ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER – 2008

POWER ELECTRONICS

SEMESTER – 5

Time : 3 Hours] [Full Marks : 70

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct answer from the given alternatives for any *ten* of the following : $10 \times 1 = 10$

i) A single phase full converter can operate in

a) 4 quadrants (V - I) b) 3 quadrants

c) 2 quadrants d) 1 quadrant. ☐

ii) A second quadrant chopper operates in

a) forward motoring mode b) forward breaking mode

c) reverse motoring mode d) reverse breaking mode. ☐

iii) The main reason for connecting a pulse transformer at the output stage of an SCR firing circuit is to

a) amplify power of the triggering pulse

b) provide electric isolation

c) reduce the turn on time of the SCR

d) avoid spurious triggering of SCR due to noise. ☐

iv) Switch mode power supplies are superior to linear power supplies in respect of

a) size & efficiency b) efficiency & regulation

c) regulation & noise d) noise & cost. ☐

v) Bipolar junction transistors have

a) low input resistance compared to FET

b) high input resistance compared to FET

c) zero input resistance

d) infinite resistance. ☐

vi) A triac can be considered as

a) two SCRs connected in antiparallel with a common gate

b) two transistors corrected in antiparallel

c) two SCRs connected in parallel with a common gate

d) two SCRs connected in parallel with two gates. ☐

vii) In a constant current source inverter

a) a capacitor is connected in series with voltage source

b) an inductor is connected in series with voltage source

c) a capacitor is connected in parallel with voltage source

d) an inductor is connected in parallel with voltage source. ☐

viii) Resonant converters control the output power by

a) varying the switching frequency around resonating frequency

b) varying the on time of the switch

c) controlling the power loss in the switch

d) none of these. ☐

ix) An RC snubber circuit is used to protect an SCR against

a) false triggering b) failure to turn on

c) switching transients d) failure to commutate. ☐

x) Thyristor *A* has rated gate current of 2A & thyristor *B* has rated gate current of 100 mA. So,

a) *A* is GTO & *B* is conventional SCR

b) *A* is SCR & *B* is GTO

c) *A* may operate as VJT

d) *B* may operate as transistor. ☐

xi) If gate current is increased, the forward break-over voltage of an SCR will

a) increase

b) decrease

c) remain same

d) no relation exists between them. ☐

xii) For the regulation of AC voltages, which of the following device is used ?

a) Diode b) Triac

c) Diac d) SCR. ☐

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Explain with two transistor analogy of SCR, how positive feedback action takes place during turn on of an SCR. 5

3. What is a current source inverter ? Mention its merits & demerits compared to voltage source inverter. 2 + 3

4. Draw & explain dynamic switching characteristic of an SCR. 5

5. Discuss what would happen if gate is made positive with respect to cathode during the reverse blocking of an SCR. 5

6. What is meant by commutation ? Briefly explain with relevant waveform, the complementary commutation of an SCR. 1 + 4

GROUP – C

(Long Answer Type Questions)

Answer any *three* questions. 3 × 15 = 45

7. a) Draw a comparison between power transistor, power MOSFETS & IGBT in relation to their application in power electronics.

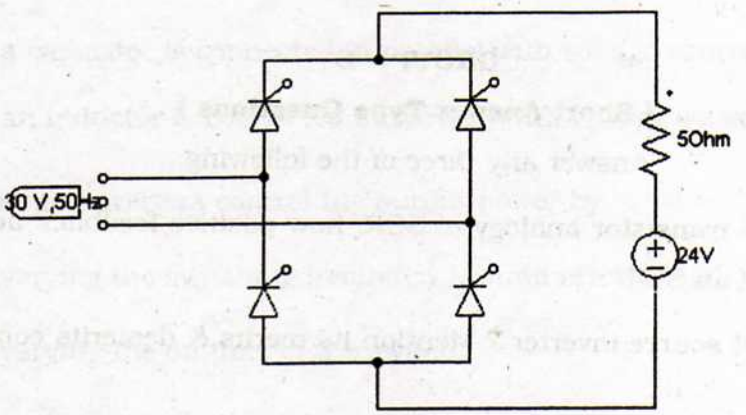
   b) How di/dt & dv/dt protections are achieved in SCR ?

   c) Draw & explain a triggering circuit of an SCR. 5 + 5 + 5

8. a) Explain the operation of a single phase half controlled bridge converter connected to *R-L* load. Show the waveforms of the output voltage, SCR current & source current for a firing angle & considering ripple free output current.

   b) Derive the expression for average & RMS value of output voltage for the converter mentioned in (a).

   c) A battery is charged by a fully controlled single phase converter as shown in fig. The input supply is 30 V at 50 Hz. The load consists of a 24 V battery and a resistance of 5Ω connected in series to limit the current. What is the minimum possible firing angle ? Compute the value of average output voltage. 6 + 4 + 5



9. a) What is a cycloconverter ? What benefit does it offer in comparison to invertor ?

   b) With the help of schematic diagram & relevant waveforms, explain the operation of three-phase to single phase cycloconverter.

   c) What do you mean by blocked group operation & circulating current mode operation of a cycloconverter ?

   d) Mention applications of cycloconverter. 3 + 6 + 3 + 3

10. a) Explain different *PWM* methods to control output voltage of an inverter.

b) Discuss constant (V/f) method of speed control of an induction machine. 10 + 5

11. Write short notes on any *three* of the following : 3 × 5

a) Multi-phase choppers

b) Series & parallel operation of SCR

c) Static VAR controller

d) Dual converter.

END