KATHMANDU UNIVERSITY
End Semester Examination [C]
May/June, 2019

Marks Scored:

Level: B.Sc.
Year: IV

Course : PHYS 404
Semester : I

Exam. Roll No.:

Time:30 mins.

F.M. : 20

Registration No.:

Date: 06 JUN 2019

SECTION "A"
[20Q. × 1 = 20 marks]

Choose and tick (√) the most appropriate answer.

1. The wavelength of gap LED material is equal to
[a] 750 nm [b] 350 nm [c] 460 nm [d] 550 nm

2. Absorption is a process in which an electron in the lower state excited to a higher energy state by absorbing a suitable amount of
[a] velocity [b] energy [c] power [d] momentum

3. A single mode fiber of radius 2 μm has a core refractive index 1.46 and fractional refractive index 0.015. Then the cut -off wavelength is equal to
[a] 1321 nm [b] 1021 nm [c] 500 nm [d] 1700 nm

4. For the most solar cells, the fill factor is about
[a] 0.9 [b] 0.1 [c] 0.7 [d] 0.4

5. For AlGaAs LED, the loss in light power is about a few percent after operation of about
[a] 8000 hours [b] 10000 hours [c] 5000 hours [d] 12000 hours

6. The radiant intensity I of a point source with radiant flux ϕ is given by
[a] $\phi = I/4\pi$ [b] $I = \phi/4\pi$ [c] $I = 4\pi/\phi$ [d] $I/\phi = 4\pi$

7. The change in refractive index of a medium due to mechanical strain produced by an acoustic wave is called the
[a] electro optic effect [b] magneto optic effect
[c] thermo optic effect [d] acousto optic effect

8. At the peak sensitivity of the relative luminosity curve 1 watt of radiant power correspond to
[a] 885 lumens [b] 985 lumens [c] 585 lumens [d] 685 lumens

9. Lead sulphide is a near infrared photodetector material with a wavelength response from 1 to 3.4 μm and have a response time about
[a] 200 μs [b] 400 μs [c] 600 μs [d] 800 μs

10. In a semiconductor with a carrier density $n \sim p \sim 10^{17}$ cm^{-3}, under low level injector the e-h radiative life time is 2.5×10^{-7} sec. Then the recombination rate becomes
[a] 2×10^{-9} $cm^3 s^{-1}$ [b] 2×10^{-15} $cm^3 s^{-1}$ [c] 2×10^{-11} $cm^3 s^{-1}$ [d] 2×10^{-20} $cm^3 s^{-1}$

Fill in the blanks with most appropriate answer.

11. For AlGaAs, FWHM is about 40 nm, with maximum relative intensity at about _____

12. For silica fiber the attenuation is minimum at _____

13. The light coupled can be varied from 0 to 100 percent by suitably choosing the _____

14. An electron rising from the top of the valence band to the bottom of the conduction band by the absorption of a _____

15. The wavelength of the light emitted if the band gap is 2.24 eV is equal to _____

16. The response time of the PMT is generally of the order of _____

17. An electric field applied to an electro optic material will change the refractive index of the medium by virtue of _____

18. Reflection and transmission type grating elements can be incorporated in the waveguide structure as _____

19. Two basic quantities that is required for high speed photodiode detectors are a large quantum efficiency and a large _____

20. A junction formed between two or more semiconductors with different band gap is called a _____ solar cell.

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F. M. : 55

SECTION "B"
[5Q. × 4 = 20 marks]

1. Write short notes on (a) thin film and schottky- barrier solar cells (b) homojunction and heterojunction solar cells.

2. What do you understand about band structure? Write differences between direct and indirect band gap semiconductors with suitable examples.

OR

Explain the electron -hole pair creation and recombination in semiconductor.

3. Describe the types of optical fibers. Write differences between Stepped index and Graded index optical fibers.

4. Develop the inverse square law of illumination for point source.

OR

Deduce the total radiant power from a diffusing surface.

5. Explain the construction and working principle of PMT with well labeled diagrams.

SECTION "C"
[5Q. × 7 = 35 marks]

6. Explain in details about active waveguide devices based on (a) acousto optic effect (b) magneto optic effect and (c) thermos optic effect with necessary well labeled diagrams.

7. Describe the principle and operation of solar cell with necessary diagrams. Derive the expressions for open circuit voltage, output electrical power, condition for maximum power, maximum voltage, maximum current, ideal conversion efficiency, and fill factor in solar cell.

8. Describe the electroluminescence in p-n junction with necessary diagrams. What is LED Drive circuit? Explain the performance of different LED characteristics in details with suitable well labeled diagrams.

9. What do you mean by recombination mechanisms? Explain the radiative-recombination efficiency.

OR

What are meant by absorption mechanisms and emission in semiconductors? Describe the some of the important types of absorption transition and emission process in semiconductors.

10. Develop an expression for numerical aperture in optical fibers. What is meant by the attenuation in optical fibers? Describe the attenuation in optical fibers due to several mechanisms.

OR

Explain the design and equivalent circuit of photodiodes. What do you mean by PIN photodiode? Obtain an expression for photocurrent in PIN photodiode. What is phototransistor? Deduce an expression for the external current flowing in phototransistor.