

GUJARAT UNIVERSITY
Syllabus for First Year B.Sc.: Semester – II
Effective from June 2023

MDC-PHY-124T (2 Credit)
Indian Astronomy and Nuclear Physics

Physics is the fundamental and all-inclusive branch of the sciences, and has profound effect on all scientific developments. Most modern sciences arose from physics. Students of many fields find themselves studying Physics because of the basic role it plays in all phenomena and the scientific instruments they use.

Learning objectives

To gain comprehensive knowledge and understanding of theoretical principles and experimental findings in Physics and its different subfields like Indian astronomy, basic electronics, static electricity, nuclear physics.

Course learning outcome

Understanding of

- the development of astronomy from Vedic times to the recent times
- the basic concepts of celestial sphere
- the different coordinate system, Celestial longitude and latitude, Right ascension, azimuth, altitude and equinox
- the Zodiac systems
- growth and decay of radioactive elements, different types of equilibrium like ideal, transient, impossible and secular equilibrium
- radioactive series, radioactive isotopes and artificial radioactivity
- determination of age of the earth through radioactivity.

UNIT – I: INDIAN ASTRONOMY

[15 Hours]

Historical Introduction

Introduction, Ancient Indian Astronomy, The Vedic Period and Vedangajyotisa, Siddhanta, Aryabhata I, Astronomers after Aryabhata, Contents of the Siddhantas, Continuity in Astronomical Tradition.

Celestial Sphere

Introduction, Diurnal Motion of Celestial Bodies, Motion of Celestial Bodies Relative to Stars, Celestial Horizon, Meridian, Polar Star and Directions, Zodiac and Constellations, Equator and Poles, Latitude of a place and Altitude of Polar Star, Ecliptic and the Equinoxes.

Co-ordinate Systems

Introduction, Ecliptic System, Equatorial System, Horizontal System, Meridian System, Phenomenon of Precession of Equinoxes, Ancient Indian References to the Precession, Effects of Precession on Celestial Longitude, Tropical and Sidereal Longitudes.

Rasi and Naksatra Systems

Zodiac and Rasis.

Reference Books:

1. S. Balachandra Rao, Indian astronomy: An introduction. Distributed by Orient Longman Ltd, 2000.

Articles: 1.1 to 1.8, 2.1 to 2.9, 3.1 to 3.9, 4.1

2. The Story of Astronomy in India by Chander Mohan, 2015.

3. Indian Astronomy, A Sourcebook, B. V. Subbarayappa, K. V. Sarma.

UNIT – II: NUCLEAR PHYSICS

[15 Hours]

Radioactivity

The law of radioactive decay (review), Radioactive growth and decay, ideal equilibrium, Transient equilibrium and secular equilibrium, Radioactive series, Radioactive isotopes of lighter elements, Artificial radioactivity, Age of earth, Carbon dating (Archaeological time scale)

The Q Equation

Types of Nuclear Reactions, The balance of mass and Energy in Nuclear reactions, The Q Equation, Solution of the Q Equation.

Constituents of the nucleus properties

Measurement of Nuclear radius, Constituents of the nucleus and their properties.

Reference Books:

1. Nuclear Physics – An introduction, S. B. Patel, New Age International Limited.

Article: 2.3, 2.6 to 2.13, 3.2 to 3.5, 4.1.3,4.1.4.

2. Nuclear Physics by Irving Kaplan; Addison- Wesley Publishing company

3. Nuclear Physics by S. N. Ghoshal; S. Chand Publication

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MDC-PHY-124P (2 Credit)
Indian Astronomy, General Physics, Optics and Electronics
[60 Hours]

Learning objective

To develop understanding of Physics laboratory methods and their instruments. Inculcate scientific report writing to communicate abstract concepts and complex information relating to all areas in Physics.

Learning outcome

Understanding of

- Plotting and understanding of different types of charts used in Astronomy.
- Interference in wedge shape film
- Simulation of radioactive decay using calculator, probability distribution of two-coin system
- the magnetic moment using deflection magnetometer and the magnetic field lines of bar magnet
- discharging of the capacitor, LDR Characteristics and parallel resonance
- activation energy of diode and rectifier circuits
- absorption coefficient of liquid
- bridge circuit and its applications

1. Draw the diagram for plotting orbits, graduations for the sextant, graduations for the vertical circle, graduations for the horizontal circle and the Circumpolar Sky.
2. Draw the Southern Sky in winter, in autumn, in summer and in spring.
3. Draw the region of Zodiac in first, in second, in third and in fourth quadrant.
4. Draw the orbits of inner planets.
5. **Newton's rings**
To find the wave length of light of given monochromatic source
To find the radius of curvature of given lens.
6. **Deflection Magnetometer**
To determine the magnetic moment (M) of given bar magnet using deflection magnetometer in Gauss A and B position.
7. **Decay Constant**
To verify the exponential law for the decay of a charged capacitor and determine the decay constant of the capacitor.

8. **Study of probability distribution for two option system (coins).**
9. **Activation energy of a diode.**
10. **Absorption coefficient of liquid using photocell.**
11. **LDR Characteristics**
Obtain IV characteristics of given LDR and calculate its resistance (for at least three different light levels).
12. **Full-wave Rectifier**
Obtain load characteristic and % regulation of Full-wave rectifier without filter and with capacitor filter. Determine ripple factor also.
13. **Radioactive decay**
Simulation of Nuclear Radioactive decay using Calculator.
14. **Parallel Resonance**
To determine the frequency of a.c. emf by series resonance circuit by varying capacitor.

Reference books:

1. Advanced practical physics for students by Worsnop and Flint
2. B. Sc. Practical Physics by C. L. Arora; S. Chand Publication
3. Practical Physics by G. L. Squires.
4. Practical Physics by Gupta and Kumar; Pragati Prakashan
5. S. Balachandra Rao, Indian astronomy: An introduction. Distributed by Orient Longman Ltd, 2000.
6. The Story of Astronomy in India by Chander Mohan, 2015.
7. Indian Astronomy, A Sourcebook, B. V. Subbarayappa, K. V. Sarma.