

**M. Sc. II (Semester-IV) Examination**  
**PHYSICS**  
**Subject – Physics**  
**Paper Title – Nuclear and Particle Physics**  
**Paper Code – MPT401**  
**Question Bank**

**6Marks Question**

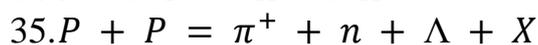
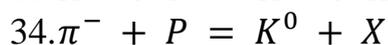
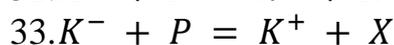
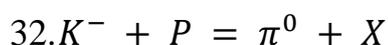
1. Explain properties of nuclear force.
2. Explain properties of deuteron.
3. Solve two body deuteron problem and show that deuteron is loosely bound.
4. Show that differential scattering cross section is independent of scattering angle for neutron-proton scattering using partial wave analysis
5. Show that neutron-proton force is strongly spin dependent based on coherent scattering of slow neutrons from ortho- and para-hydrogen molecule.
6. Explain meson theory of exchange forces with diagram.
7. Give classification of radiation detectors.
8. Explain in short different regions of current pulse versus applied voltage curve of gaseous detectors with graph.
9. Describe construction and working of the ionization chamber with well labelled diagram.
10. Describe construction and working of the proportional chamber with well labelled diagram.
11. Describe construction and working of the scintillation detectors with well labelled diagram.
12. Describe construction and working of the semiconductor detectors with well labelled diagram.
13. Write note on Lithium drifted junction detector.
14. Write a note on the existence of magic number.
15. Explain single particle shell model with harmonic oscillator potential.
16. Explain single particle shell model with square well potential.
17. Explain single particle shell model with Wood Saxon potential with spin-orbit interaction.
18. Discuss the predictions of the shell model.
19. Explain spin with the help of single particle shell model.
20. Write a note on the nuclear magnetic moments.
21. Write a note on the collective model.
22. Discuss evidences of nuclear shell model.
23. Write a note on the fundamental forces.
24. Discuss baryon octet and decuplet in detail.
25. Write brief note on conservation laws in elementary particle reaction.

**4Marks Question**

1. Explain deuteron has no excited S-states.
2. Write note on neutron-proton scattering at low energy.
3. Starting from low energy scattering amplitude, show that zero energy scattering cross section is four times the maximum classical area.

4. Write note on shape independent effective range theory in neutron-proton scattering.
5. Why p-p scattering is capable of more accuracy than neutron-proton scattering?
6. What is similarity between neutron- neutron and proton-proton forces?
7. Write a short note on exchange forces.
8. Explain basic radiation detector system with well labelled diagram.
9. Describe construction and working of the Multiwire proportional chamber with well labelled diagram.
10. Describe construction and working of the planer drift chamber with well labelled diagram.
11. What are advantages and disadvantages of scintillation counters?
12. What are material properties of semiconductor detector?
13. What are advantages and disadvantages of semiconductor detectors?
14. Draw the sequence of the nuclear energy level according to the shell model by taking into account spin orbit interaction.
15. Draw a classification diagram of the elementary particles.
16. Write a note on the Gell-Mann-Nishijima formula.
17. Write a note on the quarks.
18. Draw the weight diagram for the meson octet.
19. Draw the weight diagram for the baryon octet.
20. Draw the weight diagram for the baryon decuplet.
21. Write short note on conservation law of hypercharge.
22. Write short note on conservation law of lepton number
23. Write short note on conservation law of baryon number.
24. Write short note on conservation law of strangeness number.
25. Write short note on conservation law of isospin.
26. Write short note on conservation law of third component of isospin.
27. Write a note on the leptons
28. Discuss in detail baryons.
29. Write a note on the quarks.
30. Write a note on the mesons.
31. Write a note on the hadrons.

Identify the missing particle (4 marks for each reaction)



## 2Marks Questions

1. What is scattering length?
2. What is difference between ortho-hydrogen molecule and para-hydrogen molecule?
3. Give two forms of nuclear potential.
4. What is experimental evidence for the existence of non-central force?
5. What is general form of non-central force?
6. Which particle is exchanged between nucleons for explanation of saturation of nuclear force?
7. Define radiation detector.

8. Define ideal detector.
9. Enlist names of different detectors depending upon type of information produced.
10. What are the types of two detectors depending upon type of signal produced?
11. Draw basic radiation detector system.
12. Enlist the names of different regions of current pulse versus applied voltage curve of gaseous detectors.
13. In recombination region, why current pulse increases with increase applied voltage?
14. Which gases are filled inside ionization chamber?
15. Which gases are filled inside proportional chamber?
16. Which material is used for preparation of axial anode wire of proportional chamber?
17. Which factors affect size of current pulse in recombination region?
18. Which factors affect size of current pulse in saturation region?
19. Enlist the names of ionizations occurring in proportional chamber.
20. What is primary ionization?
21. What is secondary ionization?
22. What is Townsend avalanche?
23. Which material is used for preparation of photodiode in scintillation detector?
24. Which material is used for preparation of dynode in scintillation detector?
25. Which factors affect size of current pulse in scintillation detector?
26. What are organic scintillators?
27. Which are inorganic scintillators?
28. What is conversion efficiency and emission spectra of ZnS activated with Ag?
29. What is conversion efficiency and emission spectra of ZnS activated with Cu?
30. Enlist two limitations of inorganic scintillators.
31. What is conversion efficiency and emission spectra of NaI activated with Thallium?
32. Enlist two disadvantages of organic scintillators.
33. Who and when did introduce first solid-state nuclear detector AgCl crystal intrinsic semiconductor?
34. Enlist the types of semiconductor detector.
35. Enlist two reasons of using Lithium in Lithium drifted junction detector.

Name which conservation laws violated

36.  $P = \bar{p} + \gamma + \gamma$
37.  $\Omega^- = P + \pi^- + \mu^- + \bar{\nu}_\mu$
38.  $K^- + n = \Sigma^+ + \pi^0$
39.  $\pi^- + P = n + \pi^0$
40.  $P = n + e^+ + \nu_e$

**M. Sc. II (Semester-IV) Examination**  
**PHYSICS**  
**Thin Solid Film: Deposition and Properties**  
**(Paper Code – MPT 402)**  
**Sub Code: 92114**

**Question Bank**

**Short Note**

- 1) Write down four technical applications of thin film
- 2) What is mean by epitaxial film
- 3) Explain crystallite size
- 4) What is full form of EDAX and XRD
- 5) Write down four applications of UV-Visible spectroscopy
- 6) Write types of electron gun used in SEM
- 7) Write working of objective lense in STEM
- 8) What is mean by adatom and accommodation coefficient
- 9) Explain crystallite size
- 10) What is full form of EDAX and XRD
- 11) Write down four applications of AFM
- 12) Write types of electron gun used in SEM
- 13) Define the terms crystallographic structure of thin film
- 14) What is mean by impinging surface and impinging atom
- 15) Explain the term density of thin film
- 16) What is full form of EDAX and SEM
- 17) Write down four applications of AFM
- 18) Write types of electron gun used in SEM

**Short Answer**

- 1) What is the influence of substrate epitaxial growth of thin film.
- 2) Explain theories of epitaxy.
- 3) Explain the term condensation process.
- 4) Explain the concept influence of deposition parameters on crystallite size.
- 5) Write short note on epitaxial growth of film
- 6) Explain lattice constant of thin film.
- 7) Describe Flash evaporation method
- 8) What is spray pyrolysis techniques of thin film deposition
- 9) What is electron beam evaporation
- 10) Give application of plasma-enhanced CVD.
- 11) Write short note on Laser evaporation
- 12) Discuss indirect method of heating in PVD method
- 13) What are process variables in CVD?
- 14) Discuss electrodeposition of Cd thin films
- 15) State and explain electron beam evaporation for obtaining high purity films.
- 16) Discuss merits of MOCVD method.
- 17) Explain the stresses in thin films.

- 18) Explain adhesion in the films.
- 19) Discuss the conductivity of discontinuous metal films.
- 20) Write note on fundamental optical properties of thin films.
- 21) What are the merits of ellipsometry method in thin films?
- 22) Explain Mechanical properties of thin film
- 23) Explain electrical conduction in thin film
- 24) Explain electrical and magnetic properties of thin films.
- 25) Discuss application of semiconducting thin films.
- 26) Write short note on electrical conduction in thin
- 27) Write short note on AFM.
- 28) Write short note on EDAX.
- 29) What is Radio frequency Sputtering
- 30) Write down difference between Chemical and Physical methods
- 31) Write a note on Surface roughness of thin film
- 32) Write in brief x-ray diffraction spectroscopy
- 33) Explain the stresses in thin films.
- 34) Explain Mechanical properties of thin film
- 35) Write short note on density of thin film.
- 36) Explain the term liquid like coalescence
- 37) Write In brief x-ray diffraction spectroscopy
- 38) What is Electron Beam Evaporation
- 49) Write a note on weight difference method and Stylus method

### Long Answer

- 1) Discuss different stages involved in thin film formation . Explain the role of substrate in nucleation process.
- 2) Explain growth process of thin film formation and describe liquid like coalescence.
- 3) Describe the influence of deposition parameters on properties of thin film. Explain the term crystallite
- 4) What is epitaxial growth phenomenon. Explain theories of epitaxy
- 5) Explain in detail triode sputtering for thin film deposition
- 6) Discuss dependence of sputtering yield on sputtering variables. Explain with suitable diagram the working of low pressure sputtering method
- 7) Discuss PVD and CVD methods of thin film deposition. Compare merits and demerits of physical vapor deposition and chemical vapor deposition methods.
- 8) What are the merits of chemical bath deposition method. Discuss deposition of compound thin film by chemical bath deposition method.
- 9) With the help of neat diagram, explain glow discharge sputtering process. What is reactive sputtering?
- 10) Explain Cathod sputtering. Discuss factors affecting glow discharge.
- 11) Explain process variables in CVD method. Explain preparation of a Si by photo-CVD method.
- 12) Explain ellipsometry technique for determination of optical constants. Explain Dow-Redfield model of Optical absorption of optical constant measurements in thin films.
- 13) Derive an expression for conductivity of continuous metal films.

- 14) Discuss Reflection and Interferometric methods of optical constant measurements in thin films.
- 15) Explain construction and working of Scanning Electron Microscope. Write down its applications
- 16) Explain mechanism of thin film formation: condensation and nucleation
- 17) With the help of neat diagram, explain glow discharge sputtering process.
- 18) Explain principle, construction and working of atomic force microscopy
- 19) Explain different Types of Chemical methods.
- 20) Describe various steps involved in growth process of thin film formation.
- 21) With the help of neat diagram, explain glow discharge sputtering process.
- 22) Explain mechanism of thin film formation: condensation and nucleation
- 23) Write principle, construction and working of X-ray photo electron spectroscopy
- 24) Explain principle, construction and working of SEM
- 25) Explain growth process of thin film formation and describe liquid like coalescence.
- 27) What are the merits of chemical bath deposition method. discuss deposition of compound thin film by chemical bath deposition method.

**M. Sc. II (Semester-IV) Examination\_\_\_\_\_**

**PHYSICS**

**Subject – Physics**

**M. Sc. II Physics**

**Solid State Physics - IV (MPT 403)**

**Short note (2Mark)**

1. What is Fill Factor in Solar Cell?
2. What is Short circuit current?
3. Write a short note on Tandem solar cells.
4. Explain shunt resistance in solar cell.
5. Write the uses of solar cells.
6. Write a note on open circuit voltage?
7. Explain band gap energy.
8. Explain photo-voltaic effect.
9. What is super-capacitor?
10. Define efficiency of solar cell.
11. Write a note on Series resistance in solar cell?
12. Photoelectric Effect
13. P-N Junction
14. Dye sensitized solar cells (DSSCs).
15. Hydrogen energy
16. Lithium batteries
17. Ni/Cd batteries
18. Lead-acid batteries
19. Photoelectrochemical (PEC) solar cells
20. Battery life cycle

**Long answer questions.**

1. Write note on effect of parasitic resistances and temperature on efficiency of the solar cell.
2. Describe Steam methane reforming (SMR) process of Hydrogen production in detail
3. What are different types of Supercapacitors? Explain it in detail
4. Explain solar cell parameters. (Shunt resistance, Fill factor & Efficiency)
5. With neat labelled diagram explain Dye sensitized solar cells (DSSCs).
6. Explain applications of Hydrogen energy.
7. Write a short note on Primary and Secondary batteries.
8. Explain Lithium batteries and Ni/Cd batteries.

9. Explain briefly basics of electrochemical cell.
10. What is upper limit of short circuit current, open circuit voltage and fill factor for a single junction solar cell?
11. How Hydrogen can be stored? Explain it in detail.
12. What is IQE analysis? How can an IQE analysis be used to probe the different parts of solar cells?

**Short answer questions.**

1. What are requirements for high short circuit current in solar cell?
  2. Write a short note on Quantum dot sensitized solar cells.
  3. What are the similarities and differences between supercapacitors and batteries?
  4. Explain the Physical methods of Hydrogen storage.
  5. Describe the Hydrogen safety processes in detail.
  6. Write a short note on Photoelectrochemical (PEC) solar cells
  7. Describe construction and working of Hydrogen fuel cell.
  8. Write a short note on Regon plot.
  9. What are the design criteria for obtaining higher open circuit voltage of a cell?
  10. Write the applications of batteries.
  11. Explain briefly Lead-acid batteries.
  12. Write a short note on Photoelectrochemical water splitting.
  13. Write a short note on Polymer solar cells.
  14. Describe the Hydrogen safety processes in detail.
  15. Explain the term Battery voltage and Battery life cycle.
  16. Explain the effect of band gap energy of semiconductor material on efficiency of solar cell.
- What are the design criteria for obtaining higher open circuit voltage o

**M. Sc. II (Semester-IV) Examination**  
**PHYSICS**  
**Subject – Physics**  
**Paper Code: MPT 404 A**  
**Paper Title: Electronic Devices**  
**Question Bank**

**Q.1) Short Note**

- 1) Define Photonic devices with examples
- 2) Write down full form of MOSFET.
- 3) Define the term heterojunction LASER
- 4) What is role of SiO<sub>2</sub> layer in MOSFET?
- 5) What is meant by Input devices explain with example.
- 6) What do you mean by “forward blocking state” in SCR?
- 7) What is CCD?
- 8) Draw simplified symbol of n-channel and p-channel MOSFET.
- 9) What is bit and byte?
- 10) Write down full form and definition of LED?
- 11) Define photonic devices with one example.
- 12) Define the terms Static and dynamic memory.
- 13) Draw circuit symbol of SCR.
- 14) What do you mean by LASER explain with definition and full form.
- 15) Give types of MOSFET.
- 16) Define LED and LASER
- 17) What do you mean by transition state in case of SCR?
- 18) Define the terms Static and dynamic memory.
- 19) Give any two characteristic of MOSFET.
- 20) Give any two advantages of SCR.
- 21) Give any two applications of DIAC.
- 22) Give any two advantages of TRIAC.
- 23) Give any two applications of SCR.
- 24) Give any two applications of TRIAC.
- 25) Give any two disadvantages of TRIAC.
- 26) Give any two disadvantages of SCR.
- 27) Give any two disadvantages of DIAC.
- 28) What are output devices?
- 29) Write down examples of Static and dynamic memory
- 30) .what is photonic devices?

## Q.2) Long answer questions.

- 1) Describe characteristics of n-channel Enhancement type MOSFET
- 2) Explain Types of semiconductor memory in detail.
- 3) What is primary and secondary storage devices? Explain with examples.
- 4) Compare SCR and TRIC.
- 5) Explain construction and working of n-channel enhancement type MOSFET.
- 6) Explain construction and working of LED with neat diagram
- 7) Explain Construction and working of DIAC.
- 8) Explain Construction and working of SCR.
- 9) Explain Types of semiconductor memory in detail.
- 10) Explain construction and working of p-channel MOSFET.
- 11) Explain steps involve in working of LASER Action
- 12) Draw and explain output and input characteristics for transistor common emit configuration.
- 13) Explain types of semiconductor memory in details.
- 14) Compare between CB,CE,CC amplifiers .
- 15) Explain BJT as a switch.
- 16) Draw construction and drain characteristics of JFET.Explain its operation
- 17) Explain SCR as a switch and important features of SCR.
- 18) Give draw back, advantages and applications of SCR.
- 19) Give draw back, advantages and applications of DIAC.
- 20) Give draw back, advantages and applications of TRIAC.
- 21) State different types of transistor configuration and compare between them.
- 22) What is DC load line ? Derive expression for amplifier .
- 23) Explain frequency response in case of transistor.
- 24) Write down the difference between Rom and RAM
- 25) Explain difference between Laser and LED
- 26) Explain the process of expanding memory size.
- 27) Explain visible and organic LED
- 28) Describe read and write operation in detail
- 29) Write down construction working of Solid state LASER
- 30) Describe classification and characteristics of memories.

## Q.5) Short answer questions

- 1) Write a note on memory organization and operation.
- 2) Draw and explain input and output characteristics for transistor common base (CB) configuration.
- 3) Write a note on Cache memory.
- 4) Explain read and write operation in memory device.
- 5) Draw and explain static characteristics of SCR.
- 6) How one can achieve expand memory size of the device?
- 7) Write down basic comparison of static and dynamic memory
- 8) Compare Diac and Triac.
- 9) What is primary and secondary memory?
- 10) Write a note on memory organization and operation
- 11) Give advantages of SCR.
- 12) Write a note on “transistor biasing in the active region”.

- 13) Give advantages of MOSFET over JFET.
- 14) Write a note on Cache memory.
- 15) Explain effect of silicon dioxide layer on input resistance and capacitance.
- 16) Write down basic comparison of static and dynamic memory.
- 17) Give applications of SCR.
- 18) What is primary and secondary memory?
- 19) Write a note on memory organization and operation
- 20) Explain population inversion in details.
- 21) Write a note on “transistor biasing in the active region”.
- 22) Give advantages of MOSFET over JFET.
- 23) Write a note on Cache memory.
- 24) Explain effect of silicon dioxide layer on input resistance and capacitance.
- 25) Write down basic comparison of static and dynamic memory.
- 26) Give applications of LASER.
- 27) What is primary and secondary memory?
- 28) For BJT as a switch, why CB and CC configuration are not preferred, explain.
- 29) Explain pinch of voltage and Gate of voltage.
- 30) Draw and explain input characteristics of CE configuration.
- 31) Give draw back and advantages of TRIAC.
- 32) Compare between CB and CC configuration.
- 33) Compare between CB and CE configuration.
- 34) Write a note on memory organization
- 35) What is the Charge couple memory Devices?
- 36) Explain the types of semiconducting Lasers
- 37) Explain Radioactive transition and
- 38) Write a short note on optical absorption.
- 39) Explain characteristics of memories.
- 40) Write a note on organic LED with examples

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