

Time:3 Hrs

Total Marks: 80

- NB:** (1) Question No. 1 is compulsory
(2) Answer any THREE questions out of the remaining FIVE questions.
(3) Assume suitable data if necessary and justify them
(4) Figure to the right indicates marks

1. (a) Derive equivalent values of torque and moment of inertia for different loads with rotational and translational motion. 5
(b) What are the main factors which decide the choice of an electrical drive? 5
(c) Draw the block diagram and explain the closed loop speed control of a drive. 5
(d) Explain with neat sketches, the components of load torque in Electrical Drives. 5
2. (a) Explain load equalization and derive the moment of inertia of the flywheel required for load equalization. 10
(b) A drive has following parameters: 10
 $J=10 \text{ kg-m}^2$, $T=100-0.1N$, N-m, Passive load torque $T_l=0.05N$, N-m, where N speed in rpm. Initially the drive is operating in steady state. Now it is to be reversed. For this motor characteristics is changed to $T=-100-0.1N$, N-m. Calculate the time of reversal.
3. (a) Explain four quadrant operation of a motor driving a hoist load with suitable diagram. 10
(b) Illustrate with neat circuit diagram a chopper controlled dc separately excited machine in both motoring and regenerative braking mode. Also, draw the relevant voltage and current waveforms. 10
4. (a) Explain thermal model of motor for heating and cooling. 10
(b) A motor operates on a periodic duty cycle consisting of a loaded period of 20 min and a no load period of 10 min. The maximum temperature rise is 60°C . Heating and cooling time constant are 50 and 70 min respectively. When operating continuously on no load the temperature rise is 10°C . Determine
(i) Minimum temperature during the duty cycle
(ii) Temperature when the motor is loaded continuously. 10
5. (a) Explain plugging of three phase induction motor with relevant speed torque characteristics. 10
(b) Draw the relevant speed torque characteristics and explain variable frequency control of induction motor in both constant torque and constant power mode. Comment and compare the nature of the characteristics in both the regions. For speeds below base speed, V/f ratio is maintained constant, why? Why it is called as constant torque mode? 10
6. (a) Explain the principle of vector control and with a neat block diagram explain the direct vector control of induction motor. 10
(b) Draw the block diagram and explain the direct torque control of induction motor. 10
