QP CODE: 10066354

Time :(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)   Write a short note on Hysteresis Band Current Control Technique   05
   (b)   Explain the term intermittent periodic duty.   05
   (c)   Explain the regenerative braking of induction motor   05
   (d)   Explain DQ Model of induction motor.   05

2 (a)   With one application explain with neat diagrams the multi quadrant operation of   10
         an electrical drive. Mention the speed torque conventions in all the four quadrants.
   (b)   A drive has the following equations for motor torque (T) and load torque (T_l).   10
         $T = 1+2\omega_m$; $T_l = 3\sqrt{\omega_m}$ where ω_m is the motor speed in rad/s. Obtain the equilibrium
         points and determine their steady state stability.

3 (a)   Explain Direct Torque and Flux Control using the Switching Table of Inverter   10
         Voltage Vectors in Induction motor Drive
   (b)   A constant speed drive has the following duty cycle.   10
           i.   Load rising from 0 to 400 kW: 5 min
           ii.   Uniform load of 500 kW: 5 min
           iii. Regenerative power of 400 kW returned to the supply: 4 min
           iv.   Remain idle for: 2 min
         Estimate power rating of the motor. Assume losses to be proportional to (power)^2

4 (a)   With a neat block diagram explain closed loop speed control with an inner current   10
         control loop in an electric drive.
   (b)   Draw the circuit diagram of a four-quadrant chopper drive for a DC separately   10
         excited motor and explain in detail its operation with necessary diagrams in
         forward motoring mode and regenerative braking mode.

5 (a)   A motor drives two loads. One has rotational motion. It is coupled to the motor   10
         through a reduction gear with a=0.1 and efficiency of 90%. The load has a moment
         of inertia of 10 kg-m^2 and a torque of 10 N-m. Other load has translational motion
         and consists of 1000 kg weight to be lifted up at a uniform Speed of 1.5 m/s.
         Coupling between this load and the motor has an efficiency of 85 %. Motor has
         inertia of 0.2 kg-m^2 and runs at a constant speed of 1420 rpm. Determine equivalent
         inertia referred to the motor shaft and power developed by the motor.
   (b)   With the speed torque characteristics explain V/f control of induction motor.   10

6 (a)   Draw the block diagram and explain the principle of vector control in AC drives.   10

   (b)   Derive Plugging slip formula and explain the plugging of three phase induction   10
         motor with speed torque characteristics.

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