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Question Paper Code	11803

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL/MAY 2023

Seventh Semester

Electrical and Electronics Engineering

EE8002 - DESIGN OF ELECTRICAL APPARATUS

(Regulations 2017)

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level,CO
1.	Define gap contraction factor for slots.	*2,K2,CO1*
2.	State the properties and limitations of insulating material.	*2,K2,CO1*
3.	Define window space factor.	*2,K2,CO2*
4.	Write the constant of voltage per turn equation for transformer.	*2,K1,CO2*
5.	Write the output co-efficient of DC machine.	*2,K1,CO3*
6.	List the factors to select the specific magnetic loading of DC machine.	*2,K1,CO3*
7.	How the induction motor is designed for best power factor?	*2,K2,CO4*
8.	Why selection of number of rotor slots is very important in case of squirrel cage motors?	*2,K1,CO4*
9.	Define Short Circuit Ratio (SCR) of a Synchronous machine.	*2,K2,CO5*
10.	List out the advantages of single layer windings.	*2,K1,CO5*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a)	Draw the winding diagram in developed form for a simplex lap wound 24 slots, 4 pole dc armature with 24 commutator segments. Find the front pitch, back pitch and winding table.	*13,K2,CO1*
		OR	
	b)	(i) Derive the relation between real and apparent flux density.	*6,K2,CO1*
		(ii) Explain the different methods to evaluate the mmf for teeth.	*7,K2,CO1*
12.	a)	Calculate the KVA output of a single phase transformer from the following data: ratio of core height to distance between core centre =0.28, ratio of net iron area to area of circumscribing circle=0.7, ratio of diameter of circumscribing circle to distance between core centres =0.56, Current density=2.3A/mm^2, Frequency =50Hz, K_w=0.27, B_m=1.2 wb/m^2, Distance between core centre=0.4m.	*13,K2,CO2*
		OR	

b) Derive the output equation of single phase and three phase transformer. *13,K2,CO2*

13. a) A 250 kVA, 6600/400 V, 3 phase core type transformer has a totalloss of 4800 W at full load. The transformer tanks is 1.25m inheight and 1m X 0.5m in plan.Design a suitable scheme for tubesif the average temperature rise is to be limited to 35°C.Thediameter of the tubes is 50mm and are spaced 75mm from eachother. The average height of tubes is 1.05m.Specific heatdissipation due to radiation and convection is 6 and 6.56W/m^2-°Crespectively. Assume that convection is improved by 35 percent due to provision of tubes. *13,K2,CO3*

OR

b) (i) Derive the output equation of DC machine. *6,K2,CO3*

(ii) Determine the main dimensions of a 80kW, 4 pole, 600rpm dc shunt generator, the full load terminal voltage being 220V. The maximum gap density is 0.75 wb/m^2 and ampere conductors per metre is 27000AC/m. Assume square pole face. The pole arc to pole pitch ratio is 0.7. *7,K2,CO3*

14. a) Derive the output equation of AC machine and write the factor to choose specific magnetic and electric loading. *13,K2,CO4*

OR

b) Estimate the stator core dimensions and turns per phase for a 100kW, 3300V, 50Hz, 12 pole star connected slip ring induction motor. Assume B_{av}=0.4wb/m^2 and ac = 25000AC/m, Efficiency=0.9, power factor = 0.9, winding factor=0.96. Choose the main dimensions to give best power factor. *13,K2,CO4*

15. a) Determine the main dimensions for a 1000KVA, 50Hz, 3 phase, 375rpm alternator. The average air gap flux density is 0.55Wb/m^2 and the ampere conductors per metre are 28,000. 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 50m/s. The runaway speed is 1.8 times the synchronous speed. *13,K2,CO5*

OR

b) Identify for 500kVA, 6600V, 20Hz, 500 rpm and connected three phase salient pole machine diameter, core length for square pole face number of stator slots and number of stator conductors for double layer winding. Assume specific magnetic loading = 0.68 tesla, ac = 30000 AC/m and K_{WS} = 0.955. *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) (i) A 20 HP, 3 phase 400 V, 50Hz, 4 Pole star connected induction motor has 3 slots/pole phase with short pitched coils of 160 Span. Flux per pole is 0.009/Wb, gap area 180 cm^2 , effective airgap is 0.55m. Estimate the component of magnetizing current for the air gap. *8,K3,CO4*

(ii) How is cylindrical pole different from salient pole in a Synchronous machine? *7,K2,CO5*

OR

b) (i) A 3 phase induction motor has 54 stator slots with 8 conductors per slot and 72 rotor slots with 4 conductors per slot. Find the number of stator and rotor turns. Find the voltage across the rotor slip rings when the rotor I open circuited and at rest. Both stator and rotor are star connected and a voltage of 400V is applied across the stator terminals. *8,K3,CO4*

(ii) Mention the factors that influence the choice of specific electric and magnetic loadings in a synchronous machine. *7,K2,CO5*