

Roll No.:.....

# National Institute of Technology, Delhi

Name of the Examination: B. Tech.

Mid-Semester Examination Sept. – Oct., 2019

Branch :EEE Semester :VII  
Title of the Course :Electrical Drives Course Code :EEB401

Time: 2 Hours

Maximum Marks: 25

Note : All questions are compulsory.

1.	A motor is used to drive a hoist. Motor characteristics are given by Quadrants I and II: $T = 200 - 0.2N$ , N-m Quadrants III and IV: $T = -200 - 0.2N$ , N-m, where N is the speed in rpm. When hoist is loaded, the net load torque is $T_l = 100$ , N-m and when it is unloaded, the net load torque is $T_l = -80$ , N-m. Obtain the equilibrium speeds for operation in all four quadrants.				4 Marks																									
2.	A motor drives four load, two have rotational motion and two translational motion. Moment of the inertia of the motor is $1.2 \text{ kg-m}^2$ . Motor runs at a speed of 1000 rpm. Following are the details about the four loads: <table><tr><td>Load</td><td>Type of Motion</td><td>Speed</td><td>Inertia/Mass</td><td>Torque/Force</td></tr><tr><td>1.</td><td>Rotational</td><td>200 rpm</td><td><math>7 \text{ kg-m}^2</math></td><td>10 N-m</td></tr><tr><td>2.</td><td>Rotational</td><td>200 rpm</td><td><math>5 \text{ kg-m}^2</math></td><td>6 N-m</td></tr><tr><td>3.</td><td>Translational</td><td>10 M/s</td><td>10 kg</td><td>20 N</td></tr><tr><td>4.</td><td>Translational</td><td>10 M/s</td><td>20 kg</td><td>30 N</td></tr></table> Calculate the equivalent inertia of the system referred to the motor shaft and the power rating of the motor, assuming negligible loss in the transmission system.				Load	Type of Motion	Speed	Inertia/Mass	Torque/Force	1.	Rotational	200 rpm	$7 \text{ kg-m}^2$	10 N-m	2.	Rotational	200 rpm	$5 \text{ kg-m}^2$	6 N-m	3.	Translational	10 M/s	10 kg	20 N	4.	Translational	10 M/s	20 kg	30 N	4 Marks
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3.	Calculate the starting time of a drive with the following parameters: $J = 10 \text{ kg-m}^2$ , $T = 15 + 0.5\omega_m$ , and $T_l = 5 + 0.6\omega_m$				3 Marks																									
4.	A motor equipped with a flywheel has to supply a load torque of 600 N-m for 10 sec followed by a no load period long enough for the flywheel to regain its full speed. It is desired to limit the motor torque to 450 N-m. What should be the moment of inertia of the flywheel? The no load speed of the motor is 600 rpm and it has a slip of 8% at torque of 400 N-m. Assume the motor speed-torque characteristics to be a straight line in the range of operation. Motor has inertia of $10 \text{ kg- m}^2$ .				3 Marks																									

5.	<p>A drive consisting of semiconductor converter fed dc motor, runs according to the following periodic duty cycle:</p> <ul style="list-style-type: none"> <li>i. Acceleration from standstill to 1000 rpm in 10 sec at uniform acceleration.</li> <li>ii. Running at 1000 rpm and torque value of 800 N-m for 8 sec.</li> <li>iii. Braking from 1000 rpm to standstill in 10 sec at uniform deceleration.</li> <li>iv. Remains idle for 20 sec.</li> </ul> <p>Determine torque and power ratings of the machine. Assume forced cooling and constant field current. <math>J = 100 \text{ kg-m}^2</math>.</p>	<p>4 Marks</p>
6.	Explain the different methods of speed sensing.	<p>3 Marks</p>
7.	Explain the basic block diagram of an electric drive.	<p>4 Marks</p>