Reg. No.									

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

I SEMESTER M.TECH (POWER ELECTRONICS AND DRIVES)
END SEMESTER EXAMINATIONS, NOVEMBER 2019
POWER SEMICONDUCTOR CONTROLLED DRIVES (ELE 5173)

REVISED CREDIT SYSTEM

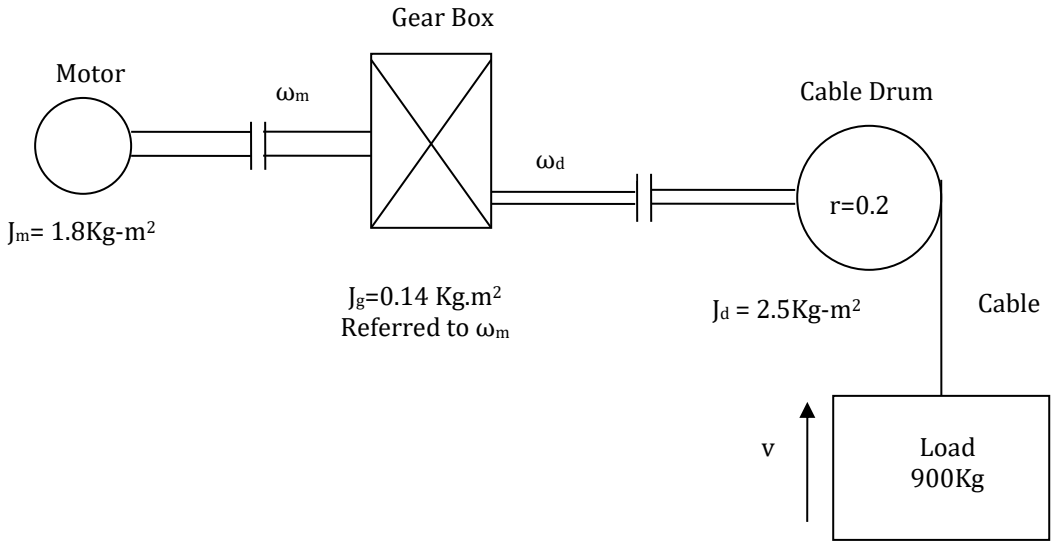
Time: 3 Hours **Date:15 November 2019** **Max. Marks: 50**

Instructions to Candidates:

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

1A. Explain the functions of a power modulator? What are the main factors which decide the choice of electrical drive for a given application? ***(03)***

1B. In the mechanism shown in the below figure, the motor drives the winch drum through 1:10 reduction gears. Assuming that the shafts & cables are non elastic, calculate the equivalent inertia of the motor & the mechanism referred to motor shaft.



(04)

1C. Sketch & explain the speed, torque and power characteristics with respect to time of an ideal transportation drive. ***(03)***

2A. What are the advantages of line commutated converter fed separately excited DC machine operated with controlled freewheeling? With the help of a circuit diagram and load voltage & current waveforms, explain the sequence of triggering of a single phase converter fed DC machine operating in motoring mode with discontinuous conduction. ***(05)***

2B. A 220V, 875 rpm,150A separately excited dc motor has an armature resistance of 0.06Ω and La= 2.85mH. It is fed from a single phase fully - controlled rectifier with an ac source voltage of 220V, 50Hz. Calculate the motor torque for α = 120° and speed = -800 rpm ***(05)***

3A. Derive the expression for the current drawn by a separately excited DC motor fed from a Class A chopper. Sketch the relevant waveforms for continuous currents. ***(04)***

3B. A DC chopper is used to control the speed of a Separately Excited DC motor. The DC voltage is 220V, Ra=0.3Ω and motor constant 0.08v/rpm. The motor drives a constant load requiring armature current of 35 A. Determine:

(i) The range of Speed Control

(ii) The range of Duty cycle assuming continuous conduction. ***(03)***

3C. Sketch and explain the power circuit for speed control of induction motor drive employing stator voltage control in closed loop operation. What are the main drawbacks of this scheme? ***(03)***

4A. With relevant waveforms and triggering sequence, explain three phase fully controlled rectifier feeding a separately excited DC motor armature operating in forward motoring mode with continuous current conduction at $\alpha = 30°$. Derive the expression for the average voltage developed across the armature. ***(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. ***(05)***

5A. Explain the concept of field oriented control. With the help of relevent block diagram, explain basic field orientation system for an induction motor with a current-controlled PWM inverter. ***(04)***

5B. 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. ***(03)***

5C. With the help of neat diagram explain the current controlled brushless DC motor used in servo drive? ***(03)***