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

II SEMESTER M.TECH (POWER ELECTRONICS & DRIVES)

END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: POWER SEMICONDUCTOR CONTROLLED DRIVES [ELE 5221]

REVISED CREDIT SYSTEM

Time: 3 Hours	Date: 17 April 2018	Max. Marks: 50

Instructions to Candidates:
- ❖ Answer **ALL** the questions.
- ❖ Missing data may be suitably assumed.
- ❖ Sine Graph sheet may be used.

1A. What are the components of load torque? How are they modeled? **(04)**

1B. A horizontal conveyer belt moving at a uniform speed of 1.5 m/s transports material at the rate of 100 tonnes/hr. Belt is 200 m long and driven by a motor at 1200rpm.

    a) Determine the load inertia referred to the motor shaft.

    b) Calculate the dynamic torque that motor should develop to accelerate the belt from standstill to full speed in 10sec. Moment of inertial of the motor is 0.1kg-m^2. **(02)**

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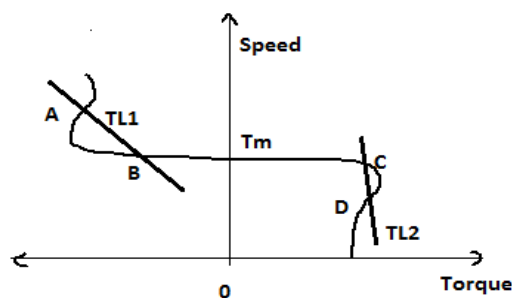

Fig.1C **(04)**

2A. A 220V, 1500 rpm, 11.6 A separately excited DC motor is controlled by single phase fully controlled rectifier with an AC source voltage of 230V 50Hz. Assume armature resistance of 2Ω and inductance of 28mH, firing angle =75° and speed 900 rpm. Find whether the motor works with continuous conduction or not. Derive the current expression used. Also draw the output voltage and current waveform for this mode of operation. **(05)**

2B. What are the advantages of controlled freewheeling in the case of line commutated converter fed DC motors. With the help of a neat circuit diagram and waveforms of load voltage and current, explain the regenerative braking operation of such 3 phase converters, for continuous conduction mode. Derive the average load voltage. **(05)**

3A. A 230V 600rpm 4A dc motor has armature resistance of 7Ω and inductance of 50mH. Determine the minimum value of Ton for which current is continuous at rated speed if the motor is controlled by a class A chopper fed from a 240V dc source operating at 500Hz chopping frequency. **(05)**

3B. Explain working of a class C chopper supplying a separately excited DC motor with the help necessary circuit diagram and waveforms. **(05)**

4A. Explain how Induction motor speed can be controlled by regulating the power in rotor circuit. Also explain the suitable power electronic scheme with which the given Induction machine can be operated in (i) Sub synchronous speed range (ii) Super synchronous speed range **(06)**

4B. Sketch & explain the block schematics of variable frequency speed control scheme for Induction Motors operated with constant air-gap flux. What are the advantages and disadvantages of the above scheme? **(04)**

5A. Explain the principle of field oriented control. With the help of a block schematic discuss detailed field orientation system that can be used in induction motor drives. **(05)**

5B. With the neat schematic diagram, explain the operation of self-controlled drive for synchronous motor. Highlight the working and importance of rotor position encoder in this scheme. **(05)**