Reg. No. : | | | | | | | | | | |

Question Paper Code: 99303

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2023

Professional Elective

Electrical and Electronics Engineering

19UEE903- DESIGN OF ELECTRICAL MACHINES

(Regulations 2019)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 20 = 100 Marks)

1.	(a)	Explain the types of duties and ratings	CO1 - U	(20)
		Or		
	(b)	(i) Derive the output equation for the DC machines	CO1- U	(10)
		(ii) Explain the general factors that influence the choice of specific magnetic loading.	CO1- U	(10)
2.	(a)	A 5 KW ,250V, 4 poles, 1500 rpm DC shunt Generator is designed to have a square pole face . The average Magnetic Flux Density in the Air gap is 0.42wb/m2 and ampere conductors per meter are 15000.Compute the main Dimensions of the machine. Assume Full load Efficiency is 87%.The ratio of pole arc to pole pitch is 0.66.	CO3 - App	(20)
		Or		
	(b)	A design is required for 50kW, 4 pole, 600RPM DC shunt generator. Full load terminal voltage is 220V. Maximum gap density is 0.83wb/m^2. Ampere conductor per metre is 30,000. Compute the suitable dimensions for a square pole face.Assume armature voltage drop as 3% of rated terminal voltage and field current is 1% of rated load current. The ratio of pole arc to pole pitch is 0.67.	CO3 - App	(20)
3.	(a)	Determine the dimensions of core and window of 5kVA, 50Hz, single phase core type transformer. A rectangular core is used. Width long side is twice as long as short side. Window height is	CO4 -App	(20)

three times its width. Voltage per turn is 1.8V. Window space factor is 0.2. Current density is 1.8A/mm^2.B_m = 1Wb/m^2

Or

(b) Determine core and window area for 1000kVA, 6000/400V, 50Hz single phase core type transformer. Assume maximum flux density of 1.25 Wb/m^2, Current density of 2.5A/mm^2, voltage per turn is 30V, window space factor is 0.32. CO4 -App (20)

4. (a) Estimate stator core dimensions, number of stator slots, number of stator conductors per slot for a 100kW, 3300V, 50 Hz, 12 pole star connected slip ring induction motor. B_{av}=0.4 Wb/m^2, ac = 25000 amp-cond./m, efficiency = 0.9, p.f = 0.9. Choose dimensions to get best power factor. Slot loading should not exceed 500 Amp-conductors. CO5 -App (20)

Or

(b) Determine the D and L of a 70 Hp, 415V, 3 phase, 50Hz, star connected, 6 pole induction motor for which ac = 30000 amp. Cond./m and B_{av} = 0.51 Wb/m^2. Take η = 90% and pf 0.91. Assume τ = L. Estimate the number of stator conductors required for a winding in which the conductors are connected in 2-parallel paths. Choose a suitable number of conductors per slot, so that the loading does not exceed 750 amp. Cond. CO5 -App (20)

5. (a) Find the main dimensions of a 100MVA, 11kV, 50Hz, 150rpm, 3 phase water wheel generator. The average gap density is 0.65 Wb/m^2 and ampere conductors per metre are 40,000. The peripheral speed should not exceed 65m/s at normal running speed in order to limit the run-away peripheral speed. CO5 -App (20)

Or

(b) Determine the suitable number of slots and conductors per slot, for the stator winding of a 3 phase 3300V, 50Hz, 300 rpm alternator. The diameter is 2.3m and the axial length of core is 0.35m. The maximum flux density in the air gap should be approximately 0.9 Wb/m2. Assume sinusoidal flux distribution. Use single layer winding and star connection for stator. CO5 -App (20)