b.i. What is a Light Emitting diode (LED)? Describe the principle, construction and working of LED. (8 Marks)

ii. Write a note on diffusion and drift current. (4 Marks)

30. a. Explain the absorption and emissions processes with necessary theory and hence derive the relation between Einsteins coefficients.

**(OR)**

b.i. Describe the theory of Drudes model and hence derive the expression for electrical conductivity. (10 Marks)

ii. Mention any two applications of photovoltaic effect. (2 Marks)

31. a. Describe the Linear and Vander Pauw Four Point Probe technique for electrical measurements.

**(OR)**

b. What are the fundamental laws of absorption? Describe the principle, construction and working of UV Visible Spectrophotometer.

32. a.i. What are Carbon nanotubes (CNT)? Mention the properties of CNTs. (4 Marks)

ii ii. Describe the fabrication of CNT's by Physical Vapor Deposition (PVD). (8 Marks)

**(OR)**

b.i. Describe the principle, construction and working of Scanning Electron Microscope (SEM). (8 Marks)

ii. Write a note on Heterojunctions. (4 Marks)

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**B.Tech. DEGREE EXAMINATION, NOVEMBER 2018**
First Semester

18PYB103J – PHYSICS: SEMICONDUCTOR PHYSICS
*(For the candidates admitted during the academic year 2018-2019)*

**Note:**
(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours Max. Marks: 100

**PART – A (20 × 1 = 20 Marks)**
Answer **ALL** Questions

1. The average distance travelled by an electron between two successive collisions in the presence of applied field is called _____
   (A) Collision time (B) Mean free path
   (C) Wave number (D) Drift velocity

2. The band gap is called _____, if the crystal momentum of electrons and holes is the same in both the conduction band and the valence band; an electron can directly emit a photon.
   (A) Direct (B) Indirect
   (C) Crystalline (D) Noncrystalline

3. _____ is the state at which the probability of electron occupation is ½ at any temperature above 0K.
   (A) Valence level (B) Fermi level
   (C) Conduction level (D) Density of states

4. When an electron in a periodic potential is accelerated relative to the lattice in an electric field or magnetic field, then the mass of the electron is called the _____
   (A) Rest mass (B) Effective mass
   (C) Zero mass (D) Accelerated mass

5. _____ is a PN Junction, which is forward biased?
   (A) Light Emitting diode (B) Zener diode
   (C) Rectifier (D) Transistor

6. When light impinges upon a semiconductor to create electron – hole pairs, some of the carriers are collected at the contact which leads to _____
   (A) gain (B) photocurrent
   (C) amplification (D) biasing

7. Which type of material is obtained when intrinsic semiconductor is doped with pentavalent impurity?
   (A) N-type semiconductor (B) Extrinsic semiconductor
   (C) P-type semiconductor (D) Insulator

8. _____ is the process of radiative recombination of electron-hole pairs created by electron bombardment.
(A) Photoluminescence (B) Cathodoluminescence
(C) Electroluminescence (D) Anodoluminescence

9. The spectral region, where the material changes from being relatively transparent to strongly absorbing is known as _____
(A) Absorption edge (B) Conduction edge
(C) Valence edge (D) Annihilation edge

10. According to Drudes theory, the velocities of electrons are assumed to have _____ velocity given by kinetic theory of gases.
(A) Root mean square (B) Drift
(C) Instantaneous (D) Uniform

11. _____is the creation of voltage and electric current in a material upon exposure to light and is a physical and chemical phenomenon.
(A) Acousto- optics (B) Photovoltaics
(C) Electrolysis (D) Electrophorsis

12. In stimulated emission, the states at which the life time of atoms is extended is _____
(A) Metastable state (B) Stable state
(C) Dense state (D) Excited state

13. For determining the resistivity of a semiconductor, the diameter of contacts between the probe and the semiconductor should be _____ the gap between the probes.
(A) Smaller than (B) Greater than
(C) Equal to (D) Double

14. _____ is a technique for characterizing semiconductor materials and devices, where the applied voltage is varied, and the capacitance is measured and plotted as a function of voltage.
(A) Capactive - voltage profiling (B) Current profiling
(C) Voltage profiling (D) Baising

15. A _____ is a method of determining quickly whether a semiconductor sample is n (negative) type or p (positive) type.
(A) Electrolysis (B) Hot point probe
(C) Rectification (D) Hydrogenation

16. _____ law states that, when a beam of monochromatic light passes through an absorbing medium, the rate of decrease in intensity with the thickness of the medium, is proportional to the intensity of light.
(A) Lambert's (B) Beer's
(C) Photoelectric (D) Snell's

17. Nanoparticles are special mainly because of their _____
(A) Surface area (B) Surface charge
(C) Volume (D) Force



18. In a quantum wire, the material size is reduced _____
(A) In three directions (B) In two directions
(C) In one direction (D) Infinitely

19. In CVD chamber, the precursors are introduced to the reaction chamber in the _____ state.
(A) Liquid (B) Solid
(C) Semisolid (D) Gaseous

20. The physical parameter that is probed in AFM resulting from different interactions is _____
(A) Charge (B) Force
(C) Potential (D) Field

**PART – B (5 × 4 = 20 Marks)**
Answer **ANY FIVE** Questions

21. Write a note on Energy bands in solids.

22. Describe the nonequilibrium properties of carriers.

23. What is a PN Junction? Explain the biasing concept in PN Junction.

24. Write a note on organic light emitting diodes.

25. Describe the optical absorption and recombination process.

26. Write a note on I-V characteristics of a diode.

27. Describe the powder method of X-ray diffraction.

**PART – C (5 × 12 = 60 Marks)**
Answer **ALL** Questions

28.a.i. What is Density of states? Derive an expression for density of states for a semiconducting material. (10 Marks)

ii. The Fermi level for potassium is 1.9 eV. Calculate the velocity of the electron at the Fermi level. (2 Marks)

**(OR)**

b. Describe the behavior of electron in a periodic potential and hence explain the Kronig Penny Model in detail with the cases.

29.a.i. What is an extrinsic semiconductor? Describe the variation of Fermi level with carrier concentration and temperature in an N-Type semiconductor. (8 Marks)

ii. Determine the position of the Fermi Level in an instrinsic semiconductor from the centre of forbidden gap at room temperature, if the effective mass of an electron is equal to twice the effective mass of hole. (4 Marks)

**(OR)**