

CBCS SCHEME

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15EE82

Eighth Semester B.E. Degree Examination, July/August 2021 Industrial Drives and Applications

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. Explain the different power modulators that are used in drive system. (10 Marks)
b. A motor drives two loads. One has rotational motion. It is coupled to the motor through a reduction gear with a = 0.1 and efficiency of 90%. The load has a moment of inertia of 10kg-m^2 and a torque of 10N-m . Other load has translational motion and consists of 1000kg weight to be lifted up at a uniform speed of 1.5m/s . Coupling between this load and the motor has an efficiency of 85%. Motor has an inertia of 0.2kg-m^2 and runs at a constant speed of 1420RPM . Determine equivalent inertia referred to the motor shaft and power developed by the motor. (06 Marks)
- 2 a. Explain the speed-torque conventions and multi quadrant operation on a motor, driving a hoist load. (08 Marks)
b. Mention the main factors which decide the choice of an electrical drive for a particular application. What is an electric drive? (08 Marks)
- 3 a. By assuming machine to be homogenous body, obtain the thermal model for heating and cooling of an electrical motor. (08 Marks)
b. A motor has a heating time constant of 60min and cooling time constant of 90min , when run continuously on full load of 20kW , the final temperature rise is 40°C .
 - i) What load motor can deliver for 10min if this is followed by a shunt down period long enough for it to cool?
 - ii) If it is on an intermittent load of 10min followed by 10min shut down, what is the maximum value of load it can supply during the ON load period?
 - iii) Half hour rating of a motor is 100kW . Heating time constant is 80min and the max efficiency occurs at $70\%\text{FL}$. Determine the continuous rating of the motor. (08 Marks)
- 4 a. Explain the chopper control a separately excited dc motor. (08 Marks)
b. A 200V , 875RPM , 150A separately excited dc motor has an armature resistance of 0.06Ω . It is fed from a single phase fully-controller rectifier with an ac source voltage of 220V , 50Hz . Assuming continuous conduction, calculate.
 - i) Firing angle for rated motor torque and 750rpm
 - ii) Motor speed for $\alpha = 160^\circ$ and rated torque
 - iii) Motor torque for $\alpha = 60^\circ$ and speed = 400rpm if armature inductance of motor drive of 0.85mH . (08 Marks)
- 5 a. Explain with relevant equations the operation of induction motor with unbalanced source voltage. (08 Marks)
b. With a neat diagram, explain star-delta, auto transformer method of starting of three phase induction motor. (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.

- 6 a. Explain the variable frequency control of an induction motor and draw the speed-torque curves. (08 Marks)
- b. A 2200V, 50Hz, 3-phase, 6 pole, Y-connected, squirrel cage induction motor has following parameters: $R_s = 0.075\Omega$, $R_r^1 = 0.12\Omega$, $X_s = X_r^1 = 0.5\Omega$. The combined inertia of motor and load is $100\text{kg}\cdot\text{m}^2$
- Calculate time taken and energy dissipated in the motor during starting.
 - Calculate time taken and energy dissipated in the motor when it is stopped by plugging. (08 Marks)
- 7 a. What are the relative advantages and disadvantages of CSI and VSI drives? (06 Marks)
- b. A Y-connected squirrel cage induction motor has following ratings and parameters: 400V, 50Hz, 4pole, 1370rpm, $R_s = 2\Omega$, $R_r^1 = 3\Omega$, $X_s = X_r^1 = 3.5\Omega$. Motor is controlled by a voltage source inverter at constant v/f ratio. For regenerative braking operation of inverter-fed induction motor drive. Determine approximate values of:
- Speed for the frequency of 30Hz and 80% of full load torque.
 - Frequency for a speed of 1000rpm and full load torque.
 - Torque for a frequency of 40Hz and speed of 1300rpm.
 - Calculate motor break down torque for inverter fed induction motor drive for a frequency of 60Hz as a ratio of its value at 50Hz. (10 Marks)
- 8 a. With circuit diagram and speed-torque curves explain the operation of static scherbius drive for slip power recovery scheme. (06 Marks)
- b. A 1-phase, 220V, 50Hz, 1425rpm induction motor has following parameters: $R_s = 2\Omega$, $R_r^1 = 5\Omega$, $X_s = X_r^1 = 6\Omega$ 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 1200rpm. (10 Marks)
- 9 a. Explain with block diagram, closed loop speed control of load commutated inverter synchronous motor drive. (08 Marks)
- b. Draw the block diagram of variable frequency control of multiple synchronous motor and explain. (08 Marks)
- 10 a. Explain permanent magnet type stepper motor. (08 Marks)
- b. Explain the various stages in textile mill and motors used in various stages. (08 Marks)

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