Time: 3 hours **Marks: 80**

Instructions:

- Question No: 1 is compulsory.
- Answer any three from the remaining five questions.
- Figures to the right indicate full marks.
- Answers to questions should be grouped and written together.

Q1	**a)**	What are the features of vector control	**20**
	b)	What are the components of load torque	
	c)	Prove that the energy loss during stopping by plugging is $\frac{3}{2}J\omega_{ms}^2$	
	d)	A motor of smaller rating can be selected for a short time duty. Why?	
Q2	**a)**	Draw the block diagram representation of electrical drive and discuss the function of each block.	**10**
	b)	A weight of 500 kg is being lifted up at a uniform speed of 1.5 m/s by a winch driven by a motor running at a speed of 1000 rpm. The moment of inertia of motor and winch are 0.5 and 0.3 kg-m^2 respectively. Calculate the motor torque and equivalent moment of inertia referred to the motor shaft. In the absence of weight, motor develops a torque of 100 N-m when running at 1000 rpm.	**10**
Q3	**a)**	Explain the operation of closed loop speed control scheme with inner current control loop. What are the various functions of inner current control loop	**10**
	b)	A drive has following parameters: $J = 10\ kg - m^2$,$T = 15 + 0.05N$, N-m and $T_l = 5 + 0.06N$, N-m, where N is the speed in rpm. Initially the drive is working in steady state. Now the drive is braked by electrical braking. Torque of the motor in braking is given by $T = -10 - 0.04N$, N-m. Calculate time taken by the drive to stop.	**10**
Q4	**a)**	Derive the thermal model of motor for heating and cooling	**10**
	b)	How a chopper fed DC separately excited DC motor operate in motoring and regenerative braking mode. Develop $\omega\ vs\ T$ relation and draw speed torque characteristics	**10**
Q5	**a)**	Describe the operation regenerative braking of an induction motor	**06**
	b)	Why Static Scherbius scheme is called slip energy recovery scheme and what are its advantages. Illustrate with relevant diagrams and derivations.	**08**
	c)	What are the reasons for using load equalization in an electrical drive?	**06**
Q6	**a)**	Describe the operation brushless DC motor	**10**
	b)	What is the basic principle of Direct torque control method? Explain with block diagram.	**06**
	c)	Derive fundamental torque equation and mention the significance of dynamic torque	**04**

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