Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

II SEMESTER M.TECH (PED) END SEMESTER EXAMINATIONS, APRIL - MAY 2017

SUBJECT: POWER SEMICONDUCTOR CONTROLLED DRIVES [ELE 5221]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 20 April 2017** **Max. Marks: 50**

Instructions to Candidates:

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

1A. Fig.1A shows plots of speed Vs motor and load torques. Comment on the steady state stability of the operating points A, B, C and D.

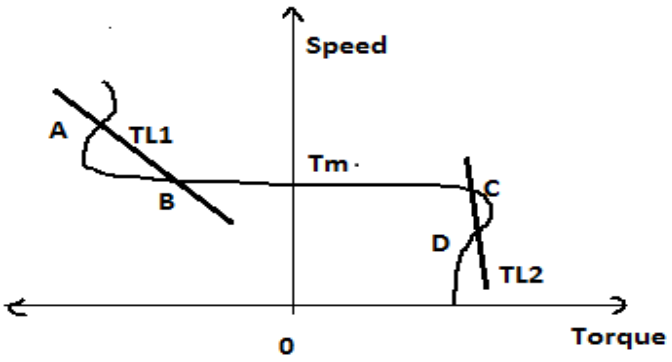

Fig 1A *(02)*

1B. A motor is required to drive the take-up roll on a plastic strip line. The mandrel on which the strip is wound is 15cm in diameter and the strip builds up to a roll 25 cm in diameter. Strip tension is maintained constant at 1000 N. The strip moves at a uniform speed of 25 m/s. The motor is coupled to a mandrel by a reduction gear with a = 0.5. The gears have an approximate efficiency of 87% at all speeds. Determine the speed and power rating of the motor required for this application. *(04)*

1C. What are the factors are consider for selecting the electrical Drives, Sketch & explain the speed torque characteristics of Ideal transportation drive. *(04)*

2A. With a neat circuit schematic, explain how speed control of a dc motor can be achieved when operated with a three phase balanced supply. Assume Motoring mode with discontinuous current conduction. Sketch the load voltage and load current waveforms, clearly showing the triggering sequence. Hence, obtain an expression of speed in terms of torque. *(06)*

2B. A 220 V, 1500 rpm, 11.6 A separately excited DC motor has R_a = 2 Ω and L_a = 28.36 mH. This motor is controlled by a single phase fully controlled rectifier with AC source voltage is 230 V, 50 Hz. Identify the mode and calculate the developed torque if α = 60° and speed = 400 rpm. *(04)*

3A. Discuss the effect of armature current ripple on the performance of a DC motor *(02)*

3B. Explain the working of class A chopper fed DC motor with the help of circuit diagram and waveforms of load voltage, load current and source current, and also derive the minimum and maximum load current *(05)*

3C. A separately excited dc motor is fed from 220V 20Amp DC supply through a chopper operating at 400Hz the load torque is 30N-m at a speed of 1000rpm. The motor has ra=0.2Ω La=2mH km= 1.5v.sec/rad, back emf =157.08 neglecting all motor and chopper losses, calculate (a) The minimum and maximum values of armature current and armature current excursion. ***(03)***

4A. 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)***

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? ***(06)***

5A. 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. ***(04)***

5B. Describe the operation of brushless DC motor drive and explain its advantages over the other drives ***(03)***

5C. With a block schematic explain how power factor control can be achieved statically in synchronous machine ***(03)***