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# PARUL UNIVERSITY

## FACULTY OF ENGINEERING & TECHNOLOGY

**B.Tech. Summer 2023 - 24 Examination**

**Semester: 1 / 2**
**Subject Code: 303192102**
**Subject Name: Engineering Physics II**

**Date: 31/05/2024**
**Time: 02:00 pm to 04:30 pm**
**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** - All are compulsory (Each of one mark) (15)

1. Probability density is given by
   (a) $|\psi|^1$ (c) $|\psi|^2$
   (b) $|\psi|^3$ (d) $|\psi|^4$
2. An atom or molecule in the excited state of energy E2 can absorb a photon of energy hv and go the lower energy state E1, then the process is known as
   (a) Stimulated emission (c) Spontaneous absorption
   (b) Stimulated radiation (d) Spontaneous emission
3. What is the principle of fibre optical communication?
   (a) Frequency modulation (c) Doppler Effect
   (b) Population inversion (d) Total internal reflection
4. Laser system does not include
   (a) Active medium (c) Optical activity
   (b) Population inversion (d) Optical resonator
5. Photodiode works in _____.
   (a) Zero Bias (c) Forward Bias
   (b) Reverse Bias (d) None of the above
6. Light amplification by stimulated emission of radiation is an acronym for _____.
7. The Life time of a normal excited state is _____.
8. A material with two dimensions in nano range and one in large scale is _____.
9. Grain size of nano-material ranges from _____.
10. The top of the valence band and bottom of the conduction band lie at the same value of k is known as _____.
11. At higher Temperature extrinsic semiconductors behave as an intrinsic semiconductors. **True or False**
12. The Pauli Exclusion Principle influence energy band formations by restricting the number of electrons in a band. **True or False**
13. Define Effective mass ($m^*$).
14. What is a semiconductor, and how does it differ from a conductor and an insulator?
15. Define Bandgap.

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

A) Explain the physical significance of a wave function.
B) List the applications of optical fiber in different fields.
C) Explain construction and working of Optocoupler and Solar cell.
D) Prove that in an intrinsic semiconductor, fermi level lies exactly at the middle of the band gap.

**Q.3** A) Discuss in detail the construction, theory and working of He-Ne laser. (07)

B) Derive an expression for the Numerical aperture (NA) and Acceptance angle of an optical fiber. (08)

**OR**

B) Derive an expression for the Time dependent Schrodinger equation. (08)

**Q.4** A) Derive an expression for the carrier concentration in the intrinsic semiconductors. (07)

**OR**

A) Derive an expression of energy for a particle confined in one-dimensional potential box. (07)

B) Explain classification and properties of the nano-materials. (08)