Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent Institution of MAHE, Manipal)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE UP EXAMINATIONS, JANUARY 2019

SUBJECT: SOLID STATE DRIVES [ELE 4011]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 02, JANUARY 2019** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions. Sine Graph may be provided.
- Missing data may be suitably assumed.

1A. With the help of speed torque characteristics explain the multi quadrant operation of an Electrical drives ***(03)***

1B. Sketch & explain the speed torque characteristics of Ideal transportation drive. ***(03)***

1C. A motor drives three loads, two have rotational motion and one translational motion. Moment of inertia of the motor is 1 kgm^2 . Motor runs at a speed of 1500 rpm. Following are the details

About the three loads: Determine the moment of inertia referred to the motor shaft and power Rating of the motor.

Load	Type of motion	Speed	Inertia/Mass	Torque/Force
I	Rotational	250 rpm	10 kgm^2	10 N-m
II	Rotational	175 rpm	7 kgm^2	6 N-m
III	Translational	5 M/S	5 kg	20 N

(04)

2A. With relevant waveforms and triggering sequence, explain Singal phase fully controlled rectifier feeding a separately excited DC motor armature operating in motoring mode with continuous conduction. Derive also the expression for the average voltage developed across the armature. ***(05)***

2B. A 220V, 1500 rpm 11.6 A separately excited dc motor has an armature resistance of 2Ω and inductance of 28.36 mH. The motor is controlled by a 1 phase fully controlled rectifier with an ac source operating at 230 V, 50 Hz. Calculate the torque developed by the motor if α=60° and speed of the motor is 400rpm ***(05)***

3A. With a neat circuit and waveforms of armature voltage and current, explain a 3-Φ fully controlled rectifier fed DC drive with controlled freewheeling operating at motoring mode at α = 75°. Clearly show the triggerring sequence. Derive the expression for average output voltage. ***(05)***

3B. Explain with the help of relevant wave forms, working of a class C chopper supplying a separately excited DC motor ***(05)***

4A. A 220V, 1500rpm separately excited dc motor has an armature resistance of 2Ω and inductance of 28.36mH. The motor is controlled by a 3 phase fully controlled rectifier with an ac source operating at 230V , 50Hz . Calculate the critical torque developed by the motor if $\alpha=60^{\circ}$ and torque = 1 N-m. ***(05)***

4B. Explain the concept of slip power recovery scheme of speed control of induction motor with the help of power flow diagram. Discuss how this scheme is implemented in static sub synchronous converter cascade. What modification is needed to achieve super-synchronous mode of operation .List advantages and disadvantages of this scheme? ***(05)***

5A. Step up chopper has input voltage of 220V and output voltage of 660V. If the conducting time of the chopper is 100μs compute pulse width of output. In case output voltage pulse width is halved for constant frequency operation find the average value of new output voltage. ***(03)***

5B. With the help of torque speed characteristics show that stator voltage control is best suited for fan and pump drive systems. Sketch the power circuit for a reversible adjustable speed induction motor drive employing stator voltage control. What are the main drawbacks of the scheme. ***(04)***

5C. With the help of a block schematic, explain how control of frequency and emf can be achieved for a synchronous machine. ***(03)***