



Manipal Institute of Technology, Manipal



(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH MECHTRONICS ENGG. DEGREE EXAMINATION APRIL 2017

SUBJECT: ELECTRIC DRIVE MTE 3201

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ANY FIVE FULL the questions.
- ✤ Missing data may be suitable assumed.

1A.	What is an electric drive? What are the basic components of an electric drive? Mention	5
	some of the advantages of an electric drive	
1B.	A 3phase 50Hz , 4 pole induction motor with full load slip of 0.5 is supporting load	5
	torque of $T_L = 0.1N^2$ Nm,(where N is in rpm) at a constant speed of 1000 rpm. The	
	break down torque is double the full load torque.	
	a) Find the full load torque of the motor.	
	b) Investigate the stability of the operating point and justify your answer.	
2A.	A small scale traction drive system is implemented with a 230 V, 960 rpm , 200 A	7
	separately excited dc motor with $Ra = 0.02$ ohms and the torque constant $Kt = 0.01125$	
	Nm/ A^2 . The source is a 230 V, 1000 Ah dc rechargeable battery and the charging is	
	triggered while the drive decelerates.	
	a) Identify the solid state motor driver required (assume continuous conduction).	
	b) Calculate the PWM required for the solid state devices for free running of the	
	tractor at a steady velocity of 500 rpm with a payload of 250 Nm.	
	c) Calculate the PWM required for the solid state devices if the deceleration phase	
	starts at a payload of 200 Nm and speed of 400 rpm	
2B.	A single sided Linear Induction motor has 98 poles, its pole pitch is 0.5m. The motor	3
	is used for elevators. Determine the linear synchronous velocity and elevator speed in	
	km/hr. if the frequency is 50 Hz and slip is 0.25.	

3A.	A separately excited dc motor is used to drive a conveyor belt in a bottling station.	5
	The precise control of the position has to be maintained for the filling process.	
	Suggest the basic control loop required and its significance.	
3B.	Explain the control and operation of a BLDC motor. Mention the merits, demerits and	5
	applications of a brushless DC motor.	
4A.	A hoist load is lifting up the load from rest, using a squirrel cage induction motor,	4
	rated for 30 Nm at 0.04 slip. The load demands a starting requirement of 20 Nm. The	
	starting current in the motor is 7 times the full load current. As an industrial drives	
	engineer your task is to identify the suitable starting technique among the following	
	methods to support the motor with the load. Justify your answer.	
	a. Y- Δ starters b. 50 % Autotransformer starting c. DOL starting	
4B.	Identify the motors to be used in the operation of the following applications. Justify	6
	A) Paper rolling with DC mains C) Aircraft Propeller (need safety factor 3)	
	B) Windshield wiper D) Mobile phone vibrator	
5A.	An electric drive is using a thyristor fed motor to run a hybrid electric vehicle through	10
	a reduction gear and clutch mechanism with gear reduction ratio $(\omega_2/\omega_1) = 0.1$ and	
	efficiency of 90 %. The driver operation consists of the following cycles.	
	i. Acceleration from rest to a speed of 200 rpm in 5 sec.ii. Constant speed operation (200 rpm) with constant torque of 2500 Nm for 10 sec.	
	iii. Deceleration from 200 rpm to 100 rpm.	
	iv. Constant speed operation (100 rpm) with constant forque of 2500 Nm for 10 sec.	
	v. Stopping the vehicle within 10 sec.	
	A)Determine the torque and power ratings required with respect to the motor shaft if the motor has an inertia of 0.2 kgm^2 and heating time constant of 40 minutes.	
	B)Suggest the motor required for the operation and the converters required if the supply is available through a diesel generator.	
	C) If the same motor drive system is forced on short intermittent duty for 20 minutes, Calculate the maximum power the motor can with stand.	