K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:VI
Class:TY	Program:B.Tech
Branch Code:ELE	Pattern:2022
Name of Course:Computer-Aided Machine Design	Course Code:ELE223011
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

		Marks	CO
Question No. 1			
1a)	Explain the following terms: 1) Heating time constant 2) Cooling time constant. State various methods of cooling of transformer.	(6)	CO1
Question No. 2			
2a)	Explain the function of Buchholz relay and Tap changer in transformer.	(6)	CO1
Question No. 3			
3a)	What are assumptions in the determination of leakage reactance for core type of transformers.	(8)	CO1
	OR		
3b)	Derive the expression for instantaneous radial force developed in transformer.	(8)	CO1
3c)	Calculate no load current of a 400 V, 50 Hz, single phase core type transformer having the following particulars: Length of mean iron path = 200 cm; Gross core area = 100cm^2; Joints equivalent to 0.1 mm air gap; flux density =0.7 T; specific core loss=0.5 W/kg; MMF = 2.2 AT/cm for iron path; density of core material = 7.5 x 10^3 kg/m^3.Stacking factor = 0.9.	(8)	CO3
	OR		
3d)	A 1 MVA, 11000/3300 V, 50 Hz, delta/star 3-phase core type transformer has the following data: Width of h.v. winding = 68 mm Width of l.v. winding = 17 mm	(8)	CO3

Height of coils = 594 mm

Length of mean turn = 1165 mm

l.v. winding turns = 93

Width of duct between h.v. and l.v. windings = 15 mm

Calculate the percentage reactance of the transformer referred to the h.v. side.

Question No. 4

4a)	Explain the following windings in a three-phase induction motor. 1) Integral slot winding 2) Fractional slot winding 3) Single layer winding 4) Double layer winding	(8)	CO1

OR

4b)	What is radial leakage flux and axial leakage flux in transformer? What are the effects of it?	(8)	CO1
4c)	Determine the main dimensions, turns per phase, number of slots and conductor cross section of a 250 hp, 3-phase, 50 Hz, 400 V, 1410 rpm, slip ring induction motor. Assume Bav = 0.5 Wb/m², ac = 30,000 A/m, efficiency = 0.9, power factor = 0.9, winding factor = 0.955, current density = 3.5 A/mm². The slot space factor is 0.4 and the ratio of core length to pole pitch is 1.2. The machine is delta connected.	(8)	CO3

OR

4d)	A 20 kW, 3-phase, 6-pole, 50 Hz, 415 V star-connected induction motor has 54 stator slots, each containing 18 conductors. Calculate the area of rotor bar and end ring currents. The number of rotor bars is 60. The machine has an efficiency of 0.9 and a power factor of 0.85. Assume the rotor mmf is 90% of the stator mmf. Also, find the rotor bar and end ring sections if the current density is 5 A/mm².	(8)	CO3

Question No. 5

5a)	Derive the equation for the end ring current for the rotor of squirrel cage induction motor along with the necessary diagram.	(8)	CO1

OR

5b)	Explain the design of squirrel cage rotor of a three phase induction motor.	(8)	CO1
5c)	Explain briefly how the number of slots in cage rotor are decided to avoid crawling and cogging. What is the effect of skewing of slots?	(8)	CO1

OR

5d)	Explain the factors to be considered while estimating the length of air gap in three phase induction motor. How length of air gap affects the overload capacity of motor?	(8)	CO1

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