



Registration Number:  
Date & Session

**ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU -27**  
**B.Sc/B.A/B.Com– III SEMESTER**  
**SEMESTER EXAMINATION: NOVEMBER 2022**  
(Examination conducted in December 2022)  
**PHOE 6 – INTRODUCTORY NANOTECHNOLOGY**

**Time: 2 Hours**

**Max Marks: 60**

**This paper contains 4 printed pages and 3 parts**

**PART-A**

**Answer the following**

**25x1=25**

1. What is the average size of the red blood cells?
  - a) 4000nm
  - b) 3000nm
  - c) 6000nm
  - d) 7000nm
2. Which of the following is a 3D nanomaterial?
  - a) Nano wires
  - b) Nano tubes
  - c) Colloids
  - d) Thin films
3. Which of the following is NOT the quantum size effect?
  - a) Opaque substance becomes transparent
  - b) Stable material turns combustible aluminum
  - c) Insoluble material becomes soluble
  - d) None of the above
4. Which of the following best describes a Quantum Wells?
  - a) Confinement in two directions
  - b) Confinement in one direction
  - c) Confinement in all the three directions
  - d) No confinement
5. SEM stands for
  - a) Scanning Electron Microscope
  - b) Single Electron Microscope
  - c) Single Etalon Microscope
  - d) Surface Electron Microscope
6. The density of states of bulk system is determined by
  - a)  $E^0$
  - b)  $E^{-1/2}$
  - c)  $E^{1/2}$
  - d)  $E^{3/2}$



7. Quantum cryptography uses \_\_\_\_\_ to transmit data through fibre optic cable.
  - a) Photons
  - b) Phonons
  - c) Electrons
  - d) Positrons
8. Which of the following is not a bottom-up approach to nano material preparation?
  - a) Vapour phase deposition
  - b) Plasma assisted deposition
  - c) Molecular beam epitaxy
  - d) Lithographic techniques
9. Ultra-high vacuum range of pressure is \_\_\_\_\_.
  - a)  $10^{-6}$  to  $10^{-4}$
  - b)  $10^{-5}$  to  $10^{-10}$
  - c)  $10^{-4}$  to  $10^{-2}$
  - d)  $10^{-12}$  to  $10^{-14}$
10. Which of the following is a growth monitoring method in Molecular beam epitaxy?
  - a) RHEED
  - b) IBM
  - c) LED
  - d) MOCVD
11. MEMS stands for
  - a) Nano Electro Mechanical Systems
  - b) Micro Electro Mechanical Systems
  - c) Micro Engineering Mechanical Systems
  - d) None of the above
12. Expand CVD
  - a) Controlled vapour deposition
  - b) Chemical Vapour deposition
  - c) Controlled voltage deposition
  - d) Chemical variation deposition
13. The removal or division of bulk material to get a desired nanostructures is known as
  - a) Top-down approach
  - b) Bottom-up approach
  - c) Sol-gel process
  - d) None of the above
14. \_\_\_\_\_ have two directions of growth and one direction of restriction.
  - a) Thin films
  - b) Thick films
  - c) Hard films
  - d) 2D layers



15. MBE uses a special source holder, which is known as \_\_\_\_\_
- a) Vacuum Chamber
  - b) Knudsen cell
  - c) Plasma cell
  - d) None of the above
16. Which method is most suitable for QW fabrication?
- a) Molecular beam Epitaxy
  - b) Micro beam Epitaxy
  - c) Molecular bunch Epitaxy
  - d) None of the above
17. The unit of hardness is the following:
- a) Moh
  - b) Mho
  - c) Micron
  - d) Meter
18. The bound electron and hole pair is referred to as
- a) Excitons
  - b) Electron pair
  - c) Hole pair
  - d) None of the above
19. Loosely bound excitons are referred to as
- a) Exciton
  - b) Frenkel Exciton
  - c) Mott-Wannier Exciton
  - d) None of the above
20. The speed of light is
- a) 3,00,000 Km/s
  - b) 330 m/s
  - c) 3000 m/s
  - d) 30 Km/s
21. Which of the following is the specialty of tunnel diodes?
- a) Temperature sensitive
  - b) Doesn't require current
  - c) Doesn't require voltage
  - d) Resistant to nuclear radiation
22. GMR stands for
- a) Giant Magneto Resistance
  - b) Giant Micro Resistance
  - c) Giant Micro Reactance
  - d) None of the above



23. Which of the following is NOT a type of carbon nanotubes?  
a) Armchair  
b) ZigZag  
c) Helical  
d) Flowerily
24. The conductivity of ZigZag CNT is like  
a) Insulator  
b) Metal  
c) Semiconductor  
d) None of the above
25. The quantum Hall effect and its related constant was discovered by  
a) Einstein  
b) Newton  
c) Klaus von Klitzing  
d) Debye

### **PART-B**

**Answer any FIVE of the following**

**5×5=25**

26. Discuss the formation of magnetic vortices with a neat diagram.  
27. With a neat diagram, explain the formation of superlattices with minibands and minigaps.  
28. Sketch the scattering and ballistic transport of electrons.  
29. What do you mean by stark effect? Explain it with a neat diagram.  
30. Discuss the top-down approach of nanomaterial fabrication.  
31. Explain proximity printing lithography with a neat diagram.  
32. Discuss the Oswald ripening process.  
33. What do you mean by Nano indentation process? Discuss it.

### **PART-C**

**Answer the following**

**1×10=10**

34. Write an essay on nanotechnology and its applications.