Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 12-12-2025 **Time:** 01:00pm– 04:00pm

School: SOE	**Program:** B.Tech. (EEE)	
Course Code: EEE3004	**Course Name:** Special Electrical Machines	
Semester: V	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	20	20	16	22	22

Instructions:

(i) Read all questions carefully and answer accordingly.
(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Mention the function of the signal controller in the driver circuit of the permanent magnet BLDC motor.	2 Marks	L1	CO2
2.	Mention the parameters that affect the emf of a permanent magnet synchronous motor.	2 Marks	L1	CO2
3.	Outline the differences between a conventional DC motor and a BLDC motor.	2 Marks	L1	CO2
4.	List out the applications of a permanent magnet synchronous motor.	2 Marks	L1	CO2
5.	Write the equivalent circuit of a permanent magnet synchronous motor.	2 Marks	L2	CO2
6.	Describe a key characteristic of a stepper motor in open-loop drive regarding accuracy and reliability.	2 Marks	L1	CO3
7.	Why is the control of the motor so significant?	2 Marks	L2	CO3
8.	List out the applications of the stepper motor.	2 Marks	L1	CO3
9.	How do the DSP and gate drive circuit help in controlling the motor?	2 Marks	L1	CO4
10.	Mention the parameters that the speed of a Linear induction motor depends.	2 Marks	L1	CO5

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	A four-phase, single-stack variable stepper motor is installed in an electric vehicle system and has eight poles with a single stack. With the use of a switching circuit and the truth table, describe the operation of a single-stack variable stepper motor.	**10 Marks**	**L3**	**CO1**
	b.	A stepper motor has a step angle of 1.8^0. Calculate i) resolution, ii) number of steps required for 50 revolutions and iii) shaft speed if the stepping frequency is 5000 pulse/sec. A four-phase, eight-pole switched reluctance motor has six rotor teeth. Find the step angle and commutation frequency for a speed of 6000 rpm.	**10 Marks**	**L3**	**CO1**
Or					
12.	**a.**	A switched reluctance motor is used in an electric vehicle. It operated in four-phase with has eight-pole with six rotor teeth. Calculate the step angle and commutation frequency for a speed of 6000 rpm. And comment on how the number of stator and rotor poles affects the step angle.	**10 Marks**	**L3**	**CO1**
	b.	Plot the characteristics of a switched reluctance motor. Comment on how the torque - rotor position and torque-speed characteristics and affect the performance of SRM.	**10 Marks**	**L3**	**CO1**

13.	**a.**	A permanent magnet DC motor is used to drive a robotic arm. During operation, the arm's speed noticeably decreases under load conditions. By using the working principle of the permanent magnet DC motor, with a neat diagram, what could be the possible reasons for the speed drop, and suggest methods to control or improve speed stability in this scenario?	**10 Marks**	**L3**	**CO2**
	b.	A DSP, hall drive and gate drive circuit are employed to regulate the speed and torque of a brushless DC motor for precise operation. How does this arrangement effectively help to control the speed and torque of the BLDC motor?	**10 Marks**	**L3**	**CO4**
Or					
14.	**a.**	A permanent magnet DC motor has an armature resistance of 1.03 Ω. It draws a current of 1.25 A at no load with 50 V supply and running at 2100 rpm. Calculate (a) speed–voltage constant, (b) rotational losses and (c) output power when it runs at 1700 rpm at 48 V supply.	**10 Marks**	**L3**	**CO2**
	b.	The DSP-based control mechanism is employed to control the BLDC motor, which is used in industrial applications. Prepare	**10 Marks**	**L3**	**CO4**

		the control flowchart to control the BLDC motor to get better control characteristics.			

15.	**a.**	Employ a digital comparator and translator in the control scheme of a closed-loop stepper motor. With a neat diagram, describe the controlling operation in a closed-loop stepper motor.	**10 Marks**	**L3**	**CO3**
	b.	A stepper motor is used in an industrial robotic application. When the stepper motor is to be operated at an input pulse frequency of 6000 pulse/sec and travel a distance of 180° in 0.025 sec. Find the i)step angle resolution of a stepper motor. And comment on how the stepper motor step angle varies with the input pulse frequency.	**10 Marks**	**L3**	**CO4**
		Or			
16.	**a.**	A microprocessor and gate drive circuit are employed to regulate the speed and torque of a brushless DC motor for precise operation. How effectively do these help in controlling the speed and torque of the BLDC motor?	**10 Marks**	**L3**	**CO3**
	b.	A stepper motor has a resolution of 500 steps/revolution in single-phase ON mode. Find its resolution in half-step mode. Find the number of steps required for the rotor to move a distance of 72°. Comment on how the step angle's significance affects in control of the resolution of a stepper motor.	**10 Marks**	**L3**	**CO4**

17.	**a.**	The Linear Induction Motors are used in traction applications. With a neat block diagram, analyze the control scheme employed in a linear induction motor with signal conditioner, voltage, and current sensors.	**10 Marks**	L4	**CO5**
	b.	A Linear Induction Motor used for traction purposes. The thrust developed by a three-phase linear induction motor is 100 kW when running at 200 kmph. The supply frequency is 50 Hz and the pole pitch is 0.5 m. Determine, i) the power developed, ii) synchronous speed, iii) slip and iv) copper loss in the secondary.	**10 Marks**	**L3**	**CO5**
		Or			
18.	**a.**	The frequency, thrust, voltage, and air gap length are important parameters to get the performance characteristics of the LIM. Analyze the various characteristics of a linear induction motor.	**10 Marks**	**L4**	**CO5**
	b.	The following data are given for a linear induction motor: supply frequency = 25 Hz, input power = 6 kW, stator copper loss and iron loss = 1.2 kW, velocity of the motor = 2.4 m/s, pole pitch = 0.6 cm. Find the gross mechanical power developed and thrust developed.	**10 Marks**	**L3**	**CO5**