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Question Paper Code : 62205

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Sixth Semester

Electrical and Electronics Engineering

080280035 — ELECTRICAL MACHINE DESIGN

(Regulations 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define the term "Specific electric loading".

2. State the relation between windows dimensions and leakage reactance in transformers.

3. What are the main dimension of the rotating machine?

4. List out the demerits of slip ring induction motor?

5. What do you understand by circumscribing circle in case of transformer core design?

6. Compare core type and shell type transformer w.r.t their design.

7. List out the factors that determine the choice of air gap length of a 3-phase induction motor.

8. What are the advantages of cage induction motor over slip ring induction motor?

9. What is short circuit ratio?

10. What type of synchronous generators are preferred in thermal and Hydel power stations?

PART B — (5 × 16 = 80 marks)

11. (a) Derive the expression for the total gap contraction factor. Also discuss the effect of saliency in salient pole machines.

Or

(b) A laminated tooth of armature steel in an electrical machine is 30 mm long and has a taper such that maximum width is 1.4 times the minimum. Estimate the mmf required for a mean flux density of 1.9 wb/m^2 in this tooth use Simpson's rule. The B at curve for the material of tooth is

B wb/m^2 :	1.6	1.8	1.9	2.0	2.1	2.2	2.3
at A/m :	3700	10,000	17,000	27,000	41,000	70,000	1,09,000

12. (a) Determine the diameter and length of armature core for a 55kw, 110V, 1000 rpm, 4 pole shunt generator, assuming specific electric and magnetic loadings of 26000 amp.cond./m and 0.5 Wb/m^2 respectively. The pole-arc should be about 70% of pole-pitch and length of core about 1.1 times the pole-arc. Allow 10 ampere for the field current and assume a voltage drop of 4 volt for the armature circuit. Specify the winding to be used and also determine suitable values for the number of armature conductors and slots.

Or

(b) The following data refers to the shunt field coil for a 440V, 6 pole, DC generator. mmf per pole = 7000A, depth of winding = 50mm, length of inner turn = 1.1 m, length of outer turn = 1.4 m, losses radiated from outer surface excluding ends 1400W/m^2, space factor = 0.62, resistivity = 0.02Ω/m and mm^2. Assuming a voltage drop of 20% of terminal voltage across the field regulator, calculate the diameter of wire, length of coil, number of turns and exciting current.

13. (a) Calculate the main dimensions and winding details of a 100 KVA, 2000/400V, 50Hz single phase shell type, oil immersed, self cooled transformer. Assume voltage/turn = 10V flux density in core = 1.1 wb/m^2 : current density = 2A/mm^2, window space factor = 0.33. The ratio of window height to window width and ratio of core depth to width of central limb 2.5. The stacking factor is 0.9.

Or

(b) The tank of a 1250 KVA, natural oil cooled transformer has the dimensions length, width and height as 1.55 m × 0.65 m × 1.85 m respectively. The full load loss is 13.1 KW. Find the number of tubes for this transformer assuming ; w/m^2 –°C due to radiation = 6 and due to convection = 6.5, improvement in convection due to provision of tubes = 40%; temperature rise = 40°C; length of each tube = 1 m; diameter of tubes = 50 mm. Neglect the top and bottom surfaces of the tank as regards cooling. Suggest a suitable scheme of arrangement of cooling tubes.

14. (a) A 15 KW, 440 V, 4 pole, 50 Hz, 3-phase induction motor is built with a stator bore 0.25 m and core length of 0.16 m. The specific electric loading is 23000 ampere conductor per metre. Using the data of this machine, determine the core dimensions, number of stator slots and number of stator conductors for a 11 KW, 460 V, 6 pole, 50 Hz motor. Assume a full load efficiency of 84% and power factor of 0.8 for each machine. The winding factor is 0.96.

Or

(b) Derive the output equation of 3-phase induction motor from basis and also explain the significance of output co-efficient.

15. (a) Estimate the stator core dimensions, number of stator slots and no. of stator conductor/slot for a 100 KW, 3300 V, 50 HZ, 12 pole, star connected slip ring induction motor. B_{av} = 0.4 Wb/m^2; ac = 25000 ampere conductors/m; efficiency = 90%; Power factor = 0.9; Winding factor = 0.96; Choose main dimensions to give best power factor. The slot loading should not exceed 500 ampere conductors. (16)

Or

(b) State and explain the factors governing the choice of average flux density in the air gap and ampere conductors per meter in the design of three phase induction motor. (16)