A

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M.TECH DEGREE EXAMINATION, APRIL-MAY 2017

Electrical & Electronics Engineering

(Electrical Machines, Power Control & Drives)

01EE6302 Electric Drives

Max. Mark: 60   Duration: 3 Hours

Answer any two full questions from each Part

PART-1

1. a) A weight of 500kg is being lifted up by a uniform speed of 1.5m/s by a winch driven by a motor running at a speed of 1000rpm. The moment of inertia of the motor and the winch are 0.5 and 0.3 kgm^2 respectively. Calculate the motor torque and equivalent moment of inertia referred to motor shaft. In the absence of weight, motor develop a torque of 100Nm when running at 1000rpm.

(5 mark)

   b) Draw the block diagram of electric drive system and explain the important functions of Power modulator. (At least four numbers).

(4 mark)

2. a) Derive the open loop transfer function of separately excited DC motor for speed control and obtain the step response due to change in load.

(5 mark)

   b) Derive the average value of output voltage of single phase full converter for continuous and discontinuous modes of operation.

(4 mark)

3. a) What is regenerative braking? Describe the regenerative braking of chopper fed separately excited DC motor. Illustrate your answer with circuit diagram and wave forms.

(7 mark)

   b) Derive the expression for minimum and maximum braking speed for obtaining regenerative braking of DC motor.

(2mark)

PART-2

4. (a) Explain the stator voltage control method of speed control of induction motor using suitable equations and characteristics. Using semiconductor voltage controller, explain how the stator voltage can be controlled to operate the motor in two quadrants.

(10 mark)

b. Why stator voltage control is suitable for speed control of induction motors in fan and pump drives.

(2 mark)

5. a) Using suitable Drive, Explain the Sub synchronous and super synchronous modes of operation of a three phase wound rotor induction motor.

(8 mark)

b) Using block diagram, explain the implementation of direct vector control of three phase induction motor with respect to rotor flux orientation

(4mark)

6. a) Distinguish between Direct and Indirect vector control scheme and mention the advantages of indirect vector control.

(5mark)

b) Using block diagram of indirect vector controller, describe the implementation of vector control of VSI fed three phase induction motor drive.

(7 mark)

PART -3

7. a) Draw and explain the performance characteristics of synchronous motor drive in constant torque region and field weakening region.

(3 mark)

b) Using block diagram, explain V/F method of speed control of VSI fed Three Phase Synchronous Motor drive. Explain clearly how the motor speed should be able to track the command frequency, without loosing synchronism.

(6 mark)

8. a) Explain the working of a self controlled load commutated inverter fed synchronous motor drive for speed control applications.

(5 mark)

b) Using block diagram, explain how closed loop speed control operation could be achieved in the above synchronous motor drive.

(4 mark)

9. a) Obtain the dynamic machine model of a permanent magnet BLDC motor and derive the equation for electromagnetic torque developed.

(5 mark)

b) Draw and explain the Current Control Loop Configuration for the speed control of a BLDC Motor drive.

(4 mark)