
b) What are the merits and demerits due to higher electric loading? [8+7]

2.a) What are the electrical materials used in machines? Discuss them.
b) Explain the selection of motor power ratings. [9+6]

3.a) Optimize the transformer design from the point of view of (i) minimum cost and (ii) minimum loss.
b) What is window space factor? Find the width of window for optimum output of a transformer. [8+7]

4. Determine the main dimensions of the core, the number of turns and cross section of the conductors for a 5 kVA, 11000/400 V, 50 Hz, single phase core type distribution transformer. The net conductor area in the window is 0.6 times the net cross section of iron in the core. Assume a square cross section for the core, a flux density 1 wb/m ^{2}, a current density 1-4 A/mm ^{2} and a window space factor 0.2. The height of window is 3 times its width. [15]

5.a) Which factor should be considered when estimating the length of the air gap of induction motor? Why the airgaps should be as small as possible?
b) Comment on shape and sizes of rotor bars in induction motor. [8+7]

6. Determine the main dimensions, turns per phase, number of slots, conductor cross section and slot area of a 250 HP, 3-phase, 50 Hz, 1410 r.p.m slip ring induction motor. Assume Bav =0.5 Wb/m^2, exciting current (ac) = 30000 A/m , efficiency = 0.9 and power factor = 0.9, winding factor = 0.955, current density =3.5 A/mm ^{2}. The slot space factor is 0.4 and the ratio of core length to pole pitch is 1.2. The machine is delta connected. [15]

7.a) What are the factors to be considered to select the specific electrical loading of synchronous generator.
b) How would you calculate the full load field mmf in a synchronous machine? [8+7]

8. Illustrate the finite element-based method of design of permanent magnetic synchronous motors. [15]

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