Total No. of printed pages = 9

END SEMESTER EXAMINATION – 2019

Semester : 5th

Subject Code : CAI-504

POWER ELECTRONICS

Full Marks –70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

1. *All* questions of PART – A are compulsory.

2. Answer any *five* questions from PART – B.

PART – A
Marks – 25

1. Fill in the blanks : 1×7=7

. (i) BJT has _____ on state loss compared to MOSFET.

(ii) Holding current of SCR is _____ than latching current.

[Turn over

(iii) SCR is a _____.

(iv) SCR is turned off when anode current falls below _____.

(v) Snubber circuits are used for protection from _____ in SCR.

(vi) IGBT has characteristics of both _____ and _____.

(vii) A MOSFET is a _____ controlled device.

2. Write true or false :   1×5=5

(i) GTO can be turned off by applying a negative gate pulse.

(ii) A TRIAC has 6 semiconductor regions.

(iii) UJT is a three terminal device.

(iv) The equivalent circuit of IGBT consists of two BJTs.

(v) Firing circuits are used for commutation of SCR.

3. Choose the correct answer :   1×13=13

(a) Which is not a method of SCR turn on ?

   (a) gate triggering

   (b) dv/dt triggering

   (c) negative gate triggering

   (d) light triggering

(b) The Schottky barrier diode has

   (a) Semiconductor-semiconductor contact

   (b) Metal-semiconductor contact

   (c) Metal-metal contact

   (d) None of the above

(c) IGBT is a

   (a) Current controlled device

   (b) Phase controlled device

   (c) Voltage controlled device

   (d) None of these

(d) A single phase half-wave controlled rectifier circuit has an R-load. A freewheeling diode is also in the circuit. When freewheeling diode is conducting the SCR

    (a) is forward biased

    (b) is reverse biased

    (c) may be forward biased or reverse biased

    (d) forward biased initially but reverse biased afterwards

(e) Second breakdown is present in

    (a) MOSFET   (b) BJT

    (c) IGBT   (d) SCR

(f) A thyristor can be protected against high dv/dt by

    (a) connecting an inductor in series with the thyristor

    (b) connecting a capacitor in series with the thyristor

    (c) connecting an inductor in parallel with the thyristor

    (d) connecting a capacitor in parallel with the thyristor

(g) A Thyristor is a _____ switch.

    (a) one directional

    (b) two directional

    (c) three directional

    (d) four directional

(h) A TRIAC is a _____ switch.

    (a) unidirectional

    (b) bidirectional

    (c) three directional

    (d) None of the above

(i) A diac has _____ terminals.

    (a) four   (b) three

    (c) two   (d) None of these

(j) Chopper control for DC motor provides variation in

    (a) Frequency   (b) Input current

    (c) Input voltage   (d) Input impedance

(k) In an SCR, the angle of conduction is changed by changing _____.

(a) Anode voltage

(b) Forward current

(c) Reverse Breakdown voltage

(d) Gate current

(l) An SCR has _____ PN junctions.

(a) four

(b) three

(c) two

(d) one

(m) Which of the following is an uncontrolled device ?

(a) MOSFET

(b) IGBT

(c) Diode

(d) BJT

PART – B

Marks – 45

4. (a) Why equalization circuits are required in SCR series or parallel operation ?   4

(b) How an UJT can be used as a relaxation oscillator ? Explain.   5

5. Deduce the expression for average and RMS value of load voltages for the following circuits :

(a) Single phase full-wave rectifier with resistive load.

(b) Single phase half-wave rectifier with RL load. Also, draw the circuit diagram and relevant waveforms in each case.   9

6. (a) Draw the circuit diagram for step up and step down chopper with relevant voltage waveforms. Also, determine the expression for average value of output voltage in each case.   6

(b) Describe the operation of two quadrant chopper with a suitable circuit diagram.   3

7. (a) Draw the circuit diagram for three phase half-wave rectifier with resistive load and determine the expression for average value of load voltage. 7

(b) Describe the different methods of SCR triggering. 5

(c) A step up chopper has input voltage of 110 V and output voltage of 330 V. If the conducting time of thyristor chopper is 200μs, determine the pulse width of the output voltage. 2

8. (a) What is an inverter? Explain the working principle of an inverter. 4

(b) Describe the operation of a single phase to single phase step up cycloconverter using a suitable circuit diagram. 5

9. (a) Give the steady state analysis of a single phase inverter. 6

(b) What do you mean by latching current and holding current in an SCR? 3

10. (a) A single phase half-wave rectifier is operated from 230V, 50 Hz source and the load resistance is R=12Ω. For a firing angle delay of 30°, determine the RMS value of load voltage. 4

11. Draw suitable circuits for the following applications using SCR or Traic and explain in brief :

(i) Temperature Control of a Heater

(ii) Battery Charger

(iii) Fan Regulator. 9

12. Describe how separately excited DC motors and DC series motors are controlled by the following methods :

(i) Single phase DC Drives.

(ii) Chopper Drives.

Draw suitable circuit diagrams. 9

44/CAI-504/PE   (8)   70(W)

44/CAI-504/PE   (9)   70(W)