

IV B. TECH I SEMESTER REGULAR EXAMINATIONS, NOVEMBER - 2023
ELECTRIC DRIVES
(ELECTRICAL AND ELECTRONICS ENGINEERING)

Time: 3 hours

Max. Marks: 70

Note : Answer ONE question from each unit (5 × 14 = 70 Marks)

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UNIT-I

1. a) How are the load torques classified? Give an example for each type of load torque. [7M]
- b) Discuss the dynamics of motor load system and also derive the relations for motor- load torque system. [7M]

(OR)

2. a) Draw the Torque – Speed characteristics of the following loads [7M]  
(i) Centrifugal pump (ii) Traction load
- b) Explain the four quadrant operation of an electric drive for hoist application. [7M]

UNIT-II

3. a) Obtain the speed-torque characteristics of separately excited DC Motor operated with single phase full converter. [7M]
- b) A 230 volts, 1400 rpm, 20 amps separately excited DC motor has an armature resistance of 15 Ω. It is fed from a single phase fully controlled bridge rectifier with an AC source voltage of 220 volts, at 50 Hz. Assuming continuous load current, compute: [7M]
  - (i) The motor speed at firing angle of 40 degrees and torque of 6 N-m.
  - (ii) Developed torque at the firing angle of 40 degrees and speed of 1400 rpm.

(OR)

4. a) What are dual converters? Explain the basic operation of a single-phase dual converter. Also mention their applications. [7M]
- b) Explain the operation of single phase half controlled converter fed self excited DC motor drive. [7M]

UNIT-III

5. a) With neat circuit diagram and waveforms, explain the four quadrant operation of a separately excited dc motor fed from class E chopper. [7M]
- b) A 230 volts, 960 rpm, 200 Amps separately excited DC motor has an armature resistance of 0.02 Ω. The motor is fed from a dc source of 230 volts through a chopper. Assuming continuous conduction a) Calculate the duty ratio of chopper for monitoring operation at rated torque and 350 rpm b) If maximum duty ratio of chopper is limited to 0.95 and maximum permissible motor speed obtainable without field weakening. [7M]

(OR)

6. a) Explain the principle of operation of class-A chopper with all relevant diagrams? [7M]
- b) A DC series motor is fed from a 600 volts source through a chopper. The DC motor has the following parameters armature resistance is equal to  $0.04 \Omega$ , field resistance is equal to  $0.06 \Omega$ , constant  $k = 4 \times 10^{-3} \text{ Nm / Amp}^2$ . The average armature current of 300 Amps is ripple free. For a chopper duty cycle of 60% determine.
- (i) Input power drawn from the source.  
(ii) Motor speed and iii. Motor torque.

UNIT-IV

7. a) What are the slip power recovery control schemes of induction motors. Explain how static Kramer drive is used to control the speed of induction motors. [7M]
- b) A 440 V, 3 $\phi$ , 50 Hz, 6 pole, 945 RPM, delta connected induction motor has the following parameters referred to stator side.  $R_1 = 2.0 \Omega$ ;  $R_2 = 2.0 \Omega$ ;  $X_1 = 3 \Omega$ ,  $X_2 = 4 \Omega$ . Motor speed is controlled by stator Voltage Control. When driving a fan load, the motor runs at rated speed with rated voltage. To run the motor at 800 RPM calculate
- (i) torque developed by the motor  
(ii) the voltage to be applied to the motor and  
(iii) the corresponding current drawn.

(OR)

8. a) Discuss the operation of voltage regulators fed induction motor drive. [7M]
- b) For a 3-phase delta connected 6-pole 50 Hz 400 V, 925 rpm squirrel cage induction motor is having  $R_s = 0.2 \Omega$ ,  $R_r = 0.3 \Omega$ ,  $X_s = 0.5$ , and  $X_r = 1.1 \Omega$ . The motor is operated from a voltage source inverter with constant V/f ratio from 0 to 50 Hz and having the constant voltage of 400 V above 50 Hz frequency. Calculate
- (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 650 rpm.

UNIT-V

9. a) Explain the closed loop operation of synchronous motor drives with neat block diagram. [7M]
- b) Explain the variable frequency control of synchronous motors using PWM. [7M]

(OR)

10. a) Describe VSI fed synchronous motor drive in detail with a suitable block diagram. [7M]
- b) With the help of a neat labelled diagram, explain the working principle, salient features and the advantages of Self Controlled Mode of operation of a Synchronous motor. [7M]

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