

III B. Tech II Semester Supplementary Examinations, November -2018**POWER SEMICONDUCTOR DRIVES**

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

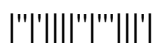
- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
 2. Answering the question in **Part-A** is compulsory
 3. Answer any **THREE** Questions from **Part-B**

PART -A

- 1
 - a) Briefly describe how the plugging and dynamic braking is used in DC Series motor? [3M]
 - b) List the advantages of converter control of dc motor? [4M]
 - c) Mark the quadrants of operation of a dc drive fed from type C and type D chopper? [3M]
 - d) Variable frequency control of induction motor is more efficient than stator voltage control. Why? [4M]
 - e) How the speed and power factor of a WRIM are controlled by injecting a voltage in the rotor circuit. Explain? [4M]
 - f) Briefly explain the principle of separate control of synchronous motor? [4M]

PART -B

- 2
 - a) What are the advantages of electric braking over mechanical braking? Explain with proper circuit diagram about speed- torque characteristics of DC motor under dynamic braking for the following types [8M]
 - i) Separately excited dc motor
 - ii) Series motor
 - b) A 230 V, 750 rpm, 25 A dc series motor is driving at rated conditions a load whose torque is proportional to speed squared. The combined resistance of the armature and field is 1 Ω . Calculate the motor terminal voltage and current for a speed of 400 rpm. [8M]
- 3
 - a) Explain speed control possibilities of DC Motor by using Dual converter [8M]
 - b) A three phase full converter is used to control the speed of a 220 V, 3.73 Kw, 1200 rpm dc separately excited motor. The ac supply is 240 V, 50 Hz. The motor emf constant is 1.7 Vs/rad. The armature resistance is 1.5 Ω . For $\alpha=60^\circ$, the motor speed is 800 rpm, determine [8M]
 - i) The average value of motor current
 - ii) The supply power factor
- 4
 - a) Explain the operation of two quadrant type D chopper with the help of suitable waveforms? [8M]
 - b) A 230 V, 1000 rpm, 40 A separately excited dc motor has armature resistance of 0.5 Ω and armature inductance of 40 mH. The motor is controlled by regenerative braking by chopper operating at a frequency of 800 Hz from a dc source of 230 V. (Assume continuous current conduction). Calculate i) The duty ratio of chopper at rated torque at an operating speed of 700 rpm. ii) What will be the maximum allowable speed of the motor, if the chopper has maximum duty ratio of 0.95 and maximum allowable current is twice the rated current. iii) Field current for duty ratio of 0.9 and motor speed of 1200 rpm and armature current of 25 A. Assume that motor field also controlled by armature voltage and rated field current is 0.8A. [8M]



- 5 a) For variable frequency control of induction motor explain the following [8M]
i) For speeds below base speed (v/f) ratio is maintained constant. Why?
ii) For above base speeds, the terminal voltage is maintained constant. Why?
- b) A 3 phase, 440 V, 4 pole, 1420 rpm, 50 Hz, delta connected SCIM has the following [8M]
parameters referred to the stator.
 $R_s = 0.35 \text{ ohm}$, $R_r' = 0.4 \text{ ohm}$, $X_s = 0.7 \text{ ohm}$, $X_r' = 0.8 \text{ ohm}$. The motor is fed from a VSI. The drive is operated with constant v/f control up to 50 Hz and at rated voltage above 50 Hz. Calculate the braking torques for a frequency of 75 Hz both for motoring and braking operations?
- 6 A 3 phase, 440 V, 6 pole, 960 rpm, 50 Hz, Star connected Induction motor has the [16M]
following parameters referred to the stator.
 $R_s = 0.2 \text{ ohm}$, $R_r' = 0.15 \text{ ohm}$, $X_s = 1.5 \text{ ohm}$, $X_r' = 4 \text{ ohm}$. The stator to rotor turns ratio is 3.5. The motor speed is controlled by Static Scherbius drive. The drive is designed for a speed range of 25% below the Synchronous speed. The maximum value of the firing angle is 165° . Calculate
i) The turns ratio of the transformer
ii) Torque for a speed of 700 rpm and $\alpha = 130^\circ$.
- 7 a) Explain the self controlled Synchronous drive operation of VSI [8M]
b) Describe the variable frequency control of synchronous motor with suitable PWM [8M]
technique?

