PVP 14

Code: EE6T2

III B.Tech - II Semester – Regular/Supplementary Examinations
AUGUST 2021

ELECTRICAL MACHINE DESIGN
(ELECTRICAL & ELECTRONICS ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer *all* the questions. All questions carry equal marks

11x 2 = 22 M

1.

a) Define the distribution factor.
b) What are the factors to be considered for estimating the length of air gap in an induction motor?
c) What is accelerated commutation?
d) Define crawling and cogging in an induction motor.
e) What are the properties of transformer insulations?
f) What is overload capacity?
g) What is cross-fluxing in transformer?
h) Write the output equation of single phase and three phase transformers.
i) What is interleaving winding?
j) Write down the output equations of synchronous machine.
k) What is the short circuit ratio?

PART – B

Answer any *THREE* questions. All questions carry equal marks.

3 x 16 = 48 M

2. a) From the first principles deduce an expression for the output equation of a DC machine in terms of main dimensions and specific loading. 8 M

b) Calculate for diameter and length of armature for a 7.5 kW, 4 pole, 1000 rpm, 220V DC shunt motor. Given full load efficiency is 0.83, maximum gap flux density is 0.9 wb/m^2 specific electric loading is 30,000 ampere conductor/ meter, field form factor is 0.7. Assume that the maximum efficiency occurs at full load and the field current is 2.5% of rated current, the pole face is square? 8 M

3. a) Give the constructional difference between core type and shell type transformer. How the iron losses are minimized? 8 M

b) Determine the main dimensions of the core, the no. of turns and the cross section of the conductor for a 5 kVA, 11000/ 400V, 50Hz, 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 the window is 3 times its width. 8 M

4. a) Develop the output equation for three phase transformer? 8 M

b) A 250 kVA , 6600/400V, 3 phase core type transformer has a total loss of 4800W at full load. The transformer tank is 125 cm in height and 100x50 cm in plan. Design a suitable screen for tubes if the average temperature rise is to be limited to 35℃. The diameter of tubes is 5 cm and are spaced 7.5 cm for each other. The average height of tubes is 105 cm. 8 M

5. a) With relevant equations, explain the estimation of No-load current of a three phase induction motor. 8 M

b) A 15 kW, 3- phase, 6- pole, 50 Hz, cage motor has the following data: D=0.32 m, L=0.125 m, no. of stator slots=54, no. of conductors/slot=24, current in each conductor = 17.5A, full load pf = 0.85 lag. Design a suitable cage rotor giving no. of rotor slots, section of each rotor bar and end ring and effective resistance of the rotor. Given the full load speed as 950 rpm, Resistivity of cu as 0.02Ω mm^2/m. 8 M

6. a) Discuss the factors to be considered while selecting a suitable number of armature slots in a synchronous machine. 8 M

b) Determine the main dimensions of a 75000 kVA, 13.8 kV, 50 Hz, 62.5 rpm, 3 phase, star connected Alternator. Also find the no. of stator slots, conductor per slot, conductor area. 8 M