Reg. No. : | | | | | | | | | | |

Question Paper Code: 36302

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

Sixth Semester

Electrical and Electronics Engineering

01UEE602 - ELECTRICAL MACHINE DESIGN

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Differentiate specific magnetic loading and electric loading.
2. Classify machines based upon their duty rating.
3. What are the deciding factors in design of armature?
4. Mention the factors governing the choice of armature slots in a dc machine.
5. Why transformer draw current under no load?
6. State the considerations in the design of transformer tank.
7. What are the information obtained from the circle diagram of induction motor?
8. Define dispersion coefficient for induction motors and also specify its effects.
9. Define short circuit ratio of synchronous machine.
10. State the factors for separation of D and L for cylindrical rotor machine.

PART - B (5 x 16 = 80 Marks)

11. (a) For a certain DC generator the core loss is 1000 *W* and the armature resistance is 0.025 Ω. The core and windings form a cylinder 0.25 *m* long and 0.25 *m* in diameter. Specific loss dissipation is 230 W/m^2-^oC. Calculate the specific electric loading which would result in windings and core having a temperature rise of 40^oC. The machine is wave wound with 270 armature conductors. Assume that the heat is dissipated from the cylindrical surface only. (16)

Or

(b) Explain the following:

(i) Major considerations in electrical machine design. (8)

(ii) Thermal considerations in design. (8)

12. (a) (i) Calculate the apparent flux density at a section of the teeth of an armature of a D.C machine, from the following details at that section: slot pitch = 2.4 *cm*; slot width = tooth width =1.2 *cm*; length of armature core including 5 ducts 1 *cm* each is 38*cm* iron staking factor = 0.92. True flux density in teeth at that section is 2.2 Wb/m^2 for which *mmf* is 70000 *A/m*. (10)

(ii) Prove that in a DC machine, volume of the parts is proportional to the torque of the machine. (6)

Or

(b) Discuss about temperature rise and methods of cooling of transformer. (16)

13. (a) Estimate the per unit regulation, at full load and 0.8 power factor lagging for a 300 *KVA*, 50 *Hz*, 6600 / 400 *V*, 3 phase delta/star ,core type transformer. The data given is: HV winding: outside diameter = 0.36 *m*, inside diameter = 0.29 *m*, area of conductor = 5.4 mm^2. LV winding: outside diameter = 0.26*m*, inside diameter = 0.22 *m*, area of conductor = 170 mm^2, Length of coils = 0.5 *m*, Voltage per turn = 8 *V*, resistivity = 0.21 Ω / *m* / mm^2. (16)

Or

(b) A 250*kVA*, 6600/400*V*, 3 phase core type transformer has a total loss of 4800*Watts* on full load. The transformer tank is 1.25*m* in height and 1*m*x0.5*m* in Plan. Design a suitable scheme for cooling tubes if the average temperature rise is to be limited to 35°*C*. the diameter of the tube is 50*mm* and spaced 75*mm* from each other. The average height of the tube is 1.05*m*. (16)

14. (a) Compute the main dimensions of a 15*kW*, three phase, 410*V* 50*Hz*, 2850 *rpm* squirrel cage induction motor having an efficiency of 0.88 and full load power factor 0.9. Assume that specific magnetic loading 0.5 Tesla, specific electric loading 25,000 ampere conductors per meter .The rotor peripheral speed should be approximately 20*m/sec* at synchronous speed. (16)

Or

(b) Discuss the factors to be considered for selection of rotor slots of squirrel cage machine. (16)

15. (a) Calculate the main dimensions for a 1000 *kVA*, 50 *Hz*, 3 phase, 375 *rpm* alternator. The average air gap flux density is 0.55 Wb/m^2 and the ampere conductors per meter are 28000. Use rectangular poles and assume a suitable value for ratio of core length to pole pitch in Order that bolted on pole construction is used for which the maximum permissible Peripheral speed is 50 *m/s*. The run-away speed is 1.8 times the synchronous speed. (16)

Or

(b) Estimate the diameter, core length, size and number of conductors, number of slots for stator of a 15 *MVA*, 11 *KV*, 50 *Hz*, 2 pole star connected turbo - with 60° phase spread. Assume average flux density in the air gap is = 0.55 Wb/m^2; electric loading = 36,000 *A/m*; current density = 5 A/mm^2; peripheral speed = 160 *m/s*. The winding should be arranged to eliminate 5^{th} harmonic. (16)