

**III B. Tech II Semester Supplementary Examinations, February-2022**  
**POWER ELECTRONIC CONTROLLERS AND 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. Answer **ALL** the question in **Part-A**  
 3. Answer any **FOUR** Questions from **Part-B**

**PART -A****(14 Marks)**

1. a) Write the components of basic electrical drive system? [2M]
- b) Draw the current waveform of 1-phase half controlled converter fed dc motor for firing angle  $90^\circ$ . [2M]
- c) Give the disadvantages of chopper fed dc drives. [2M]
- d) Give the advantages of AC voltage controller fed induction motor drive. [3M]
- e) What are the advantages of static rotor resistance control method? [3M]
- f) When can be a synchronous motor is load commutated? [2M]

**PART -B****(56 Marks)**

2. a) Explain the four-quadrant operation of an electric motor with relevant characteristics when the motor is driving a hoist load. [7M]
- b) A 220 V, 860 rpm, 60 A, DC separately excited motor has an armature resistance of  $0.06 \Omega$ . It is coupled to an overhauling load with a torque of 210 N-m. Determine the speed at which the motor can hold the load by regenerative braking. [7M]
3. a) Obtain the speed-torque characteristics of separately excited DC motor operated with 1-phase full-converter and describe the effect of firing angle. [7M]
- b) A separately excited DC motor is operating from a single phase semi converter at a speed of 1200 rpm, with input voltage of 320 V and back emf of 100 V. The converter is fired symmetrically with  $\alpha = 45^\circ$ . The armature resistance of  $5 \Omega$ . Calculate average current and the motor developed torque. [7M]
4. a) Discuss with suitable diagrams the first-quadrant and fourth-quadrant DC-DC converters. [7M]
- b) A 230 V separately excited DC motor takes 50 A at a speed of 800 rpm. It has armature resistance of  $0.4 \Omega$ . This motor is controlled by type-C chopper with an input voltage of 230 V and frequency of 800 Hz. Assuming the continuous conduction mode, calculate speed of regenerative braking operation at duty ratios of 0.7 and 0.4. [7M]
5. a) Explain speed control of induction motor by AC voltage controllers. [7M]



- b) For a 3-phase delta connected 6-pole 50 Hz 440 V, 905 rpm squirrel cage induction motor is having  $R_1 = 0.2 \Omega$ ,  $R_2 = 0.3 \Omega$ ,  $X_1 = 0.5 \Omega$  and  $X_2 = 1.1 \Omega$ . The motor is operated from voltage source inverter with constant V/f ratio from 0 to 50 Hz and having the constant voltage of 440 V above 50 Hz frequency, calculate: [7M]
- i) Speed for a frequency of 35 Hz with half full load torque
  - ii) Torque for a frequency of 35 Hz for a speed of 600 rpm.
6. a) Draw the circuit diagram and explain the operation of rotor-resistance control of induction motor. [7M]
- b) A three phase, 50 Hz, Y-connected, 440 V, induction motor rotates at 2800 rpm at full load. The motor is driven by slip-energy recovery system. Calculate the triggering angle for a motor speed of 2100 rpm, assume turns ratio is equal to one. [7M]
7. a) Draw the block diagram and explain the operation of load commutated CSI fed synchronous motor drive. [7M]
- b) Explain closed loop speed control of synchronous motor drive fed from VSI. [7M]

\*\*\*\*\*

