Code No: RT32026 **R13** SET - 1

III B.Tech II Semester Supplementary Examinations, November- 2019

POWER SEMICONDUCTOR DRIVES

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

*****

PART –A (22 Marks)

1 a) List the differences between Plugging and regenerative braking methods. [4M]
b) Mark the four quadrant operations of the drive on speed-torque plane. [4M]
c) Draw and explain the speed- torque characteristics of dc motor controlled by two quadrant type C chopper. [3M]
d) Briefly explain the V/f control of induction motor. [4M]
e) List the advantages and disadvantages of static rotor resistance control of IM. [4M]
f) When operating in true synchronous mode, why the frequency must be changed in small steps? [3M]

PART –B (48 Marks)

2 a) Explain the four quadrant operation of a drive using hoist control as an example. [8M]
b) Calculate the resistance to be connected across a DC series motor used in a crane, when the supply is cut off and dynamic braking is applied to limit the speed to 500 rpm, if the descending load exerts a constant load torque of 200 N-m. The magnetization curve of the motor running at 750 rpm is a straight line given by $E_g = (5.7\ I_a + 228.6)$ V, between $I_a = 30$ A and 50A. The total resistance including the series field resistance is 1.1 Ω [8M]

3 a) Explain the operation of a separately excited dc motor using three phase fully controlled rectifier. Derive the relation between speed and torque and draw the corresponding characteristics. [8M]
b) The speed of a separately excited dc motor is controlled by means of a 3 phase full converter from a 3 phase 415 V, 50 Hz supply. The motor constants are inductance 10 mH, resistance 0.9 Ω and armature constant 1.5 V/rad/s. Calculate speed of the motor at a torque of 60 Nm when the converter is fired at 55^0. Neglect losses in the converter. [8M]

4 a) Explain the operation of two quadrant chopper fed separately excited DC motor which gives forward motoring and forward braking operation and also draw current and voltage waveforms for continuous current operation. [8M]
b) A 220 V, 20 A, 1000 rpm separately excited dc motor having an armature resistance of 2 Ω is controlled by a chopper. The chopping frequency is 500 Hz and the input voltage is 230 V. Calculate the duty ratio for a motor torque of 1.25 times rated torque at 600 rpm. [8M]

Code No: RT32026 **R13** SET - 1

5 a) Explain variable frequency control of induction motor to obtain speeds below and above base speed. Derive the necessary equations. [8M]

b) Describe the torque–speed characteristics of Induction motor with below and above base speed when using v/f control. [8M]

6 a) Explain the operation of three phase slip ring induction motor drive when static Kramer scheme is employed, with the help of circuit diagram. Draw the speed-torque characteristics. [8M]

b) A 3 Phase, 420 V, 50 Hz, star connected Induction motor has the following constants referred to the stator. R_s = 2.95 Ω, R'_r = 2.08 Ω, X_s = 6.82 Ω, X_r' = 4.11Ω per phase. The motor draws a current of 6.7 A at no load and controlled by rotor resistance control. The resistance R_e has been controlled by chopper. Find the value of R_e to get a speed range of 1500 to 500 rpm, assuming a turns ratio of two between stator and rotor. The torque and speed of the load are related by Tα N. Determine the characteristics giving the speed Vs time ratio of the chopper. [8M]

7 a) How is the output voltage of a VSI improved by PWM techniques? Explain how we will use this converter for speed control of a synchronous motor? [8M]

b) Discuss various methods of speed control of synchronous motors in detail. [8M]

*****