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7. (a) What is a power inverter? Explain the operation of a series inverter with suitable waveforms.
- (b) Explain with circuit diagram, how a DIAC is used as a triggering device for a TRIAC. (8+7)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2457 IC

Unique Paper Code : 42517615

Name of the Paper : Photonics Devices and Power Electronics

Name of the Course : B.Sc. (Prog.) Electronics : DSE-1B

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt Five Questions in all, including Question No. 1 which is compulsory.

1. Attempt any FIVE : (5×3=15)

(a) What is a Laser diode?

(b) Compare the LCD and LED displays.

(c) Define quantum efficiency and responsivity of a Photodetector.

- (d) What is the need for semiconductor power devices?
- (e) Is SCR a current controlled or a voltage controlled device? Explain.
- (f) Draw the V-I characteristics and explain the working principle of a DIAC.
- (g) Which type of commutation is generally used for series inverters?
2. (a) Describe the three ways in which a two-level atomic system interacts with radiation. Derive the relation between Einstein coefficients. What is the ratio of spontaneous to stimulated emissions at thermal equilibrium?
- (b) Why light from usual light source is incoherent?
(12+3)
3. (a) Discuss the principle and structure of p-n, p-i-n and avalanche photodiodes.
- (b) Explain with relevant curves, the structure and working of a Solar cell. (9+6)

4. (a) Describe the structure of a step-index optical fiber. How is it able to guide light through its length? Also, derive an expression for its numerical aperture (NA).
- (b) Consider a bare fiber consisting of a core of refractive index 1.48 and having air ($n_2 = 1$) as cladding. What is its NA? What is the maximum incident angle up to which light can be guided by the fiber? (11+4)
5. (a) Using the two-transistor model, explain how an SCR is triggered due to (i) large dV/dt and (ii) gate pulse.
- (b) Briefly explain various (four) triggering modes of TRIAC. (8+7)
6. (a) What is a Phase controlled rectifier? How is it different from an uncontrolled rectifier? Also, define firing angle (α) for an SCR.
- (b) Draw and explain the working of a full-wave phase controlled converter with an inductive load. Draw the load voltage and current waveforms for $\alpha = 30^\circ$ and 120° . (6+9)