



<b>B Sc</b>	<b>Semester IV</b>	<b>Credits: 4</b>
<b>Course: 5</b>	<b>Modern Physics</b>	<b>Hrs/Wk: 4</b>

**Student able learn:**

- To Create awareness on the topics of Atomic & Molecular Physics, Quantum mechanics, Nuclear Physics, and Solid state physics.
- To be Explain all the topics of Experiments, Concepts and Derivations to the student.
- Explain the basic principles of quantum mechanics and apply to Atomic, Molecular structure of energy levels etc..
- Motivate all the students to pursue PG courses in reputed institutes and to endow the students with creative and analytical skills; this will equip them to become entrepreneurs.

**UNIT I :**

**Atomic and Molecular Physics:(12 hrs):** Vector atom model and Stern-Gerlach experiment, Quantum numbers associated with it, Angular momentum of the atom, Coupling schemes, Spectral terms and spectral notations, Selection rules, Intensity rules, Fine structure of Sodium D-lines, Zeeman effect, Experimental arrangement to study Zeeman effect; Raman effect, Characteristics of Raman effect. Experimental arrangement to study Raman effect, Quantum theory of Raman effect, Applications of Raman effect.

**UNIT II:**

**Matter waves & Uncertainty Principle:(12 hrs):** Matter waves, de Broglie's hypothesis, Wave length of matter waves, Properties of matter waves, Davisson and Germer's experiment, Phase and group velocities, Heisenberg's uncertainty principle for position and momentum & energy and time, Illustration of uncertainty principle using diffraction of beam of electrons and photons (Gamma ray microscope), Bohr's principle of complementarity.

**UNIT III:**

**Quantum (Wave) Mechanics:(12 hrs):** 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 (i) one dimensional potential box of infinite height (Infinite Potential Well) and (ii) three dimensional box - tunneling effect.

**UNIT IV:**

**Nuclear Physics:(12 hrs):** *Nuclear Structure:* General Properties of Nuclei, Mass defect, Binding energy; *Nuclear forces:* Characteristics of nuclear forces- Yukawa's meson theory; *Nuclear Models:* Liquid drop model, The Shell model, Magic numbers; *Nuclear Radiation detectors:* G.M. Counter, Cloud chamber, Solid State detector; *Elementary Particles:* Elementary Particles and their classification.

**UNIT-V:**

**Nano materials:(7hrs):** Nanomaterials – Introduction, Electron confinement, Size effect, Surface to volume ratio, Classification of nano materials– (0D, 1D, 2D); Quantum dots, Nano wires, Fullerene, CNT, Graphene (Mention of structures and properties), Distinct properties of nano materials (Mention-*mechanical, optical, electrical, and magnetic properties*); Mention of applications of nano materials: (*Fuel cells, Phosphors for HD TV*).

**Superconductivity: (5 hrs):** Introduction to Superconductivity, Experimental results-critical temperature, critical magnetic field, Meissner effect, Isotope effect, Type I and Type II superconductors, BCS theory (elementary ideas only), Applications of superconductors



**REFERENCE BOOKS**

1. BSc Physics, Vol.4, Telugu Akademy, Hyderabad
2. Atomic Physics by J.B. Rajam; S.Chand& Co.,
3. Modern Physics by R. Murugesan and Kiruthiga Siva Prasath. S. Chand & Co.
4. Concepts of Modern Physics by Arthur Beiser. Tata McGraw-Hill Edition.
5. Nuclear Physics, D.C.Tayal, Himalaya Publishing House.
6. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publ.Co.)
7. K.K.Chattopadhyay&A.N.Banerjee, Introd.to Nanoscience and Technology(PHI LearningPriv.Limited).
8. Nano materials, A K Bandopadhyay. New Age International Pvt Ltd (2007)
9. Textbook of Nanoscience and Nanotechnology, BS Murthy, P Shankar, BaldevRaj,BB Rath and J Murday-Universities Press-IIM



ADIKAVI NANNAYA UNIVERSITY:: RAJAHMAHENDRAVARAM  
B.Sc Physics Syllabus (w.e.f:2020-21 A.Y)

<b>B Sc</b>	<b>Semester IV</b>	<b>Credits: 1</b>
<b>Course: 5</b>	<b>Modern Physics Lab</b>	<b>Hrs/Wk: 2</b>

Details of Lab/Practical/Experiments/Tutorials syllabus:

**Minimum of 6 experiments to be done and recorded**

1.  $e/m$  of an electron by Thomson method.
2. Determination of Planck's Constant (photocell).
3. Verification of inverse square law of light using photovoltaic cell.
4. Determination of the Planck's constant using LEDs of at least 4 different colours.
5. Determination of work function of material of filament of directly heated vacuum diode.
6. Study of absorption of  $\alpha$ -rays.
7. Study of absorption of  $\beta$ -rays.
8. Determination of Range of  $\beta$ -particles.
9. Determination of M & H.
10. Analysis of powder X-ray diffraction pattern to determine properties of crystals.
11. Energy gap of a semiconductor using junction diode.
12. Energy gap of a semiconductor using thermistor
13. GM counter characteristics
14. Study of photo cell characteristics.



MODEL QUESTION PAPER ( Sem - End)

B.Sc DEGREE EXAMINATION  
Semester – IV  
Paper 5: MODERN PHYSICS

Time: 3 hrs

Maximum Marks : 75

Section A

Answer Any Five Questions

5X5=25M

1. Explain L-S and J-J coupling schemes.  
L -S మరియు J - J కప్లింగ్ పద్ధతులను వివరించండి .
2. State and explain Zeeman effect.  
జీమన్ ఫలితాన్ని వివరించండి.
3. How inter nuclear distance in a molecule can be determined  
న్యూక్లియర్ అంతర్గత దూరం ఎలా కనుగొనవచ్చును.
4. Define Binding energy of nucleus. Calculate binding energy of nucleus  
కేంద్రక బంధన శక్తిని విరింపుము , దానిని ఏవిధంగా లెక్కగడతారో తెలుపుము.
5. What are properties of nuclear forces.  
కేంద్రక బలాల ధర్మాలను తెలుపుము.
6. Write about Geiger-Nuttal law.  
గైగర్ .. నట్టల్ నియమాన్ని వివరించండి .
7. Briefly explain the principle of solid state detector.  
సలాడ్ స్టేట్ డిటెక్టర్ పని చేయు విధానాన్ని వివరించండి.
8. The mass of  $^{35}_{17}\text{Cl}$  is 34.98 a.m.u. Find the binding energy per nucleon. Mass of neutron is 1.008665 a.m.u and mass of proton is 1.007665 a.m.u.  
 $^{35}_{17}\text{Cl}$  యొక్క ద్రవ్యరాశి 34.98 a.m.u. న్యూట్రాన్స్ ద్రవ్యరాశి 1.008665 a.m.u మరియు ప్రోటాన్స్ ద్రవ్యరాశి 1.007665 a.m.u. బంధన శక్తి ప్రతి న్యూక్లియాన్ ను కనుగొనుము.

Section B

Answer ALL The Questions.

5X10 = 50M

9. a) Describe the Stern Gerlach experiment and indicate the importance of the results obtained.  
స్టెర్న్ గేర్లక్ ప్రయోగము వివరించి ప్రాధాన్యతను తెలపండి  
(OR)  
b) Explain Raman effect. Describe experimental arrangement to observe Raman effect.  
రామన్ ప్రయోగ ఫలితాన్ని ప్రయోగ పూర్వకంగా రాయండి
10. a) Describe Davison and Germer Experiment.  
డేవిసన్ మరియు జర్మన్ ప్రయోగ ఫలితాన్ని తెలుపండి  
(OR)  
b) Describe Heisenbergs Uncertainty relation. Derive Energy – time uncertainty.



ADIKAVI NANNAYA UNIVERSITY:: RAJAHMAHENDRAVARAM  
B.Sc Physics Syllabus (w.e.f:2020-21 A.Y)

ఇసన్ బర్గ్ అన్ని శ్చిత సూత్రాన్ని వివరించి శక్తి, కాలముల అన్ని శ్చిత సూత్రాన్ని నిరూపించండి

11. a) Derive an expression for energy levels of particle in box which is 3-D motion.  
పెట్టెలో 3-D చలనం కలిగిన కణం యొక్క శక్తి సూత్రాన్ని ఉత్పాదన చేయండి.

(OR)

b) Derive Schrodinger time dependent wave equation.  
స్కాండిజర్ కాల సమీకరణాన్ని ఉత్పాదించండి

12. a) Explain Liquid drop model of nuclus.  
ద్రవ బిందు నమూనా గురించి వివరించండి

(OR)

b) Explain the construction and working of GM counter.  
కౌంటర్ నిర్మాణము పనిచేయు విధానాన్ని తెలపండి

13. a) Explain about type -1 and type -2 superconductors and write brief about BCS theory.  
1 - వ రకం 2 - వ రకం అట్టి వాహక పదార్థాల గురించి వివరించి BCS సిద్ధాంతమును వ్రాయండి  
(OR)

b) Explain the distinct properties of nano materials.  
నానో పదార్థాల యొక్క ధర్మాలను వివరించండి