USN | | | | | | | | | | | 15EE82

Eighth Semester B.E. Degree Examination, Aug./Sept. 2020
Industrial Drives and Applications

Time: 3 hrs.   Max. Marks: 80

Note: *i) For Regular Students: Answer any FIVE full questions irrespective of modules.*
ii) For Arrear Students : Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a. Write the block diagram of an electrical drive and mention the functions of power modulator. **(04 Marks)**
     b. A motor drives two loads, one has rotational motion and the other translational motion. Moment of inertia of motor is 1.2 kg.m^2. Motor runs at a speed of 1000 rpm. The load with rotational motion has an inertia of 7 kg.m^2 and a torque of 10N.m at a speed of 200 rpm. The load with translational motion moves at a speed of 10m/sec with the weight of 10 kg and a force of 20 N. Calculate the equivalent inertia and torque of the system, referred to the motor shaft and power rating of the motor assuming negligible loss in the transmission system. **(05 Marks)**
     c. With a neat diagram, explain the four quadrant operation of a motor driving a hoist load. **(07 Marks)**

2   a. Derive expressions for equivalent values of moment of inertia and torque as referred to motor shaft for loads with rotational motion. **(07 Marks)**
     b. A motor equipped with a flywheel is to supply a load torque of 1000N.m for 10 sec followed by a light load period of 200 N.m long enough for the flywheel to regain its steady state speed. It is desired to limit the motor torque to 700 N.m. What should be the moment of inertia of flywheel? Motor has an inertia of 10 kg-m^2. Its no load speed is 500 rpm and slip at a torque of 500 N.m is 5%. Assume speed-torque characteristic of motor to be straight line in the region of interest. **(05 Marks)**
     c. Explain how a current limit control functions in closed loop control of drives. **(04 Marks)**

Module-2

3   a. Derive an expression for temperature rise of a motor during normal operation. **(10 Marks)**
     b. A 50KW, 3 phase, 440V, 50Hz, 1440 rpm squirrel – cage induction motor has constant loss to variable loss at full load in the proportion 1 : 3. Its rated temperature rise is 55°C and its heating and cooling time constants are 40 and 60 minutes respectively. Find the intermittent rating if periodic load of half hour duration are applied at an interval of half hour. **(06 Marks)**

4   a. Explain with drive current and relevant waveforms (discontinuous current) a single phase fully controlled rectifier control of a separately excited DC motor. **(08 Marks)**
     b. A 230V, 74A. 1750rpm separately excited motor with armatures resistance of 0.18 ohm is supplied through a 3 phase fully controlled rectifier from as AC source of 208V line 50Hz. The motor is operating in continuous conduction mode. The field is excited to a voltage which gives rated operation. If the motor is delivering full load torque determine the speed for : i) $\alpha = 45°$ ii) $\alpha = 135°$. **(08 Marks)**

Module-3

5 a. With relevant equations, explain the operation of a 3 phase induction motor with unbalanced source voltages. **(08 Marks)**

   b. With a neat schematic diagram of star – delta starter explain its working. **(04 Marks)**

   c. Explain the braking of 3 ph induction motor by plugging. **(04 Marks)**

6 a. Explain the AC dynamic braking of 3 phase induction motor with two load connection. **(08 Marks)**

   b. Discuss the variable frequency control of a 3 ph induction motor supplied from voltage source. **(08 Marks)**

Module-4

7 a. With a neat circuit diagram and relevant waveform explain the operation of VSI driven induction motor. **(08 Marks)**

   b. Draw the block diagram and explain the closed loop speed control of voltage source induction motor drive. **(08 Marks)**

8 a. Explain the starting operation of a synchronous motor with damper winding from a fixed frequency supply. **(08 Marks)**

   b. Explain the two modes variable frequency control of a synchronous motor. **(08 Marks)**

Module-5

9 a. With a neat circuit diagram, explain the self controlled synchronous motor drive employing load commutated inverter. **(08 Marks)**

   b. With a neat diagram explain the multi-stack stepper motor. **(08 Marks)**

10 a. What are the advantages of stepper motor? With a neat figure explain permanent magnet stepper motor. **(06 Marks)**

   b. What are the different types of steel rolling mills? Explain any one type and requirements of motor for that drive. **(06 Marks)**

   c. What are the required features of the motors used in machine tools? **(04 Marks)**

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