

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(MID SEMESTER EXAMINATION)**

**CLASS: B.Tech  
BRANCH: EEE**

**SEMESTER : VII  
SESSION : MO/2025**

**SUBJECT: EE437 INDUSTRIAL DRIVES AND CONTROL**

**TIME: 02 Hours**

**FULL MARKS: 25**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

		CO	BL
Q.1(a) Enumerate the advantages of electrical drives.	[2]	1	1
Q.1(b) Describe different components of load torques.	[3]	1	1
Q.2(a) Classify different types of load torque.	[2]	1	3
Q.2(b) Derive the condition for steady state stability.	[3]	1	3
Q.3(a) A motor has two loads. One has rotational motion. It is coupled to the motor through a reduction gear with a = 0.1 and an efficiency of 90%. The load has a moment of inertia of 10Kgm <sup>2</sup> and a torque of 10 Nm. The other load has translational motion and consists of a 1000 kg weight lifted up to a uniform speed of 1.5m/s. Coupling between this load and the motor has an efficiency of 85%. Motor has an inertia of 0.2kgm <sup>2</sup> . And runs at a constant speed of 1420 rpm. Determine the equivalent inertia referred to the motor shaft and the torque developed by the motor.	[2]	1	3
Q.3(b) A drive has the following equations for motor and load torques: $T = (1 + 2\omega_m) \text{ and } T_l = 3\sqrt{\omega_m}$ Compute the equilibrium points and determine their steady-state stability.	[3]	1	2
Q.4(a) Explain why a motor of smaller rating is sufficient for short-time duty operation.	[2]	2	2
Q.4(b) Explain the different classes of motor duty and illustrate each class with a suitable waveform.	[3]	2	2
Q.5(a) Explain the concept of closed-loop operation in an electrical drive system.	[2]	2	2
Q.5(b) A rolling mill driven by a thyristor converter-fed DC motor operates on a speed-reversing duty cycle. The motor field current is maintained constant at the rated value. The moment of inertia referred to the motor shaft is 10,000 kg-m <sup>2</sup> . The duty cycle consists of the following intervals:	[3]	2	3
i. Rolling at full speed (200 rpm) and at a constant torque of 25,000 N-m for 10 seconds.			
ii. No-load operation for 1 second at full speed.			
iii. Speed reversal from 200 rpm to -200 rpm in 5 seconds.			
iv. No-load operation for 1 second at full speed.			
v. Rolling at full speed and at a torque of 20,000 N-m for 15 seconds.			
vi. No-load operation at full speed for 1 second.			
vii. Speed reversal from -200 rpm to 200 rpm in 5 seconds.			
viii. No-load operation for 1 second at full speed.			

Determine the torque rating and the power rating of the motor.