S.A ENGINEERING COLLEGE

**(An Autonomous Institution)**

## DEPARTMENT OF PHYSICS

## PHYSICS FOR INFORMATIONSCIENCE

## IA 2-QUESTION BANK

Part A (with Answers)

Question Bank – Part A (with Answers)

UNIT III – Magnetic Principle in Computer Data Storage

1. Q: Define holographic optical data storage.

Ans: Holographic optical data storage is a technique that records and reads data throughout the volume of a medium using the interference pattern of laser beams.

2. Q: What is its basic principle of holography ?

Ans: It is based on recording data as 3D interference patterns formed by intersecting a reference beam and a data-bearing signal beam in a photosensitive material.

3. Q: Write any two applications of magnetic hard disk drives.

Ans: 1. Data storage in computers  
2. Archiving and backup in data centers

4. Q: Define CD-ROM. How does it store data?

Ans: CD-ROM (Compact Disc Read-Only Memory) stores data in the form of pits and lands on a reflective surface read by a laser beam.

5. Q: List any two advantages of magnetic disks.

Ans: 1. High storage capacity  
2. Rewritable multiple times

6. Q: Give any two examples of magnetic data storage devices.

Ans: 1. Hard disk drive  
2. Magnetic tape

7. Define Giant Magneto-resistance (GMR):  
GMR is a property where the electrical resistance of a material changes when a magnetic field is applied. It is used in hard disk read heads to detect data stored magnetically.

8. What does WORM stand for, and how is it different from a standard CD-ROM?  
WORM stands for Write Once Read Many.

* You can write data only once, but read it many times.
* A CD-ROM is usually pre-written and cannot be changed or written by the user.

UNIT IV – Optical Materials and Display Devices

9. Q: What are optical materials?

Ans: Materials that interact with light through reflection, refraction, absorption, or transmission are called optical materials.

10. Q: Define carrier generation and recombination.

Ans: Carrier generation is the process of creating electron-hole pairs, while recombination is the process of electrons and holes annihilating each other.

11. Q: Write any two advantages of photodiode.

Ans: 1. Fast response time  
2. High sensitivity to light

12. Q: List any two applications of solar cells.

Ans: 1. Solar power panels  
2. Powering calculators

13. Q: What is dark current?

Ans: Dark current is the small electric current that flows through a photodiode even when no light is present.

14.Q: Classify the optical materials based on their interaction with visible light.

Ans: 1. Transparent  
2. Translucent  
3. Opaque

15. Q: Write the working principle of solar cells.

Ans: Solar cells work on the principle of photovoltaic effect, where sunlight generates electron-hole pairs that create current.

16. Q: What is the principle behind the P-N junction diode?

Ans: It operates based on the movement of charge carriers across a p-n junction, allowing current in one direction only.

17. Q: Write a short note on Light Emitting Diode?

Ans: LED is a semiconductor device that emits light when current flows through it, due to electron-hole recombination.

18. Q: The wavelength of light emission in an LED is 1.55µm. Calculate the band gap in eV.

Ans: Band gap E = hc/λ =

19 Q: Calculate the wavelength of radiation emitted by an LED with a band gap energy of 3.8 eV.

Ans: λ = hc/E = (1240 eV·nm)/(3.8 eV)

20. Q: Name any two optical data storage techniques.

Ans: 1. CD-ROM  
2. Holographic data storage

21.Write the working principle of solar cells:  
Solar cells work based on the photovoltaic effect.  
When sunlight hits the cell, it creates electron-hole pairs, and these generate electric current.

22. Write a note on Light Emitting Diode (LED):  
An LED is a semiconductor device that glows when electric current passes through it.  
It gives off light due to recombination of electrons and holes.

23. Write the principle of OLED:  
OLEDs work by passing current through organic materials that emit light.  
They are brighter, thinner, and more flexible than regular LEDs.

24. What is a Charged Coupled Device (CCD)?  
CCD is a device that captures light and converts it into electronic signals.  
It is mainly used in digital cameras and scanners.

UNIT V – Nanodevices and Quantum Computing

25. Q: What is the advantage of quantum computing over classical computing?

Ans: Quantum computing can perform complex computations much faster due to superposition and parallelism.

26. Q: What is quantum bits (qubits)?

ns: Qubits are the basic units of quantum information, which can exist in a superposition of 0 and 1 states.

27. Q: Define the term quantum wire.

Ans: Quantum wire is a nanostructure where electrons are confined in two dimensions, allowing movement only along one axis.

28. Q: Name any two applications of quantum computing.

Ans: 1. Cryptography  
2. Drug discovery

29. Q: What is meant by quantum confinement?

Ans: Quantum confinement is the effect observed when electrons are confined to very small dimensions, altering their energy levels.

30. Q: List any two applications of the quantum dot.

Ans: 1. Quantum dot displays  
2. Biological imaging

31. Q: Define coulomb blockade.

Ans: Coulomb blockade is a phenomenon where electron flow is blocked due to electrostatic repulsion in very small conductive regions.

32. Q: Define Giant Magneto-resistance.

Ans: GMR is a quantum mechanical effect where electrical resistance changes significantly in response to a magnetic field.

33. Q: What is meant by a single electron transistor (SET)?

Ans: SET is a device that controls electron flow one electron at a time using quantum tunnelling and Coulomb blockade.

34. Q: What is meant by quantum tunnelling?

Ans: Quantum tunnelling is a phenomenon where particles pass through a potential barrier that they classically couldn’t overcome.

35. Q: Define the term quantum dot.

Ans: Quantum dot is a nanoscale semiconductor particle that confines electrons in all three spatial dimensions.

36. Q: What is the role of quantum gates in quantum computing?

Ans: Quantum gates manipulate qubits to perform logical operations essential for quantum computation.

37.Define Coulomb Blockade:  
Coulomb blockade is a condition where electrons are blocked from flowing through a small device due to electrostatic repulsion, allowing only one electron at a time to pass.

38. What is the advantage of quantum computing over classical computing?  
Quantum computers can solve complex problems faster using qubits that do multiple calculations at once through superposition and entanglement.

39. What is quantum entanglement?  
Quantum entanglement is when two particles become linked, so that the state of one affects the other, even if they are far apart.

### ****UNIT III – Magnetic Principle in Computer Data Storage****

1. **Explain the writing and reading of data in a magnetic hard disk using GMR sensors.**
2. **Explain the concept of magnetic data storage in a computer hard disk, including its working principle and key components.**
3. **(i) Define holographic optical data storage.**  
   **(ii) Explain how light interference is used for data storage in holographic memory.**
4. **Describe how holographic optical data storage works. What makes it different from traditional optical data storage methods in terms of data encoding and retrieval?**
5. **What does WORM stand for, and how is it different from a standard CD-ROM?**

UNIT IV – Optical Materials and Display Devices

1. Classify the optical materials based on their interaction with visible light and explain each category with examples.
2. (i) Explain three types of scattering of light in solids.  
   (ii) Write a short note on:  
       (a) Transparent materials  
       (b) Translucent materials  
       (c) Opaque materials
3. Discuss the three types of carrier generation and recombination processes in semiconductors.
4. Explain the principle, construction, and working of an LED along with its advantages, disadvantages, and applications.
5. Describe the construction and working of a light-emitting diode along with its merits and demerits.
6. Describe the principle, construction and working of an Organic Light Emitting Diode (OLED).
7. Explain the working principle of a Liquid Crystal Display (LCD). How does it utilize the properties of liquid crystals for image formation?
8. What is a Charged Coupled Device (CCD)? Explain its working and applications in optical systems.
9. Explain a solar cell circuit and explain the principle, construction and working of it, when it is exposed to sunlight along with its disadvantages.

UNIT V – Nanodevices and Quantum Computing

1. Describe quantum confinement and quantum structures in nanomaterials.
2. Explain quantum confinement and its significance in the design of nanodevices like quantum wells, wires and dots.
3. Explain the tunnelling phenomenon. Mention the conditions necessary for the single electron phenomenon to occur.
4. Explain in detail about the tunneling process and also give an account on resonant tunneling diode with a neat diagram.
5. Explain the concept of Coulomb blockade and its application in single-electron phenomena. Describe its significance in the construction of single-electron transistors.
6. Explain the working of single-electron transistors (SETs) using the principles of quantum tunnelling and Coulomb blockade. Discuss their potential applications.
7. Describe the concept of multiple qubits and their significance in quantum computing.
8. Discuss the following in detail:  
   (i) Quantum system for information processing  
   (ii) Quantum states  
   (iii) Classical bits  
   (iv) Quantum bits
9. What is the advantage of quantum computing over classical computing? Explain with suitable examples.