2020

ELECTRONICS — HONOURS

Paper : DSE-B-2

(Power Electronics)

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer ***question no.* 1** and ***any four*** questions from the rest.

1. Answer ***any ten*** questions : 1×10

(a) When anode is positive with respect to cathode in an SCR, the no. of reverse biased junction is/are

(i) 1 (ii) 2

(iii) 3 (iv) 4.

(b) In a thyristor, anode current is caused due to

(i) electrons (ii) electrons and holes

(iii) electrons or holes (iv) holes only.

(c) A thyristor, when triggered, changes from forward blocking state to conduction state if its anode to cathode voltage is equal to

(i) V_{DRM} (ii) V_{DSM}

(iii) V_{RRM} (iv) V_{RSM}.

(d) In an SCR, holding current is

(i) equal to latching current (ii) greater than latching current

(iii) less than latching current (iv) not related to latching current.

(e) During forward blocking state, the thyristor is associated with

(i) large current, low voltage (ii) high voltage, low current

(iii) medium voltage, high current (iv) medium current, high voltage.

(f) A thyristor may be termed as

(i) DC switch (ii) AC switch

(iii) either (i) or (ii) (iv) square wave switch.

(g) A forward voltage may be applied to a thyristor after its

(i) anode current reduces to zero (ii) gate recovery time

(iii) reverse recovery time (iv) anode voltage reduces to zero.

(h) The $\frac{di}{dt}$ rating of an SCR is specified for its

(i) decaying anode current (ii) decaying gate current

(iii) rising gate current (iv) rising anode current.

(i) The $\frac{dv}{dt}$ limitation of a thyristor can be improved by connecting a RC network across the thyristor, which is called

(i) Turn-on snubber (ii) Turn-off snubber

(iii) Series snubber (iv) Parallel snubber.

(j) The switching speed and on-state losses of a thyristor is

(i) directly proportional to the width of n_1 region

(ii) inversely proportional to the width of n_1 region

(iii) directly proportional to the width of n_2 region

(iv) directly proportional to the anode current.

(k) In the case of power BJT, the period from the end of positive base (switching) current until the device enters linear (active) region is called

(i) saturation time (ii) rise time

(iii) transit time (iv) delay time.

(l) The power MOSFETs are

(i) current controlled devices (ii) voltage controlled devices

(iii) resistive controlled devices (iv) inductive controlled devices.

2. (a) Define latching current and holding current as applicable to an SCR. Show these currents on its static I–V characteristics.

(b) What are the necessary conditions for turning-on of an SCR? Discuss. (2+2+2)+4

3. (a) Explain the constructional details of IGBT and its I–V characteristics.

(b) Draw the two transistor equivalent circuit for an IGBT and explain it briefly. (3+2)+(3+2)

4. (a) "Every rectifier is a converter but every converter need not be a rectifier."— Explain the statement.

(b) Define 'Firing angle'.

(c) With a neat circuit diagram, explain the working of a single phase controlled rectifier with resistive load. Show the input and output waveforms. 2+1+(2+4+1)

5. (a) Draw a neat diagram and explain the constructional details of a power MOSFET.

(b) Explain the switching characteristics of a power MOSFET with a neat diagram. (2+4)+(3+1)

6. (a) Define an inverter.

(b) Write down the classification of inverters.

(c) With a neat circuit diagram briefly explain the working of a series inverter. 2+2+(1+5)

7. (a) How do you classify DC choppers on the basis of the following?

(i) According to the input / output voltage levels.

(ii) According to the directions of output voltage and current.

(iii) According to circuit operation.

(iv) According to commutation methods.

(b) With a neat circuit diagram explain the operation principle of step-up / down choppers. 4+(2+4)

8. (a) With a neat circuit diagram briefly explain the working of a Boost type converter.

(b) Why is a CuK converter better than Buck-Boost converter? (2+5)+3

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