

Duration: (3 Hours)

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) Explain the block diagram of an electrical drive with an example. 5  
(b) A motor of smaller rating can be selected for intermittent duty. Why? 5  
(c) Illustrate with neat diagram the working of single phase fully controlled rectifier control of DC separately excited motor. 5  
(d) What do you mean by load equalization? What are the reasons for using load equalization in an electrical drive? 5
- 2 (a) Illustrate the four-quadrant operation of a DC motor driving a hoist load by means of a suitable diagram. Assume that a four quadrant chopper supplies the motor. Clearly show the directions & polarities of the following quantities; i) Speed ii) load torque iii) developed torque iv) converter output voltage v) converter output current and vi) back emf of the motor. 10  
(b) Explain in detail steady state stability in electric drives. Derive the condition for the steady state stability? 10
- 3 (a) Draw the block diagram and explain the operation of closed loop speed control scheme of a DC motor with inner current control loop. What are the various functions of inner current loop? 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 the minimum temperature during the duty cycle and the temperature when the motor is loaded continuously. 10
- 4 (a) Explain V/f method of speed control of induction motor with neat speed torque characteristics. Compare it with stator voltage control. 10  
(b) Illustrate with neat diagrams plugging of induction motor and show the transition from motoring mode to braking mode. Explain the diagram and state the precautions to be taken while plugging. 10
- 5 (a) Explain the d-q model of induction motor and draw the equivalent circuit. 10  
(b) A 3-phase, 400V, 50 Hz, 4 pole, 1370 rpm star connected squirrel cage induction motor has following parameters referred to stator:  $R_s = 2 \Omega$ ,  $R_r' = 3\Omega$ ,  $X_s = X_r' = 3.5\Omega$ . The motor is fed from a voltage source inverter with constant V/f ratio. The inverter allows frequency variation only from 10 to 50 Hz. Soft starting is used for the motor. Calculate the starting torque and current of this drive as a ratio of their values when the motor is started at rated voltage and frequency. 10
- 6 (a) Explain with block diagram and phasor diagram direct vector control scheme in induction motor drives. 10  
(b) With a neat block diagram explain direct torque and flux control of induction motor 10

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