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Question Paper Code: 36302

B.E. / B.Tech. DEGREE EXAMINATION, MAY 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. Define space factor.
2. Mention the different types of duties of a machine.
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. List the different methods of cooling of transformer.
6. State the considerations in the design of transformer tank.
7. What are the information obtained from the circle diagram of induction motor?
8. Why induction motor is called as rotating transformer?
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) State and explain the various classes of insulating materials, employed in electrical machines, according to temperature limits. (16)

Or

(b) State and explain the general factors that influence the choice of specific electric and magnetic loadings for rotating machines. . (16)

12. (a) State and explain the factors which govern the choice of specific magnetic loadings. (16)

Or

(b) 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)

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

14. (a) Evaluate the main dimensions, turns per phase, number of slots, conductor cross section and slot area of a 250 *HP*, 3- Phase, 50 *Hz*, 400 *V*, 1410 *rpm* slip ring induction motor. Assume average flux density in the air gap = 0.5 Wb/m^2 , ampere conductor/meter = 30,000 *A/m*, efficiency = 0.9 and power factor = 0.955, current density = 3.5 A/mm^2. The slot space factor is 0.4 and the ratio of core length to pole pitch is 1.2. The machine is delta connected. (16)

Or

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

15. (a) Explain all the valid points regarding armature design of synchronous machine. (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)

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