PRN:		Course Code :	ELE2702

Final Year **B. Tech** End Semester Examination Summer 2024

Electrical Machine Design

Day and Date: 24 MAY 2024, Friday Max Marks: **100**

Time : 10:30 to 1:30 pm Duration: **03** hrs

Instructions: All questions are compulsory.

			Marks	Bloom's Level	CO
Q.1		**Attempt the following**			
	a)	Draw and explain duty cycles of Machines	08	L1	CO1
	b)	Draw and discuss cooling time curve and derive cooling time constant	08	L1	CO1
		OR			
	b)	Draw and explain heating time curve and derive heating time constant	08	L2	CO1
Q.2		**Attempt the following**			
	a)	Derive output equation of single phase transformer	08	L2	CO2
	b)	Discuss Distribution Transformer & Power Transformer	08	L4	CO4
		OR			
	b)	Discuss optimum designs of transformer in terms of minimum cost and maximum efficiency	08	L4	CO4
Q.3		**Attempt any two from the following**			
	a)	Discuss choice of specific electric & magnetic loadings of DC machine	08	L3	CO2
	b)	Describe guiding factors for selection of no. poles, core length , armature diameter, length of air gap, No. of armature slots for DC machines	08	L2	CO3
	c)	Discuss losses and efficiency of DC machine	08	L2	CO3
Q.4		**Attempt any two from the following**			
	a)	Find the main dimensions of a 15KW, 3 phase, 50Hz, 2810 r.p.m squirrel cage induction motor having an efficiency of 0.88 and full load power factor of 0.9. Assume: specific magnetic loading = 0.5 wb/m^2 , specific electric loading = 25000 A/m, Take the rotor peripheral speed as approximately 20 m/s at synchronous speed.	08	L2	CO1
	b)	Determine the main dimensions, turns per phase, number of slots, conductor cross section and slot area of a 250h.p, 3 phase, 50 Hz, 400V, 1410 r.p.m slip ring induction motor. Assume Bav = 0.5 wb/m^2 , ac = 30000 A/m, efficiency =0.9 and power factor = 0.9, winding factor = 0.955, current density = 3.5 A/mm^2. The slot space factor is 0.4 and the ratio of core length to pole pitch is 1.2. The machine is delta connected.	08	L2	CO2
	c)	Derive output equation of A C Machine	08	L2	CO3

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Q.5 **Attempt any Two of the following**

a)	The following is the design data available for a 1250 KVA, 3 phase, 50Hz, 3300 V, star connected, 300 rpm. Alternator of salient pole type: Stator bore D= 19 m, stator core length L = 0.335m, pole arc/ Pole pitch = 0.66, turns per phase = 150, single layer concentric winding with 5 conductors per slot, short circuit ratio = 12, assume that the distribution of gap flux is rectangular under the pole arc with zero values in the interpolar region. Calculate a) Specific magnetic loading b) Armature mmf per pole c) Gap density over pole arc d) Air gap length	09	L3	CO3
b)	A 5000 KVA, 33 KV, 50Hz 600 r.p.m, 3 phase salient pole alternator has 180 turns per phase. Estimate the length of air gap if the aveage flux density is 0.54 wb/m^2 the ratio pole arc to pole pitch 0.65, the short circuit ratio 1.2, the gap is 80 percent of no load field mmf and the winding factor 0.955	09	L3	CO3
c)	Discuss choice of specific magnetic and electric loading of synchronous machine	09	L3	

Q.6 **Attempt any Two of the following**

a)	Explain working of servo motor	09	L3	CO3
b)	Describe construction and working of stepper motor	09	L5	CO4
c)	Discuss Permanent magnet brushless DC motor	09	L5	CO4

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