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Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
Industrial Drives and Applications

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting
at least TWO questions from each part.**

PART – A

- 1 a. Explain the speed-torque conventions and multi-quadrant operation on a motor, driving a hoist load. (06 Marks)
- b. Explain the different power modulators that are used in drive system. (10 Marks)
- c. A drive has following parameters:
 $J = 10 \text{ kg-m}^2$, $T = 100 - 0.1 N$, N-m, Passive load torque $T_l = 0.05 N$, 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 characteristics is changed to $T = -100 - 0.1N$, N-m. Calculate the time of reversal. (04 Marks)
- 2 a. By assuming machine to be homogeneous body, obtain the thermal model for heating and cooling of an electrical motor. (06 Marks)
- b. What are the load torque components? Define active and passive load torque. (08 Marks)
- c. Half hour rating of a motor is 100 kW. Heating time constant is 80 min and the maximum efficiency occurs at 70% full load. Determine the continuous rating of the motor. (06 Marks)
- 3 a. With dynamic equivalent circuit, explain the transient analysis of separately excited dc motor with armature control. (08 Marks)
- b. Explain single phase half-controlled rectifier control of dc separately excited motor with continuous and discontinuous conduction. (12 Marks)
- 4 a. Explain the chopper control of separately excited dc motor for regenerative braking. (08 Marks)
- b. A 230 V, 960 rpm and 200 A separately excited dc motor has an armature resistance of 0.02Ω . The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230 V. Assuming continuous conduction.
 - (i) Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm.
 - (ii) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm. (06 Marks)
- c. Explain the rectifier control of dc series motor and draw its speed torque curves. (06 Marks)

PART – B

- 5 a. Obtain the analysis and performance of a three phase induction motor when operated from unbalanced source voltages. (10 Marks)
- b. With a neat diagram, explain star-delta, Auto transformer method of starting of three-phase induction motor. (10 Marks)
- 6 a. Explain the variable frequency control of an induction motor and draw the speed torque curves. (10 Marks)
- b. Explain the operation of voltage source inverter fed induction motor drives. Also sketch various schemes of VSI fed induction motor drive. (10 Marks)

- 7 a. With a neat block diagram, explain the true synchronous mode variable frequency control of multiple synchronous motors. (05 Marks)
- b. Explain the self controlled synchronous motor drive employing load commutated thyristor inverter. (10 Marks)
- c. A 500 kW, 3-phase, 3.3 KV, 50 Hz, 0.8 (lagging) power factor, 4 pole, star-connected synchronous motor has following parameters, $X_s = 15\Omega$, $R_s = 0$, Rated current is 10 A, calculate
- Armature current and power factor at half the rated torque and rated current.
 - Torque for unity power factor operation at field current of 12.5 A. (05 Marks)
- 8 a. Explain the driving motors used in the cement industry for different operation. (10 Marks)
- b. Write a technical note on:
- Rolling mill drives.
 - Paper mill drives. (10 Marks)
