Hall Ticket Number:

Code No. : 12023 N (B)

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (CBCS) II-Semester Main Examinations, May/June-2019

Optoelectronic Devices

(CSE and IT)

Time: **3** hours Max. Marks: **60**

*Note: Answer **ALL** questions in **Part-A at the same place** and any **FIVE** from **Part-B***

Q.No.	Stem of the question	M	L	CO	PO
	Part-A (10 × 2 = 20 Marks)				
1.	Discus inter band, intra band and defect state transitions in a semiconductor with a necessary diagrams?	2	2	2	1,12
2.	A photocell cathode is coated with a material having a work function of 3.5eV. The photocell is irradiated with light wave of frequency 4×10^{15} Hz. Find the velocity of the emitted electrons.	2	2	2	1,12
3.	A GaAs laser operating at 850nm has cavity length 600 microns and a refractive index 3.6. Evaluate the frequency separation between two consecutive modes of the laser source and find approximate number of modes that are supported by the cavity?	2	3	1	1,12
4.	What do you understand by population inversion? How is it achieved in a laser?	2	2	1	1,12
5.	A silica optical fiber has a core refractive index of 1.59 and cladding refractive index 1.47. Calculate the critical angle at core and cladding interface.	2	3	3	1,12
6.	A 20 km long optical has 1.4dB/km attenuation. The fiber is joined for every kilometer and each connector has attenuation 0.6dB/km. Estimate the minimum optical power to be launched into the fiber to maintain power at the destination detector as 0.5 microwatt.	2	3	3	1,12
7.	Write a note on spectral response of a solar cell	2	1	2	1,12
8.	A solar cell of area 1.5cm x1.5cm is illuminated by a light of intensity $450W/m^2$. If maximum current and maximum voltages respectively are 27mA and 0.584V, calculate the efficiency of the solar cell.	2	2	2	1,12
9.	Write a short note on thermistor.	2	1	4	1,12
10.	What are the basic differences between a sensor and an actuator?	2	1	4	1,12
	Part-B (5 × 8 = 40 Marks)				
11. a)	Describe in detail the working and construction of a double heterojunction LED with neat illustrations including energy band diagram.	6	4	2	1,12
b)	An avalanche photodetector has quantum efficiency 0.6 at 1310nm. Calculate responsivity and photocurrent when the incident optical power is 20nW.	2	1	2	1,12
12. a)	What are quasi-Fermi energy levels? Obtain expression for gain in a laser diode for lasing action.	4	2	1	1,12
b)	Describe the construction and working of a semiconductor laser. List out its merits and demerits.	4	2	1	1,12

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13. a)	Explain in detail various losses in optical fibers	4	3	3	1,12
b)	Calculate refractive index of core and cladding of an optical fiber having numerical aperture 0.25 and fractional change is 0.0125. When the fiber is immersed in sea water of refractive 1.35, estimate the acceptance angle. Give your comments	4	3	3	1,12
14. a)	Describe the open circuit and short circuit conditions of a solar cell with appropriate circuit diagrams and arrive at the expression for open circuit voltage.	6	3	2	1,12
b)	The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than 2480 nm is incident on it. Calculate the band gap of the semiconductor.	2	3	2	1,12
15. a)	Explain various static characteristics of a sensor along with diagrams wherever necessary	4	2	4	1,12
b)	What is a thermocouple? State principle and working of a thermocouple	4	2	4	1,12
16. a)	Describe the construction and working of an Avalanche Photodiode and mentions its advantages over photodiode.	5	3	2	1,12
b)	Derive relation between spontaneous and stimulated emissions in terms of Einstein's coefficients.	3	2	1	1,12
17.	Answer any ***two*** of the following:				
a)	Explain the block diagram of fiber optic communication link.	4	3	3	1,12
b)	Write a note on thin film solar cells and list out the requirements for thickness of the thin film solar cell.	4	3	2	1,12
c)	What are positive and negative temperature coefficient thermistors? Explain the empirical relation between the resistance and temperature of a thermistor.	4	2	4	1,12

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	60
2	Knowledge on application and analysis (Level-3 & 4)	40
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	NIL

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