CBCS SCHEME

Eighth Semester B.E. Degree Examination, June/July 2019
Industrial Drives and Applications

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1.   a.   Obtain expressions for equivalent load torque and equivalent of a motor drive with i) translational and ii) rotational motion loads. **(08 Marks)**

    b.   A motor is equipped with a flywheel is to supply a load torque of 1000 N-m for 10 sec followed by a light load period of 200N-m long enough for the flywheel to regain its steady state period. It is desired to limit the motor torque to 700N-m. What should be the moment of inertia of the flywheel? Motor has an inertia of 10kg-m^2. Its no load speed is 500rpm and the slip at a torque of 500 N-m is 50%. Assume speed torque characteristics of motor to be a straight line in the region of interest. **(08 Marks)**

OR

2.   a.   Explain clearly different components of load torque with its characteristics. Also give a brief description of classification of load torques. **(08 Marks)**

    b.   A drive has the following parameters:
$J = 10$ kg-m^2, $T = 100 - 0.1N$ N-m, passive load torque $T_l = 0.05N$ N-m where N is the speed in rpm. Initially the drive is operating in steady-state. Now it is to be reversed. For this motor characteristic is charged to $T = -100 - 0.1N$ N-m. Calculate the time of reversal. **(08 Marks)**

Module-2

3.   a.   With usual notations derive expression for the temperature rise of a machine. Sketch the temperature rise v/s time curve. **(10 Marks)**

    b.   A constant speed drive has the following duty cycle:
      i)   Load rising from 0 to 400kW in 5 min.
      ii)   Uniform load of 500 kW for 5 min
      iii)   Regenerative power of 400kW returned to supply for 4 min
      iv)   Remains idle for 2 min. **(06 Marks)**

OR

4.   a.   Explain the single phase fully controlled rectifier control of separately excited DC motor. Also obtain equations for average out put voltage V_a and speed W_m. Assume discontinuous conduction mode. **(10 Marks)**

    b.   A 220V, 1500 rpm, 50A separately excited motor with armature resistance of 0.5Ω is fed from a 3 phase fully controlled rectifier. Available ac source has a line voltage of 440V, 50Hz. Determine the value of firing angle when
      i)   Motor is running at 1200 rpm and rated torque.
      ii)   Motor is running at -800 rpm and twice the rated torque. **(06 Marks)**

Module-3

5 a. Explain the behaviour of 3 phase induction motor when fed from a non-sinusoidal voltage supply. **(06 Marks)**

b. A 2200V, 260kW, 735 rpm, 50Hz, 8 pole, 3 phase, squirrel cage induction motor has the following parameters referred to the stator:
$R_s = 0.075\ \Omega$, $R_r^1 = 0.1\Omega$, $X_s = 0.45\Omega$, $x_r^1 = 0.55\Omega$. Stator winding is delta connected and consists of two sections connected in parallel.
   i) Calculate starting torque and maximum torque as a ratio of rated torque, if the motor is started by star-delta switching. What is the max value of line current during starting?
   ii) If the motor is started by connecting series reactors in line, what should be the value of reactors so as to limit the line current to twice the rated value? **(10 Marks)**

OR

6 a. Explain ac dynamic braking of 3 phase induction motor with i) Two lead   ii) Three lead connections. **(10 Marks)**

b. Derive expressions for time required stop the induction motor by plugging when running at synchronous speed. **(06 Marks)**

Module-4

7 a. Explain with relevant diagrams the Voltage source Inverter (VSI) control of 3 phase induction motor. What are the disadvantages of this method, how they can be minimized? **(08 Marks)**

b. Explain the closed loop control for VSI controlled 3 phase induction motor. **(08 Marks)**

OR

8 a. Explain the 3 phase induction motor fed from a variable frequency CSI. What are its advantages and disadvantages and remedial measures? **(06 Marks)**

b. A single phase, 220V, 50Hz, 1425 rpm induction motor has the following parameters:
$Rs = 2\Omega$, $R_r^1 = 5\Omega$, $X_s = X_r^1 = 6\Omega$ and $X_m = 60\Omega$. It drives a fan load at rated speed when full voltage is applied. Motor speed is controlled by the stator voltage control. Calculate the motor terminal voltage for a speed of 1200 rpm. **(10 Marks)**

Module-5

9 a. Explain self controlled synchronous motor drive employing load commutated thyristor inverter. **(08 Marks)**

b. Explain brushless dc motor drive for servo applications. **(08 Marks)**

OR

10 a. Explain variable reluctance type stepper motor. **(08 Marks)**

b. Explain the drive requirements for i) Steel rolling mill   ii) Cranes and hoists. **(08 Marks)**

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