HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

B. Sc. PHYSICS : SEMESTER -VI

TYPE OF COURSE: MINOR DISCIPLINE SPECIFIC COURSE (THEORY)

COURSE NAME: NUCLEAR PHYSICS AND SPECTROSCOPY

PROGRAMME CODE: SCIUG103 COURSE CODE:SC23MiDSCPHY602

(Effective from June 2025 Under NEP–2020)

Total Credits:02 Teaching Hours per Week: 02 Teaching Hours per Semester: 30	**THEORY MINOR**	External Marks (SEE) - 25 Internal Marks (CCE) - 25

Course Objective:

- To provide concepts of Nuclear Physics and kowlwdge of nucleus and some of their properties.
- To Get deep knowledge of Alfa, Beta and Gamma rays..
- To Understands the concept of spectroscopy..
- To study the molecular, raman and electronic spectra.

Course Outcome: After the successful completion of the course students will be able to

- Understands the concept of Nuclear Physics and kowlwdge of nucleus and some of their properties.
- Get sufficient knowledge of Alfa, Beta and Gamma rays..
- Understands the concept of spectroscopy and various spectra like molecular, raman and electronic spectra.
- Get Expouser about Salient Features of Molecular Electronic Spectra and Formation of Electronic Spectra

Syllabus

UnitNo.	Content	Credit	Lect. Hrs 30
Unit-1	**NUCLEAR PHYSICS : THE NUCLEUS** **(a) Part – I Constituents of the Nucles and Some of Their Properties** Introduction (4.I.1), Rutherford Scattering and Estimation of the Nuclear Size (4.I.2), Measurement of Nuclear Radius (4.I.3), Constituents of the Nucleus and their Properties.(4.I.4). **Part – II Alpha Rays : Spectra and Decay** Range of Alpha Particles (4.II.1), Disintegration energy of Spontaneous Alpha-Decay (4.II.2), Alpha-Decay Paradox-Barrier Penetration(4.II.3). **(b) Part – III Beta Rays : Spectra and Decay** Introduction (4.III.1), Continuous Beta ray spectrum-Difficulties in understanding it (4.III.2),Pauli's Neutrino Hypothesis (4.III.3), Fermi's theory of Beta-dacay (4.III.4), The Detection of Neutrino (4.III.5). **Part – IV Introduction of Gamma(γ) Emission:** Introduction (4.IV.1), Gamma(γ)-ray emission - selection rules (4.IV.2), Internal conversion(4.IV.3). Nuclear Isomerism (4.IV.4). *Related Examples, Problems & S Q* **Basic Reference:** Nuclear Physics (An Introduction) by S. B. Patel, New age International Publishers (Second Edition)	1	15

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Unit-II	**SPECTROSCOPY** **(a) Types of Molecular Energy and Molecular Spectra :** Separation of Electronic and Nuclear Motion: the Born Oppenheimer Approximation (17.1), Types of Molecular Spectra (17.2), Types of Molecular Energy States and Associated Spectra(17.3) **(b) Raman Spectra** Nature of the Raman Effect (20.1), Experimental Arrangement for Raman Spectra (20.2), Classical Theory of Raman Effect (20.3), Quantum theory of Raman Effect (20.4), Raman Spectra and Molecular Structure (20.5), Infra-red Spectra Versus Raman Spectra (20.6), **(c) Electronic Spectra** Salient Features of Molecular Electronic Spectra (21.1), Formation of Electronic Spectra (21.2), *Related Examples, Problems & Short Questions* **Basic Reference**: Atomic & Molecular-Spectra by RajKumar, KedarNathRamNath, Delhi. (2005)	1	15

Further Reading:

1. Nuclear Physicsby D C Tayal, Himalaya Publishers.
2. Nuclear Physics by Irvin Kaplan
3. Introduction to Nuclear Physics by H Henge, Addition Wesley
4. Molecular spectroscopy by Herz-Berg.
5. Molecular spectroscopy by Banewell
6. Atomic Physics by J B Rajam (7th Edition) S. Chand publication, Delhi
7. Elements of spectroscopy by SL Gupta, V Kumar, R C Sharma, (30th Edition) Pragati Prakashan

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B.Sc. PHYSICS - SEMESTER –VI (PRACTICAL COURSE)

TYPE OF COURSE: MINOR DISCIPLINE SPECIFIC PRACTICAL COURSE
COURSE NAME: MINOR PRACTICAL COURSE (LABORATORYEXPERIMENTS)

PROGRAMME CODE: SCIUG103 **COURSE CODE: C23PMiDSCPHY602**

(Effective from June 2025 Under NEP–2020)

TYPE OF COURSE	CREDIT	Marks	COURSE CODE
Minor Discipline Core Course Practical (PMiDSC)	2	25 CCE + 25 SEE =50 (For Both Group)	SC24PMiDSCPHY602
Teaching Hours Teaching Hours per Week: 08 Hours for 4 Credit practical (120 Hours per Semester) Teaching Hours per Week: 04 Hours for 2 Credit practical (60 Hours per Semester)			

LABORATORY EXPERIMENT COURSE: (PMJDSC – Minor 602)

Minor PC: PHY-602

1. Temperature of Flame
2. e/m Thomson method
3. Viscosity by Log decrement
4. Young Modulus 'Y' by Koening method.
5. Acceleration due to gravity (g) using Kater's pendulum (with FIXED knife edges)
6. Maxwell's Bridge
7. Negative Feedback Amplifier
8. A study of Halfsubtractor and Full subtractor
9. A study of transistorized Collpit's oscillator using CR / Wavemeter
10. High resistance 'R' using leakage method
11. A study of transistorized Hartley Oscillator using CRO/Wavemeter
12. To determine frequency of AFO using Wein bridge
13. Trapezoidal simpson's rule for numerical integration.
14. Threshold current of laser diode
15. To find plank constant using semiconductor Diode (LED)
16. Circuits designing on brad board (Built any circuit and verify its working)
17. To study absorption of liquid using spectrometer

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