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

Question Paper Code: 36302

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

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. Define space factor.
2. What do you mean by H type insulation? Give an example.
3. Define Carter's coefficient in DC machine.
4. What are the deciding factors in design of armature?.
5. Why transformer draw current under no load?
6. State the considerations in the design of transformer tank.
7. Mention the rules for selecting rotor slots of squirrel cage 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 effect of short circuit ratio on synchronous machine performance.

PART - B (5 x 16 = 80 Marks)

11. (a) State and explain the various classes of insulating materials, employed in electrical machines, according to temperature limits. (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) Explain the following

(i) Guiding factors for selection of poles (8)

(ii) Unbalanced magnetic pull. (8)

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 $\Omega / m / mm^2$. (16)

Or

(b) (i) Derive the output equation of transformer. (8)

(ii) Different methods of cooling of transformer. (8)

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) (i) Discuss the factors to be considered for selection of rotor slots of squirrel cage machine. (10)

(ii) Explain how the magnetizing current and short circuit current influence the performance of induction motor drive. (6)

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)