

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2490

Roll No.

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B.Tech.

(SEM. VI) THEORY EXAMINATION 2011-12

INTRODUCTION TO ELECTRIC DRIVES

Time : 2 Hours

Total Marks : 50

Note :—Attempt all questions.

1. Attempt any **two** parts :— (7×2=14)
 - (a) Explain the various terms involved in turn on and turn-off time of SCRs in dynamic characteristics. Also explain why circuit turn-off time is kept larger than the device turn-off time.
 - (b) Define di/dt and dv/dt protection of SCRs. What are the components used to protect SCR from dv/dt and di/dt large values.
 - (c) Give the various triggering methods in SCR. Explain in detail pulse triggering method with requisite diagram.
2. Attempt any **two** parts :— (6×2=12)
 - (a) Derive the expression of a 1- ϕ full wave bridge rectifier fully controlled for R-L-E load.
An armature (RLE load) of a separately dc motor is

fed from 1- ϕ full wave fully controlled converter. The supply ac voltage $V = 220$ V, $R_a = 0.06$ Ω , $L_a = 0.85$ mH, I_a (rated) = 150 A, speed (rated) = 875 rpm, V_a (rated) is 200 V. Find the output voltage and α for a rated load when :

- (a) $E = 160$ V (speed = 733 rpm, 1st quadrant).
 (b) $E = -109$ V (speed = -500 rpm, 4th quadrant).

- (b) Explain the operation of 3- ϕ Half controlled full wave rectifier with desired waveforms.
 (c) Explain the control strategies of chopper.

In a 100-V dc chopper drive using current limit control scheme, the maximum possible value of the accelerating current is 425A, the lower limit of the current pulsation is 180 A. The length of on and off period is 14 ms and 11 ms, respectively. Determine the limit of current pulsation of the chopping frequency, the duty cycle ratio and the output voltage.

Attempt any two parts : (6 \times 2=12)

- (a) Give the differences between 180 $^\circ$ and 120 $^\circ$ modes of 3- ϕ inverter with relevant waveforms of phase and line voltages.
 (b) Explain the concept of step down cycloconverter. Enumerate the advantages and applications of cycloconverter.

- (c) Derive the expression for a 1- ϕ ON-OFF ac voltage controller. State the differences between integral cycle control and phase control.

4. Attempt any two parts :— (6 \times 2=12)

- (a) The speed of a separately-excited dc motor is controlled through 1- ϕ Half wave controlled converter from 230 V mains. The motor armature resistance is 0.5 Ω and motor constant is $K = 0.4$ V-s/rad. For load torque of 20 Nm at 1500 rpm and for constant armature current, calculate :

- (i) firing angle of the converter
 (ii) rms value of thyristor current
 (iii) I/P power factor of the motor.

- (b) Describe the regenerative braking of a chopper-fed separately excited dc motor. Illustrate answer with circuit diagram and relevant waveforms.
 (c) Enumerate the various methods of speed control of a 3- ϕ induction motor when fed through semiconductor devices.
 (d) Describe static Kramer drive and show that the steady state torque is not influenced by whether a transformer is used or not. Derive appropriate expressions to obtain torque-speed characteristics of static Kramer drive.