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

Question Paper Code: 46302

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

Sixth Semester

Electrical and Electronics Engineering

14UEE602 - ELECTRICAL MACHINE DESIGN

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. What is the material used for making commutator segments?

   (a) Berryllium copper (b) Cadmium copper
   (c) constantan (d) Nichrome

2. The value of specific electric loading can be increased in machines with

   (a) better ventilation conditions (b) Less value of maximum temperature rise
   (c) high value of current density (d) all the above

3. _____ is defined as the ratio of actual length of iron in stacks of assembled core plates to total axial length of the stack.

   (a) Stacking factor (b) Gap contraction factor
   (c) Field form factor (d) Space factor

4. The maximum value of voltage between adjacent commutator segments at load to avoid flash over is

   (a) 15 (b) 70 (c) 50 (d) 30

5. Utilisation factor is high for a transformer with

   (a) rectangular core (b) square core (c) 4 stepped core (d) 2 stepped core

6. For designing a transformer with minimum cost the cost of copper must be _____ to cost of iron.

   (a) greater than (b) less than (c) equal to (d) two times

7. Which types of slots are generally used in induction motors?.

(A) Open type (B) Semi-closed type (C) Closed type (D) None of the above.

8. In the design of induction motors, normally the number of slots per pole per phase is taken as

(A) two (B) three (C) Three or more (D) three or less.

9. What type of pole construction is used for a synchronous machine with the diameter 1.36m and speed 6.25 rps with the runaway speed 1.8 times the normal speed.

(a) T head construction (b) Bolted on pole construction
(c) Dove tailed construction (d) both a and c

10. What is the range of SCR (Short Circuit Ratio) for turbo alternators?

(a) 0.5 to 0.7 (b) 0.05 to 0.07
(c) 0.15 to 0.17 (d) 0.25 to 0.27

PART - B (5 x 2 = 10 Marks)

11. How materials are classified according to their degree of magnetism?

12. Distinguish between real and apparent flux densities in DC Machine.

13. What are the advantages of stepped core?

14. Define dispersion coefficient of an Induction Motor.

15. What is run away speed of Synchronous Machine?

PART - C (5 x 16 = 80 Marks)

16. (a) What are the main groups of Electrical conducting materials? Describe the properties and applications of those materials. (16)

Or

(b) Define specific electric loading. Explain various factors that influence the choice the of specific electric loading in machines. (16)

17. (a) (i) Derive the output equation of a dc machine.. (8)

(ii) Derive the relation between real and apparent flux densities in a DC machines. (8)

Or

(b) Determine the main dimensions, number of poles and the length of air gap of a 500 volt, 600 kW, 900 rpm DC machine. Assume average gap density as 0.6 wb/m^2 and ampere conductors per metre as 35000 AC/m. The ratio of pole arc to pole pitch is 0.75 and the efficiency is 91 percentage. The following are the design constraints: Peripheral speed should not be greater than 40 m/s, Frequency of flux reversals should not be greater than 50 Hz, Current per brush armature should not be greater than 400 A. The mmf required for air gap is 50 percent of armature mmf and gap contraction factor is 1.15. (16)

18. (a) Calculate approximate overall dimensions for a 200 kVA, 6600/440 V,50 Hz, 3 phase core type of transformer. The following data may be assumed: emf per turn=10V, maximum flux density=1.3 Wb/m^2, current density=2.5 A/mm^2, window space factor=0.3, overall height=overall width, staching factor = 0.9, use a three stepped core. For a three stepped core: Width of largest stamping=0.9d and net iron area=0.6d^2, where d is the diameter of circumscribing circle. (16)

Or

(b) A 250 kVA, 6600/400V three phase core type transformer has a total loss of 4800 W at full load. The transformer tank is 1.25 m in height and 1 m × 0.5 m in plan. Design a suitable scheme for tubes if the average temperature rise is to be limited to 35° C. The diameter of each tube is 50 mm and are spaced 75 mm from each other. The average height of tubes is 1.05 mm. Specific heat dissipation due to radiation and convection is respectively 6 and 6.5 W/b m^2 °C. Assume that convection is improved by 35% due to the provision of tubes. (16)

19. (a) Find the main dimensions of a 15KW, 3 phase, 400V, 50Hz, 2810 rpm squirrel cage induction motor having an efficiency of 0.88 and a full load power factor of 0.9.Assume:Bav=0.5wb/m^2,ac=25000amp.cond/meter. Take rotor peripheral speed as approximately 20m/s at synchronous speed. (16)

Or

(b) A 15KW ,440V,4pole,50Hz,3 phase induction motor is built with a stator bore 0.25m and a core length of 0.16m .The specific electric loading is 23000 ac/m.Using the data of this machine, determine the core dimensions, number of stator slots and number of stator conductors for 11Kw,460V,6 pole,50Hz motor. Assume a full load efficiency of 84% and power factor of 0.82 for each machine. The winding factor is 0.955 (16)

20. (a) (i) Define Short Circuit Ratio. Explain how it is determined for an alternator. Also discuss its effects on the performance of alternator. (8)

(ii) Derive the output equation of an AC machine. (8)

Or

(b) A 1000 KVA, 3300V, 50Hz, 3 phase alternator has 180 slots with 5 conductors per slot. Single layer winding with full pitch coils is used. The winding is star connected with one circuit per phase .Determine the specific electric and magnetic loadings, if the stator bore is 2.0m and core length is 0.4m .The machine has 60° phase spread. (16)