Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – May / June 2026

Date: 27-05-2026 **Time:** 01:00pm – 04:00pm

School: SOE	**Program:** B. Tech. / EEE	
Course Code: EEE3001	**Course Name:** Electrical Drives	
Semester: VI	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	16	14	22	22	26

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

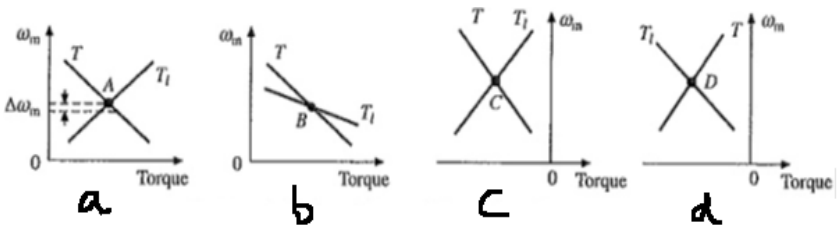
Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	The main philosophy in Electrical Drives is that the motor speed torque (T) characteristics are controlled/shaped by the power converter according to the requirement of the industrial load torque (Tl) characteristics. What would be the equilibrium condition of the drive systems?	**2 Marks**	**L1**	**CO1**
2.	In a robotic drive mill, the rate of change of moment of inertia seen by the motor during the load is not constant. What would be the fundamental torque equation of the drive?	**2 Marks**	**L1**	**CO1**
3.	In an electric drive, excessive current may be drawn from the source during transient operation, such as starting, braking and speed reversal. Which block of an electric drive will be used to address that problem?	**2 Marks**	**L1**	**CO1**
4.	A 220V, 10.5A, 1300rpm separately excited DC motor is used for a wood cutting application, A DC shunt motor is controlled by a single-phase controlled rectifier. It is required to obtain the maximum output voltage from the converter. Calculate the value of the firing angle of the rectifier.	**2 Marks**	**L3**	**CO2**

5.	In a steel rolling mill, a DC shunt motor is controlled by a three-phase controlled rectifier, and it is required to rotate the spindle, which is connected to a motor shaft in an anti-clockwise direction with positive torque. Mention the suitable power converter for the application.	**2 Marks**	**L1**	**CO2**
6.	An induction motor for a blower application in the cement industry, it is controlled by a stator voltage control method. Compute the % efficiency of the motor if its slip is 0.3. [Neglect stator copper loss, core loss and friction loss]	**2 Marks**	**L3**	**CO3**
7.	A synchronous reluctance motor (cylindrical rotor) is used in a fiber spinning application. What would be the torque angle of the motor if it is required to operate at pull-out torque in the forward direction?	**2 Marks**	**L1**	**CO4**
8.	In a cement industry, a 2.9 MW, 4-pole, 1000 rpm slip-ring induction motor is utilized as a suction fan. To achieve speed control below the rated speed while maintaining high efficiency, a slip power recovery scheme is employed to feed the slip frequency power back to the AC main. Mention the specific name of the drive system used for this application?	**2 Marks**	**L1**	**CO5**
9.	In the cement industry, a primary crusher is used to crush the limestone into 100mm pieces. Mention the motor used in the cement industry for this application.	**2 Marks**	**L1**	**CO5**
10.	List the various sections of the textile industry?	**2 Marks**	**L1**	**CO5**

Part B

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

11.	**a.**	For an electric drive, the motor torque and load torque characteristics are shown in Fig.1 during forward braking and reverse braking operations. The equilibrium points during forward motoring operation are A & B and forward braking are C & D. Discuss and comment on the stability of the points.  **Fig.1.**	**10 Marks**	**L2**	**CO1**
		Or			
12.	**a.**	Compute the equilibrium points and determine their steady state stability when the motor and load torques are $T = (1 - 2\omega_m)$ and $T_l = -3\sqrt{\omega_m}$	**10 Marks**	**L3**	**CO1**

13.	**a.**	A 220 V, 960 rpm DC shunt motor having a resistance of 0.02 Ω is controlled by a step-up chopper with a source voltage of 110 V. (i) Compute the value of duty cycle if the speed is 500 rpm and output power is at rated torque. (ii) If δ = 0.5, compute the speed when it is loaded at rated torque.	**10 Marks**	**L3**	**CO2**
		Or			
14.	**a.**	ABB make Model M3BP250MLB3, 220V, 10A, 2000 rpm DC shunt motor is used in a heavy-duty material handling crane. While lifting and lowering loads, it is required to rotate at a speed of 800 rpm in both directions at rated torque. The available power converters in the workshop are a single-phase fully controlled rectifier and a single-phase semi-converter, both fed with a 1-phase 400V, 50Hz supply. i. Choose the suitable converter for the application and justify it. ii. Compute the firing angle required to control the motor at 1000 rpm at rated torque. iii. Compute the firing angle required to control the motor at -1000 rpm at rated torque.	**10 Marks**	**L3**	**CO2**

15.	**a.**	A MENZEL make MEBKSD500-10, three-phase squirrel cage delta-connected induction motor is used as a pump drive for a cooling water pump in a fertilizer factory, as shown in Fig. 2. The specifications of the motor are 2.8kW, 400V, 50Hz, 4-pole, 1370rpm. The parameters referred to the stator side are Rs=2Ω, Rr'=5Ω, Xs=Xr'=5Ω, Xm=80Ω. When driving the pump, it runs at the rated speed at the rated voltage. For an application, It is required to operate the motor at a low value of slip. a. As an engineer, suggest a suitable method to control the motor and comment on the performance of the motor if it operates at a higher value of slip? b. Choose the stator connection of your choice and compute the motor constant.	**10 Marks**	**L3**	**CO3**

		 Fig. 5: MENZEL make Three phase inductor motor for water pumping application in fertilizer plant.			
		Or			
16.	**a.**	(a) Write the performance equations of an induction motor. (b) Draw the equivalent circuit of an induction motor and clearly label its parameters. (c) List and explain the factors affecting the torque and speed of an induction motor.	**10 Marks**	**L3**	**CO3**
17.	**a.**	A 4-pole, 50 Hz, 3-phase induction motor has a rotor resistance of 0.2 Ω per phase and rotor standstill reactance of 1 Ω per phase. On full load, it is running with a slip of 4%. Calculate the extra resistance required in the rotor circuit per phase to reduce the speed to 1260 r.p.m., under the same load condition.	**10 Marks**	**L3**	**CO3**
		Or			
18.	**a.**	(a) Explain the concept of slip power recovery in induction motors. (b) Draw the circuit diagram of a slip power recovery scheme using a static Scherbius drive and explain its operation.	**10 Marks**	**L2**	**CO3**
19.	**a.**	A 500 kW, 3-phase, 3.3 kV, 50 Hz, 0.85(lagging) power factor, 4-pole, star-connected synchronous motor, which is used as a blower in paper mills, is shown in Fig. 5. The motor has the following parameters: Xs=15 Ω, Rs=0 Ω. The rated field current is 10A. For drying the material, it is required to blow out the hot air at maximum pullout torque. It is observed that the motor is running at synchronous speed, and operating voltage and excitation are at the rated values, but the motor is not giving its positive pullout torque.	**20 Marks**	**L3**	**CO4**

		a) Identify the problem in the motor operation to exhibit the maximum pullout torque. b) Compute the current drawn by the motor at half rated torque and field current, UPF.  Fig. 3: Blower driven by Synchronous motor drive in a paper mill application			
		Or			
20.	**a.**	A 400 kW, 3-ϕ, 4.0 kV, 60 Hz, 0.85 (lagging) power factor, 4-pole, Y-connected synchronous motor has the following parameters: Xs = 18 Ω, Rs = 0, and the rated field current is 8.5 A. (a) Calculate the armature current and power factor at half the rated torque and rated field current. (b) Find the field current required to obtain unity power factor at the rated torque. (c) Calculate the torque for unity power factor operation at a field current of 11.5 A.	**20 Marks**	**L3**	**CO4**

21.	**a.**	In present-day cement industries, variable frequency drives are used in various sections such as i. Raw mill and cement mill drives ii. Kiln drive iii. Crusher drives iv. Waste gas fan drive v. Compressor drives, etc. a) Identify the suitable electric motors at different sections in the process of manufacturing cement. b) The slip power recovery scheme is the most efficient one to send the power back to the source instead of being wasted in rotor resistances. Identify the section where the slip power recovery scheme can be implemented. c) Comment on the electric motors used in the primary crusher and suction fan.	**20 Marks**	**L3**	**CO5**
		Or			
22.	**a.**	In present-day textile industries, variable frequency drives (VFDs) are widely used in various sections such as: i. Spinning section (carding, drawing, roving)	**20 Marks**	**L3**	**CO5**

		ii. Weaving section (looms) iii. Dyeing and finishing section iv. Winding and winding preparation drives v. Fan, blower, and pump drives a) Identify suitable electric motors for different sections in the textile manufacturing process and justify your choices. b) Slip power recovery schemes enhance efficiency by returning power to the supply instead of wasting it in rotor resistances. Identify the sections in a textile mill where slip power recovery schemes can be effectively implemented. c) Comment on the selection and performance requirements of electric motors used in loom drives and blower/fan drives.			