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

Question Paper Code: 31362

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

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. Classify machines based upon their duty rating.
3. Define Carter's coefficient in DC machine.
4. Mention the factors governing the choice of armature slots in a dc machine.
5. Why transformer draw current under no load?
6. Write the expression for output equation – volt/turn of transformer.
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) The output coefficient of 1250 *kVA*, 300 *rpm*, synchronous generator is 200 kVA/m^3 *-rps*.

(i) Find the values of main dimensions (D, L) of the machine if the ratio of length to diameter is 0.2. Also calculate the value of main dimensions if.

(ii) Specific loading are decreased by 10 *percent* each with speed remaining the same

(iii) Speed is decreased to 150 *rpm* with specific loading remaining the same as part in (i). Assume the same ratio of length to diameter. Comment upon the result. (16)

Or

(b) Explain the following:

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

(ii) Thermal considerations in design. (8)

12. (a) A 250 *KW*, 500 *V*, 600 *rpm* DC generator is built with an armature diameter of 0.75 *m* and a core length of 0.3 *m*. The lap connected armature has 720 conductors. Using the data obtained from this machine, estimate the armature diameter, core length, number of armature slots, armature conductors and commutator segments for a 350 *KW*, 440 *V*, 720 *rpm*, 6 pole DC generator. Assume a square pole face with ratio of pole arc to pole pitch equal to 0.66. The full load efficiency is 0.91 and the internal voltage drop is 4 *percent* of rated voltage. The diameter of commutator is 0.7 of armature diameter. The pitch of commutator segments should not be less than 4 *mm*. The voltage between adjacent segments should not exceed 15 *V* at no load. (16)

Or

(b) Explain the guiding factors for:

(i) Design of commutator and brushes. (8)

(ii) Selection of number poles. (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) 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, 400*V* 50*Hz*, 2810 *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) (i) Explain all the valid points regarding armature design of synchronous machine. (10)

(ii) Discuss the design of damper windings for synchronous drive. (6)

Or

(b) 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)