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: V
Class: TY	Program: B. Tech
Branch Code: ELE	Pattern: 2022
Name of Course: Synchronous and Special Purpose Machines	Course Code: ELE223002
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			
1)	What is armature reaction? What are the effect of armature reaction on synchronous machines at different power factors	(6)	CO1
Question No. 2			
2)	Explain Blondel's two reaction theory for salient pole machines. Draw respective phasor diagram.	(6)	CO2
Question No. 3			
3a)	State three important features possessed by synchronous motor. What do mean by 'V' curves and Inverted 'V' curves of Synchronous Motor.	(8)	CO2
	OR		
3b)	Explain any two methods of starting Synchronous Motor	(8)	CO2
3c)	A Synchronous Motor takes input power of 22 kW at 415 volt from supply. The Synchronous reactance is 5 ohm per phase and armature resistance is negligible. The back emf is 575 volt. Calculate power factor and the current drawn by motor. The motor is star connected.	(8)	CO2
	OR		
3d)	A 2300 V, 3-phase star-connected synchronous motor has a resistance of 0.2 Ω/phase and synchronous reactance of 2.2 Ω/phase. The motor operates at a 0.5 power factor lead with a line current of 200 A. Calculate the value of the induced emf per phase.	(8)	CO2
Question No. 4			
4a)	Explain the construction, working, characteristics, and applications of a Universal Motor.	(8)	CO2
	OR		
4b)	Describe the ratings and applications of compensated series motors. Explain how these motors differ from regular series motors.	(8)	CO2
4c)	A 300 W, 50 Hz, 250 V single-phase universal motor runs at 2300 rpm and takes 1.4 A when supplied from a 250 V DC supply. If the motor is connected to a 250 V AC supply and takes 1.5 A, calculate the back emf, torque, and power factor. Assume Ra = 35 Ω and La = 0.4 H.	(8)	CO2

OR

4d)	A 500 W, 50 Hz, 230 V single-phase universal motor runs at 2000 rpm and takes 1.6 A when supplied from a 230 V DC supply. If the motor is connected to a 230 V AC supply and takes 1.6 A, calculate the back emf, torque, and power factor. Assume Ra = 10 Ω and La = 0.5 H.	(8)	CO2

Question No. 5

5a)	Explain the construction, working, applications, and different modes of operation of a variable reluctance stepper motor.	(8)	CO2

OR

5b)	Explain the construction, working, applications of a permanent magnet DC motor.	(8)	CO2
5c)	Describe the construction, working, characteristics, and applications of a Permanent Magnet Synchronous Motor (PMSM).	(8)	CO2

OR

5d)	Describe the construction, working, characteristics, and applications of a BLDC Motor.	(8)	CO2

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