

5th SEMESTER DIPLOMA EXAM 2013

Subject - Power Electronics

F. M. - 80

Sub. Code - EL 502

P. M. - 28

Time - 3 Hrs.

• Question No. 1 is Compulsory.

• Answer any four question out of seven questions.

Q1. Choose the correct option of the following question:

[16 marks]

- (a) Circuit turn-off time of an SCR is defined as the time
 (a) taken by the SCR to turn off
 (b) required for the SCR current to become zero
 (c) for which the SCR is reverse biased by the commutation circuit
 (d) for which the SCR is reverse biased to reduce its current below the holding current.
- (b) In a step down cyclo convertor ^{commutation} communication required is
 (a) Natural (b) Forced (c) Depend on power (d) None of these
- (c) An SCR is considered to be semi-controlled device because
 (a) it can be turned OFF but not ON with gate pulse
 (b) it conducts only during one half cycle of an alternating current wave
 (c) it can be turned ON but not OFF with a gate pulse
 (d) it can be turned ON only during one half cycle of an alternating voltage wave
- (d) The output voltage wave form of a single -phase square wave inverter contains
 (a) only even harmonics (b) both odd and even harmonics
 (c) only odd harmonics (d) only triplex harmonics
- (e) AC to DC circulating current dual converter are operated with the following relationship between their triggering angles (α_1 & α_2)
 (a) $\alpha_1 + \alpha_2 = 180^\circ$ (b) $\alpha_1 + \alpha_2 = 360^\circ$ (c) $\alpha_1 - \alpha_2 = 180^\circ$ (d) $\alpha_1 + \alpha_2 = 90^\circ$
- (f) Which one of the statement is correct? For an SCR dv/dt protection is achieved through the use of
 (a) RL in series with SCR (b) RC across SCR
 (c) L in series with SCR (d) RC in series with SCR
- (g) An inter-group reactor is used in a single - phase cyclo converter circuit to
 (a) Reduce current ripples (b) Reduce voltage ripples
 (c) Limit circulating current (d) Limit di/dt in the semi-conductor switch
- (h) TRIAC is a
 (a) 2 terminal switch (b) 2 terminal bilateral switch
 (c) 3 terminal unilateral switch (d) 3 terminal bidirectional switch

(i) Describe SCR construction, symbol & draw its I-V characteristics representing the various voltages & currents. [8 marks]

Q2. A single-phase full wave bridge SCR circuit feeds power to a R-L load. Draw waveform for source voltage, load voltage, load current & voltage across the SCR for a given firing angle α . Hence obtain expression for avg & rms load voltage in terms of source voltage & firing angle. [16 marks]

Q3. A 200V, 1000 rpm, 10A separately excited DC motor is fed from 1 single-phase full converter supplied by an ac source 230V, 50Hz. Armature circuit resistance 1 ohm. Armature current is continuous. Calculate firing angle for:

(a) rated motor torque at 500 rpm. (b) half- the rated torque at 500 rpm [16 marks]

Q4. (a) Describe the principle of step-up chopper. Derive an expression for the average output voltage in terms of input voltage & duty cycle. [8 marks]

(b) Describe a voltage-commutated chopper with relevant current & voltage waveform as a function of time. The chopper operation may be divided into certain well-defined modes. Explain them. [8 marks]

Q5. (a) Describe the working of a single phase full bridge inverter, Assuming that the load is pure resistive. What are the advantages of single phase full bridge over the single phase half bridge inverter. [8 marks]

(b) A single phase modified MC-Murray inverter is fed by a DC source of 230V. The DC source voltage may fluctuate by $\pm 25\%$. The load current during commutation may vary from 20A to 80 A. If turn Off time is $20\mu s$. Calculate L & C. Use factor of safety 2. Also obtain the resistance for critical damping. [8 marks]

Q6. (a) Describe the various methods of triggering SCR [8 marks]

(b) Define string efficiency for series/parallel connected SCRs. Show that string efficiency of two series connected SCRs is usually less than one. [8 marks]

Q7. (a) Explain type A & type B chopper with its proper circuit diagram & its quadrant representation. [8 marks]

(b) A 220V, 60A, DC series motor, having combined resistance of armature & series field of 0.15Ω is controlled in regenerative braking mode. The DC source is 200V. Motor constant is 0.05V-sec/A-rad . The average motor armature current is rated & ripple free for a duty cycle of 50%. Determine:

(i) Power returned to supply & speed during regenerative braking.

(ii) Minimum & maximum permissible braking speeds [8 marks]

Q8. Write short notes on Any Four:

(a) Power MOSFET

(b) IGBT

(c) SMPS

(d) UPS

(e) Cycloconverter

(f) Single - phase AC regulator

[4 x 4 marks]