Reg. No.															

B.Tech. DEGREE EXAMINATION, DECEMBER 2023

First and Second Semester

18PYB103J – PHYSICS: SEMICONDUCTOR PHYSICS

(For the candidates admitted during the academic year 2018-2019 to 2021-2022)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours

Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

	Marks	BL	CO	PO
1. Metals possess _____ for bidden gap. (A) Large (B) Medium (C) Low (D) Zero	1	1	1	1
2. The unit of Fermi function is _____ (A) Kg (B) No Unit (C) m/s (D) Kg/s	1	2	1	1
3. The probability of a radiative recombination is _____for indirect band gap semiconductor. (A) High (B) Low (C) Zero (D) Infinity	1	2	1	1
4. _____ is defined as the time taken by an electron between two successive (A) Elastic time (B) Mean free path (C) Relaxation time (D) Collision Time	1	2	1	1
5. The random motion of holes and free electrons due to thermal agitation is called _____ (A) Pressure (B) Diffusion (C) Ionisation (D) Drift	1	2	1	1
6. In PN junction reverse bias, the potential barrier is _____. (A) Raised (B) Lowered (C) Standard (D) No Change	1	1	2	1
7. The Fermi level in a p-semiconductor lies close to _____ (A) The top of the conduction band (B) The top of the valence band (C) The bottom of the valence band. (D) The bottom of the conduction band	1	2	2	1

8. What is the barrier potential of a silicon diode? 1 1 2 1
   (A) Si – 0.2 V (B) Si – 0.3 V
   (C) Si = 0.4 V (D) Si = 0.7 V

9. Band to band transition in GaAs can results absorption and emission of photons with wavelength of _____ 1 2 3 1
   (A) 0.087 nm (B) 0.870 μm
   (C) 0.087 mm (D) 0.087 cm

10. The Fill Factor value lies between _____ and _____ 1 2 3 1
   (A) 1 and 100 (B) 1 and 10
   (C) 0.7 and 0.8 (D) 1 and 1000

11. The Fermi golden rule can be used for calculating the _____ probability rate for an electron. 1 2 3 1
   (A) Occupancy (B) Electron
   (C) Hole (D) Transition

12. Which one of the following is not explained by Drude model? 1 1 3 1
   (A) Distinction between metal and insulator (B) Electrical transport in metals
   (C) Thermal conductivity of metals (D) Band theory of solids

13. In a hot probe technique, the voltage generated when charge carriers diffuse is due to ____ 1 2 4 1
   (A) Pressure gradient (B) Mass gradient
   (C) Volume gradient (D) Temperature gradient

14. Deep Level Transient Spectroscopy (DLTS) detects and identifies electrically active _____ in semiconductors. 1 2 4 1
   (A) Atoms (B) Charges
   (C) Defects (D) Energy Levels

15. In semiconductors, the electrical conductivity depends on number of available charge carriers and_____ 1 2 4 1
   (A) Electron emission (B) Electron absorption
   (C) Carrier Mobility (D) Energy of phonons

16. In order to use the van der Pauw method, the sample thickness must be much less than the — and length of the sample. 1 1 5 1
   (A) Width (B) Area
   (C) Volume (D) Diameter

17. A nanotube can be classified under _____ 1 1 5 1
   (A) 1 D (B) 0 D
   (C) 3 D (D) 2 D

18. "There is plenty of room at the bottom" is the famous quote by _____ 1 1 5 1
   (A) Feynman (B) Einstein
   (C) Max Plank (D) Newton

19.	The physical parameter that is probed in AFM resulting in different interactions (A) Charge (B) Force (C) Potential (D) Current	1	2	5	1
20.	The law which states that the path difference is an integral multiple of wavelength is _____ (A) Biot Savart's law (B) Ohms law (C) Bragg's law (D) Lambert's law	1	2	5	1

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

		Marks	BL	CO	PO
21.	Write a short note on Phonons.	4	1	1	1
22.	Write the differences between direct and indirect band gap semiconductor.	4	2	1	1
23.	Explain N - type semiconductor with diagram	4	1	2	1
24.	Write a note on reverse bias p-n junction	4	1	2	1
25.	What is optical recombination process? Write three optical properties in which optical recombination process is observed.	4	2	3	1
26.	What is photoluminescence and discuss the classification.	4	2	4	1
27.	Discuss about quantum well, quantum wire and quantum dot.	4	1	5	1

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

		Marks	BL	CO	PO
28. a.	Explain three types of E-K diagram. What is meant by Brillouin Zone? Explain.	12	1	1	1
	(OR)				
b.	What are the postulates of quantum free electron theory? Write the success and failures of quantum free electron theory.	12	1	1	1
29. a.	What is the principle of LED? Explain the construction and working of light emitting diode with necessary theory and diagrams.	12	2	2	1
	(OR)				
b.	Obtain the expression for Continuity equation with the help of drift and diffusion current.	12	21	2	1

30. a.	What are the postulates of Drude model for electrical conductivity of material? Also obtain the expression for electrical conductivity of semiconductor material.	12	1	3	1
	(OR)				
b.	What is Density of states for photons? Obtain the expression to find density of state for photons in-terms of energy and frequency.	12	1	3	1
31. a.	State Hall Effect with diagram. Derive the expression for the Hall coefficient of n type semiconductor. Write any three applications of Hall Effect.	12	2	4	1
	(OR)				
b.	Explain resistivity of a given material determined using two probe method and how the samples are connected to the probes in Four Point Probe method. Mention any two advantages.	12	2	4	1
32. a.	What is the principle, construction of SEM? How are backscattered, secondary and Auger electrons utilized in SEM?	12	2	5	1
	(OR)				
b.	Write a detailed note on properties, applications and synthesis of carbon nanotubes.	12	2	5	1

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