CBCS SCHEME

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Eighth Semester B.E. Degree Examination, July/August 2022
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. With basic block diagram, explain the essential parts of electric drive. **(06 Marks)**
　　b. Explain the speed torque conventions and multi-quadrant operation of a motor, driving a hoist load. **(10 Marks)**

OR

2　a. What are the load torque components? Define active and passive load torque. **(08 Marks)**
　　b. A motor equipped with a flywheel is to supply a load torque of 1000 N-m for 10 sec followed by a light load period of 200 Nm long enough for the flywheel to regain its steady state period. It is desired to limit the motor torque to 700 Nm. What should be the moment of inertia of flywheel? Motor has inertia of 10 kg-m^2. It's no load speed is 500 rpm and the step at a torque of 500 N-m is 5%. Assume speed-torque characteristics of motor to be a straight line in the region of interest. **(08 Marks)**

Module-2

3　a. With usual notations, derive expression for the temperature rise of a machine. Sketch the temperature rise versus time curve. **(10 Marks)**
　　b. A constant speed motor has the following duty cycle:
　　　(i)　Load rising linearly from 200 - 400 KW: 4 minute
　　　(ii)　Uniform load of 400 KW: 2 minute
　　　(iii)　Regenerative power returned to the supply reducing linearly from 400 KW to 0　: 3 minute
　　　(iv)　Remains idle　: 4 minute
　　Calculate the power rating of the motor, assuming losses to be proportional to (power)^2. **(06 Marks)**

OR

4　a. Explain the single phase fully controlled rectifier control of separately excited DC motor. Also obtain equations for average output voltage V_a and speed W_m. Assume discontinuous conduction mode. **(10 Marks)**
　　b. A 220 V, 1500 rpm, 50 A separately excited motor with armature resistance of 0.5 Ω is fed from a 3ϕ fully controlled rectifier. Available ac source has a line voltage of 440 V, 50 Hz. 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 effect of unbalanced source voltages and single phasing on 3 three phase induction motor. **(08 Marks)**
　　b. A 400 V, star connected, 3-phase, 6 pole, 50 Hz induction motor has following parameters referred to the stator: $R_s = R'_r = 1\Omega$, $X_s = X'_r = 2\Omega$ for regenerative breaking operation of this motor, determine maximum overhauling torque it can hold and range of speed for safe operation. **(08 Marks)**

OR

6 a. Explain the ac dynamic braking of induction motor two-lead connection. (08 Marks)
   b. Explain the variable frequency control of induction motor from voltage source. (08 Marks)

Module-4

7 a. Explain the operation of voltage source inverter fed induction motor drives. Also sketch various schemes of VSI fed induction motor drives. (10 Marks)
   b. Explain the closed loop control for CSI controlled 3ϕ induction motor. (06 Marks)

OR

8 a. Explain the 3 phase induction motor fed from a variable frequency CSI. (06 Marks)
   b. A single phase, 220 V, 50 Hz, 1425 rpm induction moor has following parameters: $R_s = 2\ \Omega$, $R_r' = 5\Omega$, $X_s = X_r' = 6\Omega$ 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 thyrister inverter. (10 Marks)
   b. With a neat block diagram, explain the true synchronous mode variable frequency control of multiple synchronous motor. (06 Marks)

OR

10 a. Write a technical note on:
    (i) Steel rolling mills drives
    (ii) Textile mill drives (08 Marks)
    b. Describe the operation of a variable reluctance stepper motor. (08 Marks)

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