2020

ELECTRONICS — GENERAL

Paper : DSE-A-2

Full Marks : 50

(Photonic Devices and Power Electronics)

The figures in the margin indicate full marks.

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

Day 1

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

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

(a) A laser diode is made up of semiconductor which is of

(i) direct band gap type (ii) indirect band gap type

(iii) low doped type (iv) intrinsic type.

(b) A solar cell operates on the principle of

(i) Recombination effect (ii) Raman effect

(iii) Photovoltaic effect (iv) Thermoelectric effect.

(c) An SCR can be turned off by

(i) reducing anode voltage to zero (ii) reducing gate voltage to zero

(iii) reverse biasing the gate (iv) none of the above.

(d) The structure of Insulated Gate Bipolar Transistor (IGBT) is topologically the same as a

(i) Thyristor (ii) Mos gate thyristor

(iii) BJT (iv) MOSFET.

(e) Which of the following displays has minimum power consumption?

(i) Liquid Crystal Display (LCD) (ii) Light Emitting Diode (LED)

(iii) Fluorescent (iv) Nixic tubes.

(f) Which type of fiber has the highest modal dispersion?

(i) Graded index mode (ii) Step index multimode

(iii) Step index single mode (iv) Graded index multimode.

(g) _____ are not used now a days for optical fiber communication system.

(i) Co-axial cable (ii) Multimode fiber

(iii) Single mode fiber (iv) Multimode graded index fiber.

(h) Calculate the wave length of radiation emitted by an LED made up of a semiconducting material with direct band gap energy of 2·8 ev.

(i) 2·8 Å (ii) 4·3308 Å (iii) 5548·4 Å (iv) 4430·8 Å.

(i) Triac is a _____ thyristor.

(i) unidirectional (ii) bidirectional

(iii) multidirectional (iv) tridirectional.

(j) A current source inverter can be

(i) load commulated (ii) force commulated

(iii) either local or force commulated (iv) none of the above.

(k) A thyristor without the gate terminal is called

(i) SCR (ii) Schockley diode

(iii) Triac (iv) Inverter.

(l) Which of the following device is not a power electronic device?

(i) SCR (ii) Triac (iii) Laser (iv) Diac.

2. (a) What is a photo transistor? Draw its typical volt-ampere characteristics curve. Mention few advantages of it over photodiode.

(b) How LED is different from photodiode? (2+2+3)+3

3. (a) What is the condition for amplification of a semiconductor laser?

(b) What is optical cavity?

(c) Schematically describe the operation and construction of a laser diode. 2+3+5

4. (a) Briefly explain the operation of a solar cell.

(b) Sketch typical I-V characteristics curve of a solar cell.

(c) Give few advantages of LCD display over LED display.

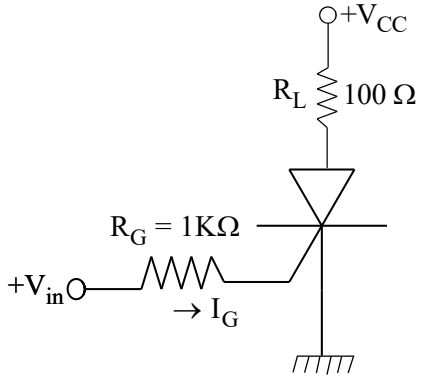
(d) How many types of Liquid crystals are there? 4+2+2+2

5. (a) Draw the structure of a circular optical fiber wave guide. Which modes are allowed in this type of wave guide and why?

(b) Why semiconductor power devices are used? Draw the basic structure of a Diac and explain its I-V characteristics. (2+3)+(1+4)

6. (a) What is an SCR? How it can be used to protect a load from excessive d.c. supply voltage? Explain with the help of a neat circuit diagram.

(b) The SCR in given figure has a gate trigger current I_{GT} = 6mA and gate trigger voltage V_{GT} = 0·7V. Calculate the minimum value of input voltage that turns the SCR ON. If the holding current is 5mA, what is the value of V_{cc} that turns the SCR OFF. (2+4)+4



7. (a) Discuss about basic structure of a Insulated Gate Bipolar Transistor (IGBT) and draw its I-V characteristics.

(b) How an IGBT can be used as switching device? What do you understand by the term SOA? (3+2)+(3+2)

8. (a) Describe with proper circuit, how SCR can be used as a phase controlled rectifier.

(b) What is a series inverter? State few of its limitations. (2+4)+(2+2)