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

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
END SEMESTER EXAMINATIONS, DECEMBER 2018
SUBJECT: SOLID STATE DRIVES [ELE 4011]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 01, December 2018** **Max. Marks: 50**

Instructions to Candidates:

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

1A. What are the components of load torque? How they are modeled? ***(03)***

1B. Explain the functions of a power modulator? What are the main factors which decide the choice of electrical drive for a given application? ***(04)***

1C. In the mechanism shown below Fig. 1C motor drives the winch drum through a reduction gear with a gear tooth ratio of 0.1. The friction torque at winch shaft is 15N-m and at motor shaft to 10 N-m, motor speed is 1500 rpm. Calculate the equivalent moment of inertia of the drive referred to motor shaft and motor torque if gears have an efficiency of 90%.

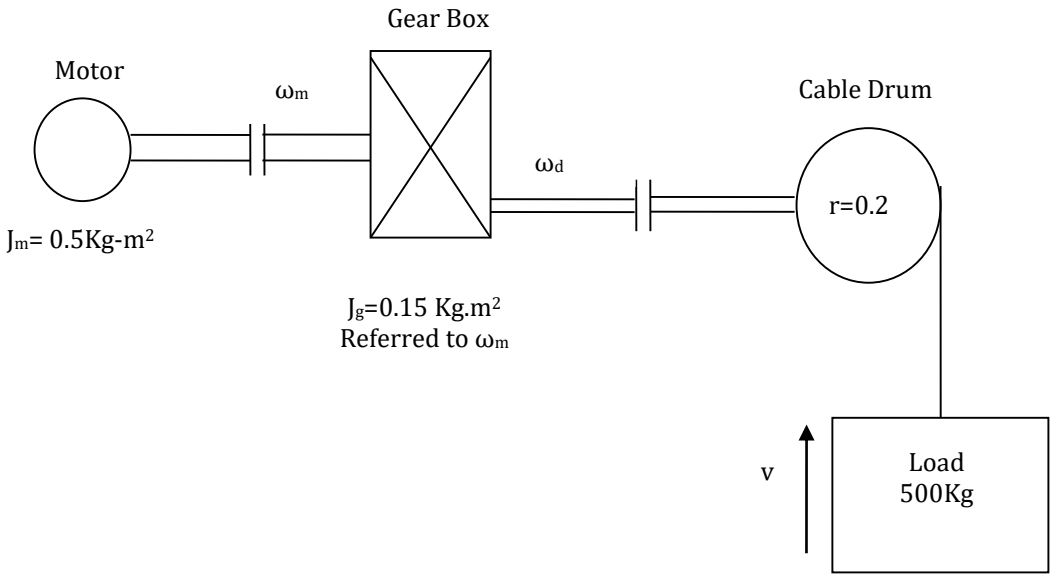

Fig.1C ***(03)***

2A. With relevant waveforms and triggering sequence, explain Singal phase fully controlled rectifier feeding a separately excited DC motor operating in controlled freewheeling motoring mode with dis-continuous conduction, when $\alpha = 60$. Derive the expression for the average voltage developed across the armature. ***(05)***

2B. A separately excited dc motor is fed from 200 V, 15 Amp, dc supply through a chopper operating at 400Hz the load torque is 25 N-m at a speed of 1000rpm. The motor has armature resistance = 0.2Ω armature inductance is 2mH. Neglecting all motor and chopper losses, calculate (a) The minimum and maximum values of armature current and armature current excursion. ***(05)***

3A. 4kW, 1000rpm 230V, 20 A dc motor has an armature resistance and inductance of 1.4 Ω and 16.5mH respectively. The motor is fed by a three phase fully controlled rectifier with an AC source voltage of 170.3 60 Hz. Find the critical torque. Draw load voltage and current waveform for a firing angle of 60° when the motor develops torque of 9 N-m. ***(04)***

3B. With relevant waveforms and triggering sequence, explain Three 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. ***(04)***

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

4A. A 220V,1500rpm,11.6A separately excited motor is controlled by a single phase fully controlled rectifier with an AC source voltage source of 230V,50Hz enough filter inductance is 28.36mH, and armature resistance is =2Ω calculate the motor torques for the fallowing firing angle is 150° and speed is -640 rpm. ***(05)***

4B. Describe the working principle of direct Field orientation control of induction motor with the help of its neat block diagram. Mention its advantages. ***(05)***

5A. Explain the principle of rotor resistance control. Find the effective value of resistance included when static resistance control scheme is used for speed control of wound rotor induction motors. ***(03)***

5B. Discuss the theoritical principle of slip energy recovery. What are its limitations? Explain any two converter options for supersynchronous speed control with the help of circuir diagram. ***(04)***

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