

GUJARAT TECHNOLOGICAL UNIVERSITY
B E Sem-VI Examination May 2011

Subject code: 162003

Subject Name: Control of Electric Drives

Date: 19/05/2011

Time: 10.30 am – 01.00 pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) State and explain the factors affecting the choice of Electric drive. **07**
(b) Explain the concept of electric drive with the block diagram for a modern electric drive system. **07**

- Q.2** (a) Develop and draw the block diagram for DC machine. **07**
(b) Explain loading transients of separately excited DC motor. **07**

OR

- (b) A drive has following parameters: **07**
Moment of inertia = 10 kg-m^2 , Torque produced by the motor = $100 - 0.1\omega$ N-m, Passive load torque = 0.05ω N-m, where ω 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 $T = -100 - 0.1\omega$ N-m. Calculate the time of reversal.

- Q.3** (a) Draw and explain static V-I characteristics of SCR. **07**
(b) Draw and explain waveforms of output voltage, output current and voltage across thyristor for single phase half wave controlled rectifier with R, L and E load and without freewheeling diode. **07**

OR

- Q.3** (a) A 230 V, 50 Hz, one-pulse SCR controlled converter with RLE load is triggered at a firing angle of 40° and the load current extinguishes at an angle of 210° . Find the circuit turn off time, average output voltage and the average load current for $R = 5 \Omega$, $L = 2 \text{ mH}$ and $E = 110 \text{ V}$. **07**
(b) Explain single phase semi-converter with circuit diagram and relevant waveforms. **07**

- Q.4** (a) Explain 3-phase half wave controlled converter with relevant waveforms for RL load and when the firing angle of the SCRs is 60° **07**
(b) Explain first quadrant type A chopper with relevant waveforms. **07**

OR

- Q.4 (a)** For type A chopper, dc source voltage = 230 V, load resistance = 10 Ω . **07**
Take a voltage drop of 2 V across chopper when it is on. For a duty cycle of 0.4, calculate average and rms values of output voltage and also calculate the chopper efficiency.
- (b)** A dc series motor is fed from 600 V dc source through a chopper. The dc **07**
motor has the following parameters:
Resistance of armature is 0.04 Ω , resistance of series field winding is 0.06 Ω and motor constant is 0.004 Nm/amp².
The average armature current of 300 A is ripple free. For a chopper duty cycle of 60 % determine the input power from the source, motor speed and motor torque.
- Q.5 (a)** Draw and explain firing circuit of TRIAC for single phase AC load **07**
control.
- (b)** Explain advantages and disadvantages of stepper motor. **07**
- OR**
- Q.5 (a)** A 220 V, 1500 rpm, 10 A separately-excited dc motor has an armature **07**
resistance of 1 Ω . It is fed from a single-phase fully-controlled bridge rectifier with an ac source voltage of 230 V, 50 Hz. Assuming continuous load current, compute motor speed at the firing angle of 30° and torque of 5 Nm.
- (b)** What are the types of electric braking used in electrical motors? Explain **07**
regenerative braking with its merits and demerits.
