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Code No. : 12027 AS N (B)

VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD
B.E. (CBCS) II-Semester Advanced Supplementary Examinations, July-2019

Optoelectronic Devices

(CSE & IT)

Time: 3 hours

Max. Marks: 60

Note: Answer ALL questions in Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

1. Define electro-luminescence. What is the P-N junction that radiates energy as light instead of heat?
2. Describe shot noise and quantum noise in a photodetector.
3. Discuss how to achieve population inversion in a laser.
4. Enumerate any four applications of semiconductor lasers.
5. Categorize various types of optical fibers?
6. What are the advantages (in terms of data transmission and dielectric nature) of optical fiber over copper wire?
7. Explain spectral response of a solar cell.
8. Under the illumination, a GaAs solar cell with a dark saturation current of 0.5 nA produces a short circuit current of 100 mA. Calculate the maximum voltage.
9. State four material parameters for the design of a thermocouple sensor.
10. Briefly explain working of photochromic sensors.

Part-B (5 × 8 = 40 Marks)

11. a) Describe the LED structures that are commonly used for optical fiber communication and discuss their merits and advantages. [5]
b) What is dark current in the case of photoconductor? [3]
Calculate the dark current of a photoconductor in a circuit with a bandwidth of 1 GHz and is connected to a load resistor of 1 KΩ.
12. a) Explain the working and construction of a homo junction laser diode with necessary band diagram. [4]
b) What are Einstein's coefficients? Give physical significance of Einstein's coefficients. [4]
13. a) Explain the terms (i) Numerical aperture, (ii) acceptance angle and (iii) acceptance cone for an optical fiber. [4]
b) The diameter of a graded index fiber is 60 μm, and its numerical aperture is 0.231. Calculate the number of modes when the operating wavelength is 0.95 μm. [4]
14. a) What is a solar cell? Explain in detail the construction and working of a photovoltaic cell. Discuss its characteristics also. [4]
b) Analyse the open circuit and short-circuit conditions of a solar cell with circuit diagrams and obtain the expression for open circuit voltage [4]

15. a) What is a resistance thermometer? What changes in the construction of the resistance thermometer are suggested when the diameter is lower than 0.01 mm. Sketch three convenient designs for such case. [6]
- b) Explain how the charge develops on two plates placed across a piezoelectric crystal with a force applied on it. [2]
16. a) A photodetector with two ohmic contacts is connected in a circuit. Does the output of the detector increase when the applied voltage is increased. If so, can we increase the voltage indefinitely? [5]
- b) Classify various types of lasers with examples. [3]
17. Answer any *two* of the following:
- a) What is an optical fiber? Mention the requirements for a material to draw it into optical fiber. [4]
- b) Explain thin film solar cell and the requirements for thickness of it. [4]
- c) Write a note on Resistance Temperature Detector (RTD) [4]
