

Code No: **R32021****R10****Set No. 1****III B.Tech II Semester Supplementary Examinations, November - 2017****ELECTRICAL MACHINE DESIGN**

(Electrical and Electronics Engineering)

Time: 3 hours**Max. Marks: 75****Answer any FIVE Questions****All Questions carry equal marks**

- 1 a) Explain in detail about Material selection in the design of electrical machines [8M]
b) What are the basic principles useful in the design of electrical machines [7M]
- 2 a) With the help of a suitable example, discuss about fractional pitch and full pitch coils [7M]
b) Draw the winding diagram in radial form for a 4 pole, 24 slot simplex lap connected DC generator with commutator having 24 segments. Indicate the position of brushes [8M]
- 3 a) Discuss in detail about the design of field systems in DC machines [7M]
b) Find the diameter and length of armature for a 9 kW, 4 pole, 1000 rpm, 210V shunt motor. Given: full load efficiency = 0.915; maximum gap flux density = 0.875 Wb/m^2 ; specific electric loading = 27000; field form factor = 0.8. Assume that the maximum efficiency occurs at full load and the field current is 2.8% of rated current. The pole face is square [8M]
- 4 a) What are the major causes of temperature rise in transformers? Explain [7M]
b) Determine the dimensions of core and yoke for a 150 kVA, 50 Hz single phase core type transformer. A cruciform core is used with distance between adjacent limbs equal to 1.6 times the width of core laminations. Assume voltage per turn 13V, maximum flux density 1.22 Wb/m^2 , windows space factor 0.32, current density 3.75 A/mm^2 , and stacking factor 0.9. The net iron area is $0.52d^2$ in a cruciform core where d is the diameter of circumscribing circle. Also the width of largest stamping is $0.82d$ [8M]
- 5 a) What are the losses in a transformer? How the design can be modified to minimize the losses? [7M]
b) A 600 kVA, 4500V, 50 Hz, three phase delta/star core type transformer has the following data: width of LV winding is 20 mm; width of HV winding is 15 mm, width of duct between HV and LV windings is 10 mm; height of winding is 0.31 m; length of mean turn is 1.2 m, HV winding turns are 190. Estimate the leakage reactance of the transformer referred to HV side. Estimate the per unit regulation of the transformer at full load and 0.83 power factor lagging if the resistance per phase referred to the HV side is 0.65Ω [8M]

Code No: **R32021**

R10

Set No. 1

- 6 a) Discuss in detail about the choice of conductor rating in the stator and rotor windings of induction motors [7M]
b) Determine the main dimensions of a 6 kW, three phase, 300V, 50 Hz, 2810 rpm squirrel cage induction motor having an efficiency of 0.86 and a full load power factor of 0.88. Assume specific magnetic loading = 0.7 Wb/m^2 , specific electric loading = 18000 A/m . Take the rotor peripheral speed as approximately 15 m/sec at synchronous speed. [8M]
- 7 a) Explain in detail about the rotor design of squirrel cage induction motor [7M]
b) Explain in detail about the design of rotor slots and rotor windings in wound rotor induction motors [8M]
- 8 a) Explain in detail about the constructional features of synchronous machines [7M]
b) Discuss in detail about the specific loadings in synchronous machines [8M]
