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M.TECH

Total Number of Pages : 2

M.TECH 1ST SEMESTER REGULAR EXAMINATIONS, DECEMBER 2018

ELECTRIC DRIVE SYSTEM

Branch: PE, Subject Code:MPEPC1010

(Regulations 2018)

Time: 3 Hours

Max Marks : 70

Question Code: RD18002002

PART-A (10 X 2=20 Marks)

1. Answer the following questions.

- What are the functions of power modulator?
- Differentiate between active load torque and passive load torque.
- What are the different components of load torque?
- What are the roles of inner current control loop?
- Half hour rating of a motor is 100KW. Heating time constant 80 minute and the maximum efficiency occurs at 70% of full load. What is the over loading factor?
- What is counter-torque braking?
- Differentiate between VSI and CSI fed induction motor drive.
- What is the difference between static Kramer drive and static scherbuis drive?
- What is the difference between true synchronous mode and self-control mode for a synchronous motor?
- What is coefficient of adhesion?

PART-B (5 X 10=50 Marks)

Answer any five questions from the following.

- 2.a) Explain what do you understand by the steady-state stability? What is the main assumption? [5]

b) The heating and cooling time constants of an electric motor are 100 and 150 minutes respectively. The rating of the motor is 125KW. If it is working on duty cycle of 15 minutes on load and 30 minutes on no-load determine the permissible overloading of the motor. Assume the losses are $P_c + k^2 P_{cu}$ and $\frac{P_c}{P_{cu}} = \alpha = 0.4$. [5]
3. (a) What is load equalisation in an electrical drive? Derive the Expression for moment of inertia of the flywheel required for load equalisation. [5]

b) A motor equipped with a flywheel has to supply a load torque of 600N-m for 10 sec followed by a no load period long enough for the flywheel to regain its full speed, It is desired to limit the motor torque to 450 N-m. What should be the moment of inertia of the flywheel? The no load speed of the motor is 600 rpm and it has a slip of 8% at torque of 400 N-m. Assume the motor speed torque characteristic to be a straight line in the range of operation. Motor has inertia of 10 kg-m². [5]
4. a) A drive consisting of converter fed dc motor running with the following periodic duty cycle. [5]

 - Acceleration from starting to 1000 rpm in 10 second at uniform acceleration
 - Running at 1000 rpm & 800 N-m for 8 second
 - Braking from 1000 rpm to stand still in 10 second at uniform deceleration
 - Remains ideal for 20 second

Determine the torque & power rating of the motor, Moment of inertia of the motor is 100 kg-m².



- b) Explain the closed loop speed control of electrical drive with suitable block diagram. [5]
5. a) A 220V, 1500 rpm, 10 A separately excited DC motor is fed from a single phase fully controlled rectifier with an ac source voltage of 230 V, 50 Hz, $R_a=2 \Omega$. Conduction can be assumed to be continuous. Calculate firing angles for (i) half the rated motor torque and 500 rpm. (ii) rated motor torque and -1000 rpm. [5]
- b) Explain the chopper controlled separately excited dc motor drive for motoring and braking with suitable circuit diagram and waveforms. [5]
6. (a) What is slip power Recovery scheme? Explain static scherbius drive operation with suitable diagram and derive the expression of motor torque. [5]
- b) A 3-phase 440V, 6 pole, 970 rpm, 50 Hz, Y-connected induction motor has the following parameters referred to stator $R_s=0.2 \Omega$, $R_r' = 0.15\Omega$, $X_s= X_r' = 0.4\Omega$. The stator to rotor turns ratio is 3.5. The motor speed is controlled by the static scherbius drive. The drive is designed for a speed range of 30% below the synchronous speed. The maximum value of firing angle is 170° . Calculate (i) turns ratio of the transformer and (ii) torque for a speed of 750 rpm and $\alpha = 140^\circ$. [5]
7. a) Explain the advantages and limitations of the 25 KV, 50 Hz ac traction using on-load transformer tap changer. [5] [5]
- b) A local train uses motor and trailer coaches in the ratio of 1:2. The weight of a motor coach is 40 tonnes and that of trailer 35 tonnes. All the wheels in the motor coach are driving wheels. The train resistance is 30 N/tonne. Effective rotating mass is 10% of the dead weight. If the coefficient of adhesion is 0.3, calculate (a) The maximum train acceleration on a level track. (b)What will be maximum acceleration if the motor and trailer coaches are used in the ratio of 1:1? [5]
8. Write Short notes on
- a) Drives in Cement Mill. [5]
- b) Drive mechanism in textile mill. [5]