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Unit 7 - Week 5

Register for Certification exam

Course outline

How to access the portal

Self-assessment before course start

Week 1

Week 2

Week 3

Week 4

Week 5

- Interaction of Photons with Electrons and Holes in a Semiconductor
- Optical Joint Density of States, and Probabilities of Emission and Absorption
- Rates of Emission and Absorption
- Quiz : Assessment 5
- Solutions of

Assessment 5

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment. **Due on 2019-03-06, 23:59 IST.**

Instructions:

1. Answer **all** questions; all questions carry equal mark.

2. All symbols have their usual meanings.

3. Only one of the options is correct

4. You can see the correct answers after the last date of submission.

Note:

Marks obtained in this quiz will be counted towards your final score. You can take the quiz and submit it any number of times, and the latest submitted answers will be taken as your final submission.

Physical Constants:

$m_0 = 9.11 \times 10^{-31}$ kg; $h = 6.627 \times 10^{-34}$ J-s; $e = 1.602 \times 10^{-19}$ C; $k_B = 1.38 \times 10^{-23}$ J/K

1) Which one of the following statements is *incorrect*? ***1 point***

- Spontaneous emission is the basis for operation of the *light emitting diodes.*
- Stimulated emission is the basis for the operation of *semiconductor lasers.*
- Stimulated absorption is the basis for the operation of *photo-detectors.*
- Spontaneous emission is the basis for the operation of *laser diodes.*

No, the answer is incorrect.
Score: 0

Accepted Answers:
Spontaneous emission is the basis for the operation of laser diodes.

Week 9
Week 10
Week 11
Week 12
Exam Instructions
Lecture Transcripts

- Electron, hole, phonon, photon
- Electron, hole, photon

No, the answer is incorrect.
Score: 0

Accepted Answers:
Electron, hole, phonon, photon

3) Calculate the optical joint density of states available for radiation of wavelength 1550 nm incident on a *direct bandgap* semiconductor with E_g = 0.7 eV. Assume that $m_c = m_v = m_0$. ***0 points***

- 6.30×10^{12} $m^{-3}s$
- 3.15×10^{22} $m^{-3}s$
- 8.91×10^{13} $m^{-3}s$
- 4.45×10^{22} $m^{-3}s$

No, the answer is incorrect.
Score: 0

Accepted Answers:
3.15×10^{22} $m^{-3}s$

4) In a semiconductor, the probability of absorption can be less than the probability of emission of photons of energy hν, if— ***1 point***

- $E_g < h\nu < E_{fc} - E_{fv}$
- $E_{fc} - E_{fv} < E_g < h\nu$
- $E_{fc} = E_{fv}$, $h\nu > E_g$
- $E_{fc} = E_{fv}$, $h\nu < E_g$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$E_g < h\nu < E_{fc} - E_{fv}$

5) The rate of spontaneous emission of a semiconductor source, with E_g = 0.70 eV for the semiconductor, is given by: ***1 point***

$$r_{sp}(\nu) = e^{-a^2(h\nu - E_g - 2kT)^2}$$

where $a = \dfrac{1}{kT}$

The wavelength corresponding to the peak of the emission spectrum at room temperature is (approximately)—

- 1.48 μm
- 1.54 μm
- 1.65 μm
- 1.77 μm

No, the answer is incorrect.
Score: 0

Accepted Answers:
1.65 μm

Previous Page End