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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:
 $J = 10 \text{ kg-m}^2$, $T = 100 - 0.1N$, 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
- (i) Armature current and power factor at half the rated torque and rated current.
 - (ii) 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:
- (i) Rolling mill drives.
 - (ii) Paper mill drives. (10 Marks)
