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

Question Paper Code: 99303

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2024

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)	Derive the output equation for the DC machines	CO1 App	(10)
		Derive the output equation for the single phase Transformer	CO1 App	(10)
		Or		
	(b)	Explain the types of duties and ratings	CO1 App	(20)
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.	CO2 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.	CO2 Ana	(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 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	CO3 Ana	(20)
		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.	CO3 Ana	(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.	CO4 U	(20)
		Or		
	(b)	Estimate the main dimensions, air-gap length, stator slots, stator turns per phase and cross sectional area of stator and rotor conductors for a 3-phase, 15Hp, 400V, 6 pole, 50 Hz, 975 rpm, induction motor. The motor is suitable for star delta starting. B_{av}=0.45 Wb/m^2, ac = 20000 amp. Cond./m. L/τ = 0.85, η = 0.9, pf = 0.85.	CO4 Ana	(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 U	(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 U	(20)