Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL (A constituent Institution of MAHE, Manipal)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING) MAKEUP EXAMINATIONS, JANUARY 2018

SUBJECT: SOLID STATE DRIVES [ELE 4011]

REVISED CREDIT SYSTEM

Time:	3 Hours Date: 2 January 2018 Max. Ma	rks: 50	
Instructions to Candidates:			
	✤ Answer ALL the questions.		
	Missing data may be suitably assumed. Use of sine graphs permitted.		
1A.	With the help of speed-torque characteristics, explain the four quadrant operation of hoist load.	05	
1B.	A motor drives two loads. One has rotational motion. It is coupled to the motor through a reduction gear of 0.1 and efficiency of 90%. The load has a moment of inertia of 10 kg-m ² and a torque of 10 Nm. Other load is translational motion and consists of 1000 kg weight to be lifted up at a uniform speed of 1.5 m/s. Coupling between this load and the motor has an efficiency of 85%. Motor has an inertia of 0.2 kg-m ² and runs at a constant speed of 1420 rpm. Determine the equivalent inertia referred to the motor shaft and power developed by the motor.	05	
2A.	A 220 V, 1500 rpm, 11.6 A separately excited motor is controlled by a 1-phase fully controlled rectifier with an ac source voltage of 230 V, 50 Hz. Armature resistance and inductance are 2 Ω and 28.36 mH respectively. Calculate the motor torque for $\alpha = 150^{\circ}$ and speed = – 640 rpm.	04	
2B.	With the help of suitable circuit schematic, discuss the triggering sequence for a three phase controlled rectifier fed separately excited dc motor, when operating in motoring mode with discontinuous current operation. Also, draw the armature voltage and armature current waveforms. Hence, derive an expression for armature current.	06	
3A.	A 220 V, 1500 rpm, 11.6 A separately excited motor has armature resistance and inductance of 2 Ω and 28.36 mH respectively. This motor is controlled by a single phase fully controlled rectifier with controlled freewheeling. AC source voltage is 230 V, 50 Hz. Identify the mode of operation and calculate the developed torque for $\alpha_n = 120^\circ$, $\alpha = 180^\circ$ and speed = – 1475 rpm.	05	
3B.	For a type A chopper circuit, source voltage is 220 V, chopping period is 2000 μ s, on-period is 600 μ s, load circuit parameters R = 1 Ω , L = 5 mH and E = 24 V. Find whether load current is continuous. Calculate the value of average output current and also the maximum and minimum values of steady state output current.	05	

4A. With the help of a circuit schematic, explain how sub synchronous and super synchronous speed control can be achieved while employing slip energy recovery scheme to slip ring induction machine.

4B. What are the attributes of a servo drive? With a block schematic, explain the operation of a basic field orientation control for an induction motor.

05

05

5A.	What are the advantages of closed loop control schemes over open loop control schemes in AC drive systems? Sketch and explain the general block diagram of a position controlled AC drive.	04
5B.	What are the advantages and disadvantages of simultaneous control mode of dual converters?	<i>02</i>
5C.	Discuss the effect of armature current ripple on the performance of a DC motor.	<i>02</i>