Total No. of printed pages = 7

CAI-504/PE/5th Sem/2018/M

POWER ELECTRONICS

Full Marks – 70

Time – Three hours

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

PART – A

Marks – 25

1. Determine the correct options for the following questions : 1×10=10

   (i) For a GTO switching is

   (a) faster than SCR

   (b) slower than SCR

   (c) may be (a) or may be (b) above

   (d) at equal speed

[Turn over

(ii) In a step down chopper using pulse width modulation, $T_{on} = 4 \times 10^{-3}$ and $T_{off} = 1 \times 10^{-3}$ s. The chopping frequency (in Hz) is

(a) 333.33 (b) 200

(c) 250 (d) 1000

(iii) The Schottky barrier diode has

(a) semiconductor-semiconductor contact

(b) metal-semiconductor contact

(c) metal-metal contact

(d). None of the above

(iv) Average load current supplied by a thyristor depends on

(a) firing angle

(b) magnitude of gate current

(c) firing frequency

(d) All of the above

(v) A thyristor is reverse biased. A positive gate pulse is applied. The thyristor

(a) will be turned on

(b) will not be turned on

(c) may or may not be turned on

(d) will turn on after sometime

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

(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

(vii) The number of doped regions in a DIAC is

(a) 2 (b) 3

(c) 4 (d) 5

(viii) Second breakdown is present in

(a) MOSFET (b) BJT

(c) IGBT (d) SCR

(ix) A thyristor can be protected against high di/dt

(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

(x) In an SCR, with increase in gate current the forward break over voltage

(a) increases

(b) decreases

(c) remains same

(d) Either increases or decreases

2. State whether the following statements are true or false : $1 \times 10 = 10$

(i) A TRIAC has two terminal, anode and cathode.

(ii) In 180° mode of operation of a 3 phase bridge inverter, two thyristors conduct at one time.

(iii) SCR can be turned on by applying a negative gate pulse.

(iv) In a chopper circuit the output voltage depends on input voltage only.

(v) An MCT has 6 semiconductor regions.

(vi) UJT is a three terminal device.

(vii) The peak inverse voltage of bridge rectifier is one fourth of peak inverse voltage of half wave rectifier.

(viii) The speed of a DC motor can be controlled by armature voltage control only.

(ix) Power MOSFET and IGBT has identical structure.

(x) Switching loss of BJT is higher than MOSFET.

3. Fill in the blanks : $1 \times 5 = 5$

(i) Inverter converts _____ into _____.

(ii) For MCT _____ gate pulse is required to turn on and _____ gate pulse is required to turn off the device.

(iii) Type-B chopper is _____ quadrant chopper.

PART – B

Marks – 45

Answer *all* the questions :

4. Draw the I-V characteristics of an SCR and define the terms - forward blocking region, latching current and holding current. 5

5. How a GTO can be turned off ? Explain with two transistor analogy. 10

6. Draw the FBSOA and RBSOA of power BJT. 5

7. Explain the working of a half wave controlled rectifier with RL load. 10

8. Give the steady state analysis of a single phase inverter. 5

9. Write short notes on (any *two*) : 5×2=10

(a) UPS

(b) Type-A Chopper

(d) SMPS