MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKEUP EXAMINATIONS, DEC 2016 - JAN 2017

SUBJECT: SOLID STATE DRIVES [ELE 403]

REVISED CREDIT SYSTEM

Time: 3 Hours	Date: 04 January 2017	Max. Marks: 50

Instructions to Candidates:
- ❖ Answer **ANY FIVE FULL** questions.
- ❖ Missing data may be suitably assumed.
- ❖ Sine Graph sheets may be used.

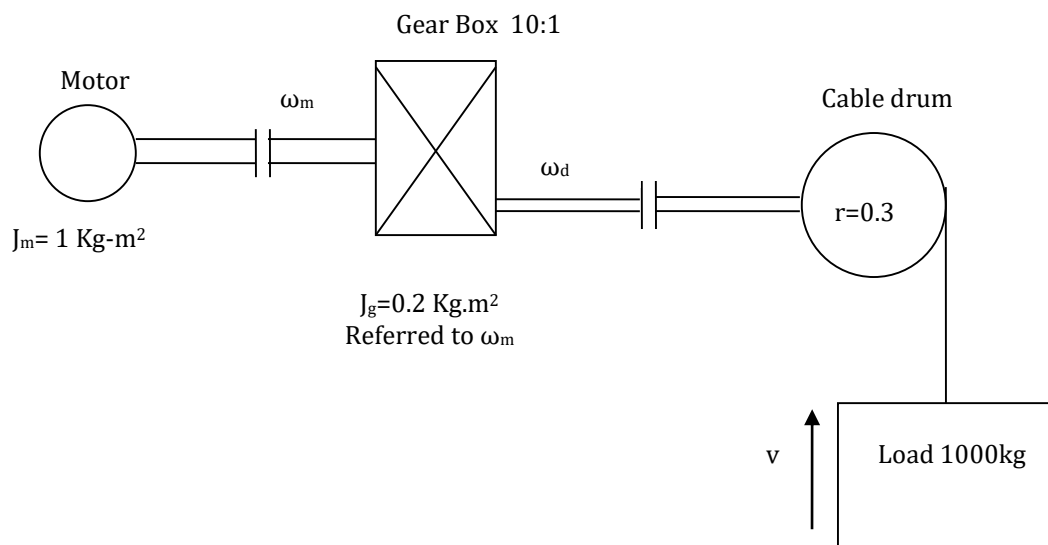|		
1A.	Define Electric Drive. With a suitable block schematic explain the components of electrical drives.	**04**
1B.	In the Mechanism shown below figure 1B. The motor drives the winch drum through 1:10 reduction Gears. Assuming that the shafts and cable are non-elastic, calculate the equivalent inertia of the motor and mechanism referred to the motor shaft. Inertia of cable drum is J_a= 3kg-m^2.	

Gear Box 10:1

Motor ω_m

ω_d

Cable drum

r=0.3

J_m= 1 Kg-m^2

J_g=0.2 Kg.m^2
Referred to ω_m

v   Load 1000kg

Figure 1B.

		03
1C.	What are the factors are consider for selecting the electrical Drives.	**03**
2A.	With relevant current and voltage waveforms explain the operation of a single phase fully controlled rectifier fed dc drive operating in motoring mode with continuous current and derive the motor speed. Show the clear triggering sequence.	**05**
2B.	A 3.74 kW, 1000 rpm, 230 V, 20 A dc motor has an armature resistance and inductance of 1.4 Ω and 16.5 mH, respectively. The motor is fed by a three phase fully controlled rectifier with an AC source voltage of 170.3 V (line), 60 Hz. Identify the mode and calculate the torque if α = 60° and speed = 443 rpm.	**05**

3A. 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*

3B. Sketch the load voltage and load current waveforms clearly showing the sequence of triggering for a three phase fully controlled converter fed separately excited DC motor operated with controlled freewheeling in motoring mode with discontinuous conduction. Also derive an expression for speed. *05*

4A. Write a short note on the various braking techniques employed for a DC motor *03*

4B. With the help of neat diagram and waveform explain operation of the Class D chopper fed DC Drive , when $t_{on} > t_{off}$ *04*

4C. Discuss the effect of armature current ripple on the performance of a DC motor. *03*

5A. 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*

5B. Direct Torque Control of induction motor drives has beacome an industry standanrd control because of its advantages compared to vector control. What are these advantages? Explain DTC of induction motor with a block schematic. *05*

6A Technically compare the operation of circulating and non-circulating current modes of dual converter. *03*

6B With the help of neat diagram explain the Brush less DC excitation for wound field synchronous machines. *03*

6C With a neat circuit diagram, explain static control of rotor resistance for a wound rotor induction motor. *04*