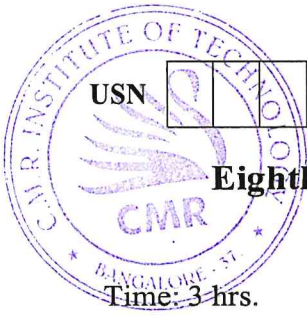


CBCS SCHEME



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17EE82

Eighth Semester B.E. Degree Examination, July/August 2022 Industrial Drives and Applications

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Draw and explain the block diagram of an electrical drive. (08 Marks)
- b. What are the advantages of electrical drives? (06 Marks)
- c. A motor drives a rotational load which is coupled to the motor through a reduction gear with $a = 0.25$ and efficiency 92%. The load has moment of inertia of $20\text{kg} - \text{m}^2$ and a torque of 20N-m . Motor has a moment of inertia of 0.2kg-m^2 and runs at a constant speed of 1400rpm . Determine equivalent inertia referred to motor shaft, equivalent torque referred to motor shaft and power developed by the motor. (06 Marks)

OR

- 2 a. Explain the components of load torques and mention their dependencies on motor speed. (06 Marks)
- b. Derive the condition of the steady state stability of an equilibrium point of a motor – load system. (07 Marks)
- c. A motor – load system has motor torque $T = 1450 - 0.95W_m$ and load torque $T_L = 0.5W_m$. Calculate the equilibrium speed and check the steady state stability of the equilibrium point. (07 Marks)

Module-2

- 3 a. Explain different classes of motor duty. (10 Marks)
- b. A motor operates on a continuous duty. The initial temperature is 30°C . The heating time constant is 60 min. After 10min, the temperature is 50°C . Determine the steady state temperature and temperature after 20 min. (05 Marks)
- c. A constant speed drive has the following duty cycle :
 - i) Uniform load of 500KW for 5 min
 - ii) Regenerative power of 400KW returned to supply for 4 min
 - iii) Remain idle for 2 minEstimate power rating of the motor assuming losses to be proportional to $(\text{power})^2$. Also find motor torque if motor runs at 1420 rpm at rated power. (05 Marks)

OR

- 4 a. Explain fully controlled fullwave rectifier control of a separately excited DC motor. Draw torque – speed characteristics for various values of α . (10 Marks)
- b. A 200V , 150A , 875rpm separately excited DC motor has an armature resistance of 0.05Ω . It is fed from a single phase fully controlled full wave rectifier with AC source voltage of 220V , 50Hz . Assuming continuous conduction mode, calculate :
 - i) Firing angle for rated torque and 750rpm
 - ii) Motor speed for $\alpha = 150^\circ$ and rated torque. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. $42+8 = 50$, will be treated as malpractice.

Module-3

- 5 a. Explain the stator voltage control of 3 – phase induction motors. (06 Marks)
 b. Explain star – delta starting of 3 – phase induction motors with the help of a neat diagram. (07 Marks)
 c. A 400V, star connected, 3- ϕ , 6 pole, 50Hz induction motor has $R_s = R_r' = 1\Omega$, $X_s = X_r' = 2\Omega$. For regenerative braking operation, find maximum over hauling torque. (07 Marks)

OR

- 6 a. Explain variable frequency control of 3 – phase induction motors. (05 Marks)
 b. Explain regenerative braking of 3 – phase induction motors. (05 Marks)
 c. A 2 – 8KW, 400V, 50Hz, 4 pole, 1370 rpm, delta connected squirrel cage induction motor has following parameters referred to stator.
 $R_s = 2\Omega$, $R_r' = 5\Omega$, $X_s = 5\Omega$, $X_r' = 5\Omega$, $X_m = 80$. Motor speed is controlled by stator voltage control when driving a fan load, it runs at rated speed and rated voltage. Calculate motor terminal voltage and current at 1200rpm. (10 Marks)

Module-4

- 7 a. Explain cyclo converter control of 3 – phase induction motors. (10 Marks)
 b. Explain current source inverter control of induction motors. (10 Marks)

OR

- 8 a. Explain starting of synchronous motors from fixed frequency supply. (10 Marks)
 b. A star connected squirrel cage induction motor has following parameters :
 400V, 50Hz, 4-pole, 1370rpm, $R_s = 2\Omega$, $R_r' = 3\Omega$, $X_s = X_r' = 3.5\Omega$, $X_m = 55\Omega$. It is controlled by a current source inverter at a constant flux. Calculate motor torque, speed and stator current when operating at 30Hz and rated slip speed. (10 Marks)

Module-5

- 9 a. Explain torque – stepping rate characteristics of stepper motor. (06 Marks)
 b. Explain drive circuits for stepper motors. (06 Marks)
 c. Explain unipolar drive for variable reluctance motor of low power rating. (08 Marks)

OR

- 10 a. Explain industrial drives for textile mills. (10 Marks)
 b. Ex industrial drives for steel rolling mills. (10 Marks)

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