



- Notes :
1. All questions carry equal marks.
 2. Due credit will be given to neatness and adequate dimensions.
 3. Assume suitable data wherever necessary.
 4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Explain the concept of Load Equalization with the help of speed torque characteristics. **8**
- b) A motor drives two loads. One has rotational motion. It is coupled to the motor through a reduction gear with a = 0.1 and efficiency of 90%. The load has the moment of inertia of 10 kg-sq meter and a torque of 10N-m. Other load has translational motion and consists of 1000 kg weight to be lifted up at an uniform speed of 1.5 m/s. coupling between this load and the motor has efficiency of 85%. Motor has an inertia of 0.2 kg-sqm and runs at a constant speed of 1420 rpm. Determine equivalent inertia referred to the motor shaft and power developed by the motor. **8**

OR

2. a) A motor is used to drive a hoist. Motor characteristics are given by Quadrants I, II and IV: $T = 200 - 0.2N$, N-m where N is the speed in rpm. Quadrants III and IV: $T = -200 - 0.2N$, N-m When hoist is loaded, the net load torque $T_L = 100$, N-m and when it is unloaded, net load torque $T_L = -80$, N-m. Obtain the equilibrium speeds for operation in all the four quadrants. **8**
- b) Derive the equations for equivalent values of drive parameters (moment of inertia and Torque) for loads with rotational motion. **8**
3. a) Explain first quadrant or monitoring chopper. Also discuss the monitoring control of DC chopper drives and draw the characteristics waveforms. Control of separately excited motor for continuous conduction. **8**
- b) A 220V, 1500 rpm, 11.6A separately excited motor with $R_a = 0.5$ ohm is controlled by a 3-phase fully-controlled rectifier with an ac source voltage of 440V, 50Hz. A star delta transformer is used to feed the armature so that the motor terminal voltage equals rated voltage when converter firing angle is zero. **8**
- i) Calculate the Transformer Turns Ratio
 - ii) Calculate the value of firing angle when:
 - a) Motor is running at 1200 rpm and rated torque
 - b) When motor is running at -800 rpm and twice the rated torque.

OR

4. a) Discuss the closed loop control of separately excited DC motor drive. **8**
- b) A 230V, 960 rpm and 200 amp separately excited dc motor has an armature resistance of 0.02 ohm. The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230V. Assuming continuous conduction. **8**

- i) Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm.
 ii) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm
 iii) If the duty ratio of chopper is limited to 0.95 and the maximum permissible motor current is twice the rated, Calculate maximum permissible motor speed and power fed to the source?
 iv) If motor field is also controlled in (iii), calculate field current as a function of its rated value for a speed of 1200rpm.
5. a) Sketch and explain the Static Kramer's Variable Speed drive system with the help of neat figure. 8
- b) Explain Static Scherbius drive system for slip power recovery scheme. 8
- OR**
6. a) What is the principle of vector control of induction motor? Explain using phasor diagram and necessary equations. 8
- b) Explain VSI fed Induction Motor Drive. Also write its drawback. 8
7. a) Half hour rating of a motor is 100 kW. Heating time constant is 80 min and the maximum efficiency occurs at 70% full load. Determine the continuous rating of the motor. 8
- b) Derive thermal model of motor for heating and cooling. Also draw its curve. 8
- OR**
8. a) A motor operates on a periodic duty cycle in which it is clutches to its load for 10 min and declutched to run on no load for 20 min. Minimum temperature rise is 40°C. Heating and cooling time constant are equal and have a value of 60 min. When load is declutched continuously the temperature rise is 15°C. Determine:
 i) Maximum temperature during the duty cycle, and
 ii) Temperature when load is clutched continuously. 8
- b) Explain various classes of motor duty with neat sketches. 8
9. a) Discuss the self controlled synchronous motor drive employing a cycloconverter along with the neat diagram. 8
- b) What do you mean by variable frequency control of synchronous motor drives? Also explain its different modes of control. 8
- OR**
10. a) Explain the closed loop speed control of load commuted inverter fed synchronous motor drive. 8
- b) Discuss the self controlled synchronous motor drive employing load commuted thyristor inverter along with the neat diagram. 8
