A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 55304

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

Fifth Semester

Electrical and Electronics Engineering

15UEE504-ELECTRICAL MACHINE DESIGN

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The apparent flux density is defined as _____ CO1- R

   (a) Actual flux/tooth area (b) Total flux/tooth area

   (c) Total flux=tooth area (d) None of these

2. Stacking factor depends upon _____ CO1- R

   (a) Thickness of core and insulation (b) Thickness of core

   (c) Thickness of insulation (d) Converter

3. In lap winding, equalizer rings are used since _____ CO2- R

   (a) Number of parallel path is = two (b) Number of parallel path is = number of poles

   (c) Number of conductors is large (d) Voltages are slightly varying

4. The number of commutator segments in a dc machine is equal to the no. of ___ CO2- R

   (a) Coil-sides (b) Turns (c) Coils (d) Slots

5. The leakage flux in a transformer depends upon the value of _____ CO3- R

   (a) Load current (b) Supply frequency (c) Mutual flux (d) None of the above

6. The function of oil in a transformer is …… CO3- R

   (a) to provide insulation and cooling (b) to provide protection against lightning

   (c) to provide protection to windings (d) to provide lubrication

7. In the case of induction motors the ratio of length to pole pitch for minimum cost is taken as _____ CO4- R

(a) 1.0 (b) 1.5 to 2 (c) 2 to 3 (d) 3 to 5

8. The number of parallel paths in an integral slot winding with P poles is equal to _____ CO4- R

(a) P (b) 2P (c) P/2 (d) P/4

9. Turbo alternators are characterized by CO5- R

(a) Short diameters and large axial lengths (b) Short diameters and small axial lengths

(c) Large diameters and small axial length (d) Large diameters and large axial lengths

10. The use of salient poles on high speed alternators will cause CO5- R

(a) Excessive windage loss and excessive noise (b) Excessive windage loss but reduced

(c) Reduced windage loss but excessive noise (d) Reduced windage loss and low noise

PART – B (5 x 2= 10Marks)

11. Define Iron space factor. CO1- R

12. State the relation between the armature diameter and commutator diameter for various ratings of dc machine. CO2- R

13. How yoke dimensions of a transformer are fixed? CO3- R

14. Mention the factors influencing length of air gap of an Induction motor. CO4- R

15. Define SCR. What are the effects of SCR on machine performance? CO5- R

PART – C (5 x 16= 80Marks)

16. (a) Explain the various factors that decide the choice of Specific Magnetic and Electric loading. CO1- U (16)

Or

(b) (i) Classify the insulating materials used in the electrical machines based on thermal considerations. CO1- U (8)

(ii) What are the major considerations accounted for the good design of electrical machines? CO1- U (8)

17.	(a)	(i) Determine the air gap length of a dc machine from the following particulars. Gross Length of core=0.12m, number of ducts one and is 10 mm wide, slot pitch=25mm,slot width=10mm, Carter's coefficient for slots and ducts=0.32, gap density at pole centre=0.7 Wb/m^2, field mmf per pole=3900A, mmf required for iron parts of magnetic circuit = 800A.	CO2- App	(8)
		(ii) Derive the relationship between real and apparent flux densities in the armature teeth.	CO2- App	(8)
		Or		
	(b)	Explain the various factors that are affected at the time of selection of number of poles in d.c.machines.	CO2- App	(16)
18.	(a)	(i) Derive the output equation of a single phase transformer.	CO3- App	(8)
		(ii) Determine the dimensions of core and yoke for a 200 kVA, 50 Hz, single phasecore type transformer. A cruciform core is used with distance between adjacent limbs equal to 1.6 times the width of core laminations. Assume voltage per turn 14 V, maximum flux density=1.1 Wb/m^2, window space factor=0.9, current density 3 $A/mm^2$and stacking factor=0.9.The net iron area is 0.56 d^2in a cruciform core where d is the diameter of circumscribing circle. Also the width oflargest stamping is 0.85d.	CO3- App	(8)
		Or		
	(b)	The tank of a 1250 kVA natural oil cooled transformer has the dimensions length, width and height as 1.55mX0.65mx1.85m respectively. The full load loss is 13.1 kW.Find the number of tubes for this transformer assuming/m^2-°C due to radiation=6;W/m^2-°C due to convection=6.5;improvement in convection due to provision of tubes=40 percent; temperature rise=40°C; length of each tube=1m;diameter of tubes=50mm.Neglect the top and bottom surfaces of the tank as regards cooling.	CO3- App	(16)
19.	(a)	(i) Find the values of diameter and length of stator core of a 7.5kW,220V,50Hz,4 pole,3 phase induction motor for best power factor. Given: specific magnetic loading=0.4 Wb/m2; specific electric loading= 22000A/m; efficiency= 0.86; and power factor=0.87.also find the main dimensions if the ratio of core length to pole pitch is unity.	CO4- App	(8)

(ii) Explain the design of rotor bars and slots. CO4- App (8)

Or

(b) Determine the main dimensions, turns per phase, number of slots, conductor cross section and slot area of a 250 h.p, 3 phase, 50 Hz, 400V, 1410 r.p.m.slip ring induction motor. Assume Bav=0.5 Wb/m2,ac= 30000A/m, efficiency=0.9, and power factor=0.9,winding factor=0.955,current density=3.5A/mm^2.The slot space factor is 0.4 and the ratio of core length to pole pitch is 1.2. CO4- App (16)

20. (a) (i) Derive an output equation of synchronous machine. CO5- App (8)

(ii) Determine suitable stator dimensions for a 500 kVA,50Hz, 3 phase alternator to run at 375 r.p.m.Take mean gap density over the pole pitch as 0.55 Wb/m^2,the specific electric loading as 25,000 A/m.The peripheral speed should not exceed 35 m/s. CO5- App (8)

Or

(b) Explain the steps taken into account in the design of field winding of a salient pole machine. CO5- App (16)