Seventh Semester B.Tech. Degree Examination, November 2017
(2013 Scheme)
13.703 : POWER SEMICONDUCTOR DRIVES (E)

Time : 3 Hours
Max. Marks : 100

PART – A

Answer all questions from Part – A. (5x4=20 Marks)

1. Explain the speed torque characteristics of a fan and a traction load.

2. Draw the block diagram and explain the current limit control scheme employed to limit the converter and motor currents to a safe limit during transient operations.

3. Derive an expression for the terminal voltage of single phase half-controlled rectifier fed dc separately excited motor under discontinuous conduction mode of operation.

4. Explain the salient features of a current source inverter fed induction motor drive.

5. List the measures that could be taken to conserve energy in electrical drives.

PART – B

Module – I

Answer any one full question from each Module.

6. a) Draw the block diagram of an electric drive system. Explain the functions of each block.

   b) A drive has following parameters : J = 1 kg-m^2, T = 15-0.01 N N-m, and passive load torque T_1 = 0.005 N N-m, where N is the speed in rpm. Initially the drive is operating in steady state. Now it is to be reversed. For this motor characteristics is altered such that T = -15-0.01 N N-m for positive as well as negative values of N. Calculate the reversal time.

OR

P.T.O.
7. a) Derive the equations for finding the equivalent values of drive parameters referred to motor shaft for loads with rotational motion and loads with translational motion.

b) Explain the operation of a bridge type single phase to single phase step down cycloconverter.

Module – II

8. a) Explain the simultaneous and non simultaneous control of a dual converter circuit.

b) The chopper used for on-off control of a dc separately excited motor has supply voltage of 230 V dc, an on time of 10 ms and an off time of 15 ms. Neglecting the armature inductance and assuming continuous conduction of motor current, calculate the average load current when motor speed is 1000 rpm and has a voltage constant of $K = 0.5 \text{ V/rad./sec}$. The armature resistance is 2 ohm.

OR

9. a) A 220 V, 1500 rpm, 40 A separately excited motor with armature resistance of 0.5 $\Omega$, is fed from a 3-phase fully controlled rectifier. Available ac source has a line voltage of 440 V, 50 Hz. Determine the value of firing angle when:
   (i) motor is running at 1000 rpm and half rated torque. (ii) when motor is running at –800 rpm and rated torque.

b) With circuit diagram and waveforms explain the working of a two quadrant chopper fed dc motor drive.

Module – III

10. a) Describe the voltage source inverter circuit used for v/f control of an induction motor.

b) A 3-phase, 400 V, 50 Hz, 10 kW, 960 rpm, 6 pole star connected induction motor has the following constants referred to the stator. $R_s = 0.4 \Omega$, $R'_r = 0.6 \Omega$, $X_s = 1.4 \Omega$, $X'_r = 1.4 \Omega$. The motor drives a fan load at 960 rpm. The stator to rotor turns ratio is 2. What resistance must be connected to each phase of the rotor circuit to reduce the speed to 800 rpm.

OR
11. a) In stator frequency control for the speed control of an induction motor explain 
the speed torque characteristics above synchronous speed and below 
synchronous speed.  

b) Explain the stator voltage control method for the speed control of induction 
motor. Why this method is not commonly using for speed control?  

Module – IV  

12. a) Explain the operation of a BLDC motor with the help of appropriate diagrams.  

b) Explain the commonly used converters for switch reluctance motor.  

OR  

13. a) With neat diagrams explain the working of a stepper motor.  

b) Explain the dc traction using semiconductor chopper controlled dc motors.