B.E./B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

Sixth 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.	State the properties and limitations of insulating material.	2,K2, CO1
2.	Define gap contraction factor for slots.	2,K1, CO1
3.	Define window space factor.	2,K1, CO2
4.	Compare shell type and core type transformer.	2,K2, CO2
5.	List the factors to select the specific magnetic loading of DC machine.	2,K1, CO3
6.	Write the output co-efficient of DC machine.	2,K1, CO3
7.	Illustrate the condition to design IM for best power factor.	2,K2, CO4
8.	Write the difference between slip ring and squirrel cage IM.	2,K1, CO4
9.	Define Short Circuit Ratio (SCR) of a Synchronous machine.	2,K1, CO5
10.	Summarize the uses of damper winding.	2,K2, 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) Determine the apparent flux density in the teeth of a dc machine when the real density is 2.15 wb/m^2, Slot pitch is 28mm, slot width is 10mm and the gross core length 0.35 m. The number of ventilating ducts is 4. Each duct is 10mm wide. The magnetizing force for a flux density of 2.15wb/m^2 is 55000 H/m. The iron stacking factor is 0.9. — 13,K2,CO1

12. a) Calculate the KVA output of 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 — 13,K3,CO2

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.

OR

b) A 250 kVA, 6600/400 V, 3 phase core type transformer has a total loss   *13,K3,CO2* of 4800 W at full load. The transformer tanks is 1.25m in height and 1m X 0.5m in plan. Design a suitable scheme for tubes if the average temperature rise is to be limited to 35°C.The diameter of the tubes is 50mm and are spaced 75mm from each other. The average height of tubes is 1.05m.Specific heat dissipation due to radiation and convection is 6 and 6.56W/m^2-°C respectively. Assume that convection is improved by 35 percent due to provision of tubes.

13. a) Determine the main dimensions, number of poles and length of airgap   *13,K3,CO3* of a 600kW, 500V, 900 rpm generator. Assume average gap density as 0.6Wb/m^2 and ampere conductors/m as 35000. The ratio of pole arc/pole pitch is 0.75 and the efficiency is 91%. The following are the design constraints: Peripheral speed $\not>$ 40 m/s, frequency of flux reversals $\not>$ 50Hz, current/brush arm $\not>$400A and armature mmf/pole $\not>$7500A. The mmf required for airgap is 50% of armature mmf and gap contraction factor is 1.15.

OR

b) (i) Derive the output equation of DC machine.   *7,K2,CO3*

(ii) Determine the main dimensions of a 80kW,4 pole,600rpm dc shunt   *7,K3,CO3* 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.

14. a) Estimate the stator core dimensions and turns per phase for a 100kW,   *13,K3,CO4* 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.

OR

b) Derive the output equation of AC machine and write the factors to   *13,K2,CO4* choose specific electric loading of IM.

15. a) Compute the main dimensions of a 100 MVA, 11kV, 50 Hz, 150rpm   *13,K3,CO5* three phase water wheel generator. The average gap flux density is 0.65 tesla and ampere conductors per meter is 40000 AC/m. The peripheral speed should not exceed 65m/s at normal running speed.

OR

b) Explain the step by step procedure for the design of field winding of *synchronous machine.* 13,K2,CO5

PART C (1 × 15 = 15 Marks)

16. a) (i) Write the computer program to design the overall dimension of *7,K2,CO2* single phase core type transformer.

(ii) A 3 phase induction motor has 54 stator slots with 8 conductors per *8,K3,CO4* 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 is open circuited and at rest. Both stator and rotor are star connected and a voltage of 400V is applied across the stator terminals.

OR

b) (i) Derive the output equation of three phase transformer. *8,K2,CO2*

(ii) Develop a flow chart and write a program for designing a slip ring *7,K2,CO4* rotor.