

P.R. GOVERNMENT COLLEGE (A), KAKINADA

III B.Sc Physics Paper – VI – Semester – VI
2017-18 Admitted batch

Course Code: PH6203

No. of credits: 03

Modern Physics

No. of Hours per week: 03

Total Lectures: 45

UNIT-I (8 hrs)

1. Atomic physics

Introduction – Drawbacks of Bohr's atomic model - Vector atom model and Stern-Gerlach experiment - quantum numbers associated with it. L-S and j- j coupling schemes. *Selection rules, intensity rules, Zeeman effect and its experimental arrangement, types of spectra.*

UNIT-II (6 hrs)

2. Molecular physics

Raman effect, hypothesis, Stokes and Anti Stokes lines. Quantum theory of Raman effect. Experimental arrangement – Applications of Raman effect.

UNIT-III (9 hrs)

3. Matter waves & Uncertainty Principle

Matter waves, de Broglie's hypothesis - wavelength of matter waves, Properties of matter waves - Davisson and Germer experiment – Phase and group velocities. Heisenberg's uncertainty principle for position and momentum (x and p), & energy and time (E and t). Experimental verification - Complementarily principle of Bohr.

UNIT-IV (9 hrs)

4. Quantum (wave) mechanics

Basic postulates of quantum mechanics-Schrodinger time independent and time dependent wave equations-derivations. Physical interpretation of wave function. Eigen functions, Eigen values. Application of Schrodinger wave equation to particle in one dimensional infinite box.

UNIT-V (6 hrs)

5. General properties of nuclei:

Basic properties of nucleus – size, mass, charge, spin, magnetic dipole and electric quadrupole moment, Liquid drop model, Shell model (Qualitative), Magic numbers.

UNIT-VI (7 hrs)

6. Radioactive decay:

Alpha decay: basics of alpha decay processes, theory of alpha decay, Gamow's theory, Geiger – Nuttall law. Beta decay, energy kinematics for Beta decay, positron emission, electron capture, neutrino hypothesis.

Physics – Board of Studies

Note: Topics in Bold & Italic are newly added from this academic year

REFERENCE BOOKS

1. BSc Physics, Vol.4, Telugu Academy, Hyderabad
2. Molecular Structure and Spectroscopy by G. Aruldas. Prentice Hall of India, New Delhi.
3. Modern Physics by R. Murugesan and Kiruthiga Siva Prasath. S. Chand & Co.
4. Modern Physics by G. Aruldas & P. Rajagopal. Eastern Economy Edition.
5. Concepts of Modern Physics by Arthur Beiser. Tata McGraw-Hill Edition.
6. Quantum Mechanics, Mahesh C Jain, Eastern Economy Edition.
7. Elements of Solid State Physics, J.P. Srivastava, Prentice Hall of India Pvt., Ltd.
8. Solid State Physics, A.J. Dekker, McMillan India.

P.R. GOVERNMENT COLLEGE (A), KAKINADA
III B.Sc Physics Paper – VI – Semester – VI (Model Paper)
2017-18 ADMITTED BATCH

Course Code: PH6203

No. of credits: 03

Modern Physics

Note: - Set the question paper as per the blue print given at the end of this model paper.

Time: 2 1/2 Hrs.

Max. Marks: 60

Section	Questions to be given	Questions to be answered	Marks
A	5	3	3 x 10M = 30M
B	9	6	6 x 5 M = 30M
Total	14	9	60M

Blue Print

Module	Essay Questions 10 marks	Short Questions 5 marks	Problems 5 marks	Marks allotted
I	1	1	1	20
II	1	1	--	15
III	--	2	1	15
IV	1	1	1	20
V	1	--	--	10
VI	1	1	--	15
Total Marks				95

Note: At least two problems should be answered.

QUESTION BANK
SUBJECT: PHYSICS **PAPER: VI** **SEMESTER: V**

UNIT-I (Atomic physics)

Essay Questions - 10M

1. Explain the Quantum Numbers associated with Vector Atom model.
2. Describe the Stern and Gerlach experiment and indicate the importance of the results obtained.

Short Questions - 5M

3. Explain L – S Coupling Scheme.
4. Explain j – j Coupling Scheme.
5. Explain different types of spectra
6. Explain the selection rules of L,S and J.
7. Explain Zeeman effect.

Problems - 5M

8. Prove that for a given principal quantum number n, there are n^2 possible states each of which can accommodate a maximum of 2 electrons.
9. Consider a state with $L=1$ and $S=1/2$. What are the possible spectrum terms.

UNIT-II (Molecular physics)

Essay Questions - 10M

10. What is Raman effect? Explain the formation of Stoke's and Anti Stoke's lines on the basis of quantum theory.
11. What is Raman effect? How it is experimentally studied. Mention any two applications of Raman Effect

Problems - 5M

12. The exciting line in an experiment is 5460 \AA and the stokes line is at 5520 \AA . Find the wave length of anti – stokes line.
13. A sample was excited by 4358 \AA line. A Raman line was observed at 4447 \AA . Calculate the Raman shift.

UNIT III(Matter waves & uncertainty principle)

Short Questions - 5M

14. Write the properties of matter waves.
15. Describe the Davisson and Germer experiment.
16. What are matter waves? Derive an expression for de-Broglie wavelength of matter waves.
17. State and Explain Heisenberg's uncertainty principle.
18. Explain de – Broglie hypothesis of matter waves.
19. State Heisenberg's principle for Energy and Time.

Problems - 5M

20. If the uncertainty in the momentum of an electron is 1.65×10^{-24} kg m/sec. calculate the uncertainty in its position.
21. Calculate the de-Broglie wavelength associated with a proton moving with a velocity equal to $1/20^{\text{th}}$ of the velocity of light. Mass of the proton is 1.67×10^{-27} kg)

UNIT – IV(Quantum mechanics)

Essay Questions - 10M

22. Derive Schrodinger time dependent wave equation.
23. Derive Schrodinger time independent wave equation.
24. Obtain an expression for the energy of particle in one dimensional potential well of infinite height.

Short Questions - 5M

25. Mention the basic postulates of quantum mechanics.
26. Explain the physical interpretation of wave function.
27. Explain Eigen functions and Eigen values.

Problems - 5M

28. Find the least energy of an electron moving in the dimension in an infinitely high potential box of width 1 \AA . Given mass of the electron 9.11×10^{-31} kg and $h = 6.63 \times 10^{-34}$ J-s
29. An electron is moving in one dimensional potential box of infinite height of width 25 \AA . Calculate the lowest energy of electron.

UNIT –V (General properties of Nuclei)

Essay Questions - 10M

30. Explain liquid drop model in detail. Write its drawbacks.
31. Explain shell model of nucleus. Mention its merits and demerits.
32. Explain basic properties of nuclei.

UNIT –VI (Radio active decay)

Essay Questions - 10M

33. Explain Gamow's theory of α -decay

Short Questions - 5M

34. Write the Giger-Nuttal law for range of a α - particle.
35. Explain Neutrino hypothesis.