PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Summer 2018 - 19 Examination

Semester: 1   Date:16/05/2019
Subject Code: 203192104   Time: 02:00pm to04: 30pm
Subject Name: Engineering Physics   Total Marks: 60

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions.   **(15)**

1. Which one of the following is the unit of Density of states $\rho(k)$?
   a) m^{-2} b) m^{-3}
   c) J/s   d) m^3

2. Which of the following is the principle of LASER?
   a) Electroluminescence   b) Spontaneous Emission
   c) Stimulated Emission   d) Induced absorption

3. What is the carrier lifetime for intraband transition?
   a) 10^{-8}s to 10^{-9}s   b) 10^{-12}s to 10^{-13}s
   c) 10^{8}s to 10^{-15}s   d) None of the above

4. Under which of the following process the transitions involve the process of absorption and emission of Photon?
   a) Phonon transition   b) Acoustic transition
   c) Radiative transition   d) Non Radiative transition

5. 1nanometer = _____m
   a) 10^{-2} b) 10^{-3}
   c) 10^{-15} d) 10^{-9}

6. The full form of LASER is _____.

7. Under quasi equilibrium probability of emission is _____ than probability of absorption.

8. The distance between the boundaries of $+\dfrac{\pi}{a}$ to $-\dfrac{\pi}{a}$ is called as_____.

9. Intrinsic Carrier concentration depends on effective mass and Energy bandgap of the material.
   (True or False)

10. Photo detectors works in _____ bias condition.

11. Define Electron Affinity.

12. Define Stimulated emission.

13. Define Quantum Efficiency.

14. If we want to increase the Responsivity, its Quantum efficiency must not be changed.
    (**True or False**)

15. Give any one example of one dimensional nanostructure.

Q.2 Answer the following questions. (Attempt any three)   **(15)**

A) Derive the equation which gives the relation between for Rate of Carrier injection and excess carrier recombination time.

B) Derive the expression for Rate of Spontaneous Emission R_{sp} or $r_{sp}(\upsilon)$ using density of states.

C) State any 5 applications of Photo detectors.

D) Write a note on Quantum Well, Quantum Wire and Quantum Dot.

Q.3 A) 1) Give any five difference between direct band gap and indirect band gap semiconductor.   **(05)**

2) Write a note on Radiative transition and Non-Radiative transition.   **(02)**

B) Mention the properties of LASER and also obtain the relation between Einstein's coefficients under thermal equilibrium.   **(08)**

OR

B) 1) Obtain the equation which show the relation between Quantum Efficiency and Responsivity.   **(05)**

2) What are Low dimensional structures?   **(03)**

Q.4 A) 1) Derive the necessary condition for emission using Quasi equilibrium.   **(05)**

2) Explain the classification of Low dimensional nanomaterial.   **(02)**

OR

A) 1) Mention the materials which are used for LED and LASER under Ultraviolet, Visible and Infrared range.   **(05)**

2) What are the general characteristics of Photo detector?   **(02)**

B) Determine the equation for the density of state for k-space and E-space with appropriate diagram.   **(08)**