

Solution Quiz 2

PH 205

Quiz 2 (07 November 2023)

Full marks: 10

Time: 40 minutes

Tick the correct answer(s) for each question. In case of MCQs, the correct answer(s) will carry 1 mark, whereas wrong answer will carry -1/2 mark.

1. Which of the following is incorrect for a homojunction LED:

- (a) It has a relatively lower efficiency than the heterojunction LED
- (b) Photon reabsorption is usually present in the device
- (c) The effective volume from which the photons emerge is quite large
- (d) The homojunction LEDs are made by epitaxial process.

2. In a quantum well LASER, which of the following statement(s) is/are incorrect?

- (a) The threshold current for lasing is very small
- (b) The optical confinement factor is close to unity
- (c) Strained quantum well LASER has low threshold current

3. Which of the following is incorrect for a diode LASER:

- (a) Output power increases with temperature
- (b) The threshold current increases with temperature
- (c) The long wavelength lasers are more sensitive to temperature of operation

4. Which of the following is incorrect for a solar cell:

- (a) Si solar cells have higher efficiency than GaAs solar cells
- (b) The power conversion efficiency is dependent on the doping type of top layer (illuminated)
- (c) The power conversion efficiency of conventional solar cells is below 30%
- (d) Antireflection coating can be used to increase the efficiency of a solar cell

5. Which of the following is incorrect for a low threshold Laser:

- (a) The active layer thickness should be low.
- (b) The radiative recombination time should be large.
- (c) The injected carrier density should be large.
- (d) The area of the device active region should be small.

[P.T.O]

Write down the correct answer(s) in the given space against each question.

6. Name any two semiconducting materials can be used for making photodiode for operation in the wavelength range $1.0 - 1.6 \mu\text{m}$ with high efficiency.

ANS: (a) Germanium or Ge (b) AlGaAs / InGaAsP

7. For some photodetector, the fraction of electron-hole pairs that contribute to the detector current is 0.8 and the absorption coefficient of the detector material is 10^4 cm^{-1} and the thickness of the active layer is $4 \mu\text{m}$. Assuming no reflection loss, the external quantum efficiency (%) of the photodetector is

ANS: 78.5 %

8. A solar cell has a fill factor of 0.75. If the open circuit voltage and short circuit current are 0.5 V and 50 mA, respectively, the max power output from the cell will be

ANS: 18.75 mW.

9. For a GaAs LED, given that the radiative recombination time is 20 ns and the non-radiative recombination time is 100 ns. The internal quantum efficiency (%) of the LED is

ANS: 83.3 %

10. In a GaAs Fabry-Perot Laser cavity, the absorption loss in the cavity is 100 cm^{-1} . The reflection coefficient of the GaAs-air interface is 0.33. The cavity length (L in μm) at which the absorption loss and the mirror loss becomes equal is:

ANS: L = 111 μm

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