PVP 14

Code: EE6T2

III B.Tech - II Semester – Regular Examinations – May 2017

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) Mention any 2 advantages of increasing number of poles of D.C machines.
b) Define specific electric loading.
c) Write the output equation for the 1-phase and 3-phase transformer.
d) Compare shell type and core type transformers (list any 2).
e) List any 2 methods for cooling of transformer.
f) What are the factors to be considered for choosing the type of winding for a core type transformer?
g) List any 2 factors that get affected while choosing specific electric loading in a induction motors.
h) Mention any 2 factors that are get affected by the length of air gap in 3-phase induction motor.
i) What is crawling and cogging?
j) What are the effects of short circuit ratio on machine performance?

k) What are the factors that effect the selection of armature slots in a synchronous machine?

PART – B

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

3 x 16 = 48 M

2. a) Explain in detail about the design of field systems of DC Machines. 8 M

b) Find the diameter and length of armature for a 8 kW, 4 pole, 1000 rpm, 200V shunt motor. Given: full load efficiency = 0.89; maximum gap flux density = 0.88 Wb/m^2; specific electric loading = 30000; field form factor = 0.8. Assume that the maximum efficiency occurs at full load and the field current is 3% of rated current. The pole face is square. 8 M

3. a) Explain about the construction of single phase transformer in detail. 8 M

b) Calculate the active and reactive components of no-load current of 400V, 50 Hz, single phase transformer having the following data: 8 M
Stacking factor=0.9; density= 7.8×10^3 Kg/m^3; length of mean flux path= 2.2 m; gross iron section= 10×10^{-3} m^2; primary turns=200; joints equivalent to =0.2 mm of air gap. Use the following data:

B_m (Wb/m^2)	0.9	1.0	1.2	1.3	1.4
Mmf (At/m)	130	210	420	660	1300
Iron loss (W/Kg)	0.8	1.3	1.9	2.4	2.9

4. a) Derive an expression for the no. of cooling tubes required to limit the temperature rise in a 3-phase transformer. Design its tank dimensions and show them pictorially. 8 M

b) Calculate approximate overall dimensions for a 200 kVA, 6600/440 V, 50 Hz, 3 phase core type transformer. The following data may be assumed: EMF per turn = 9V; maximum flux density = 1 Wb/m^2; current density = 2 A/mm^2; window space factor = 0.3, overall height = overall width; stacking factor = 0.9; Use a 3 stepped core. For a three stepped core: Width of largest stamping = 0.9 d and Net iron area = 0.6 d^2 where d is the diameter of the circumscribing circle. 8 M

5. a) Explain in detail about the design of rotor slots and rotor bars in squirrel cage induction motor. 8 M

b) Find the values of diameter and length of stator core of a 8 kW, 220 V, 50 Hz, 4 pole, three phase induction motor for best power factor. Given the specific magnetic loading = 0.35 Wb/m^2; specific electric loading = 20000 A/m; efficiency = 0.9; and power factor = 0.86. 8 M

6. a) Explain in detail about the stator design of synchronous machines. 8 M

b) What are the factors that will get affected while choosing specific electric and specific magnetic loadings in synchronous machines? 8 M