



Seventh Semester B.E. Degree Examination, June/July 2023
Industrial Drives and Application

Max. Marks: 100

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

Module-1

- 1 a. With a neat diagram, state the essential parts of an electric drive system. Explain them briefly. (10 Marks)
- b. A weight of 500Kg is being lifted up at a uniform speed of 1.5 m/s by a motor driven by a motor running at a speed of 1000rpm. The moment of inertia of the motor and load are 0.5 and 0.3Kg-m² respectively. Calculate the motor torque and the equivalent moment of inertia referred to the motor shaft. In the absence of weight, motor develops a torque of 100 N-m when running at 1000rpm and efficiency of 100%. (10 Marks)

OR

- 2 a. Explain the speed torque conventions and multi-quadrant operation of a motor driving a hoist load. (10 Marks)
- b. A 6 pole, 50Hz, 3 phase wound rotor induction motor has a flywheel coupled to its shaft. The total moment of inertia of motor load flywheel is 1000Kg-m². Load torque is 1000 N-m of 10s duration followed by a no load period which is long enough for the drive to reach its no-load speed. Motor has a slip of 3% at a torque of 500N-m. Calculate :
 - i) Maximum torque developed by the motor
 - ii) Speed at the end of deceleration period
 Assume motor speed torque curve to be a straight line in the operating range. (10 Marks)

Module-2

- 3 a. With a neat circuit and graph, explain the regenerative dynamic and plugging type of braking system for separately excited DC shunt motor. (12 Marks)
- b. A 200V, 10.5A, 2000rpm shunt motor has the armature and field resistance of 0.5 and 400Ω respectively. It drives a load whose torque is constant at rated motor torque. Calculate motor speed if the source voltage drops to 175V. (08 Marks)

OR

- 4 a. Explain the operation of a single phase fully controlled rectifier control of separately excited DC motor. (12 Marks)
- b. A 220V, 970 rpm, 100A dc separately excited motor has an armature resistance of 0.05Ω. It is braked by plugging from an initial speed of 1000rpm. Calculate :
 - i) Resistance to be placed in armature circuit to limit braking current to twice the full load value
 - ii) Braking torque
 - iii) Torque when the speed has fallen to zero (08 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 effect of unbalanced voltage and single phasing on the induction motor performance. (10 Marks)
- b. Explain the plugging of three phase induction motor with speed torque characteristics. (10 Marks)

OR

- 6 a. Variable frequency control of inductor motor is more efficient than stator voltage control, why? (10 Marks)
- b. A 2200V, 50Hz, 3 phase, 6 pole, Y-connected, squirrel-cage induction motor has following parameters :
 $R_s = 0.075\Omega$, $R_r' = 0.12\Omega$, $X_s = X_r' = 0.5\Omega$.
 The combined inertia of motor and load is 100Kg-m^2 . Calculate time taken and energy dissipated in the motor during starting. (10 Marks)

Module-4

- 7 a. With block diagrams, explain various schemes of voltage source inverter control of three phase induction motor drive. (10 Marks)
- b. Explain the static Scherbius drive scheme of slip power recovery in induction motors. (10 Marks)

OR

- 8 a. Explain the operation of self controlled synchronous motor drive employing load commutated thyristor inverter. (10 Marks)
- b. A 500kW, 3 phase, 3.3kV, 50Hz, 0.8 lagging power factor, 4 pole, star – connected synchronous motor has following parameter : $X_s = 15\Omega$, $R_s = 0$. Rated field current is 10A. Calculate :
 i) Armature current and power factor at half the rated torque and rated field current
 ii) Field current to get unity power factor at the rated torque (10 Marks)

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Module-5

- 9 a. What are the main features of stepper motors which are responsible for its wide spread use. Also mention its advantages. (10 Marks)
- b. With the help of a block diagram, explain the closed loop variable speed drive employing sinusoidal PMAC motor fed from current regulated voltage source inverter. (10 Marks)

OR

- 10 a. Explain with diagrams, screw – down operation in a rolling mill drive. (10 Marks)
- b. With schematic, explain the wire section in paper mill drive and mention the types of motors used in paper mill drive. (10 Marks)
