

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

DSC-C-PHY-121T (4 Credit)
Indian Astronomy, Nuclear Physics, Circuits and Electrostatics

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.
- the functioning of resistance, capacitance, and inductors in the DC as well as AC circuits.
- working of bridge circuits and its applications
- Active basic component diode and its application in different rectifier circuits
- Gauss's law, electric potential, and electrostatic energy with examples
- Potential and electric field of an electric dipole

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 Nakshatra 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 Publications

UNIT – III: ELECTRIC & ELECTRONIC CIRCUITS

[15 Hours]

DC Circuits

RL circuits (Growth and decay of current), RC circuit (Charging and discharging of capacitor), L-C-R circuit in series with DC source only the case if $R^2/(4L^2) = 1/LC$ (i.e., up to the differential equation only).

AC Bridges

Condition for bridge balance, Maxwell bridge, Schering bridge, Wein bridge, Owen's bridge

Diode circuits

Load line analysis of a diode circuit, use of diode in rectifier, Half wave, full wave and bridge rectifier with their performance, Capacitor input filter.

Reference Books:

1. Modern Electronic Instrumentation and Measurement Techniques Helfrick and Cooper, PHI Articles: 5.5, 5.6, 5.8, 5.10
2. Mechanics and Electrodynamics, Brijlal, N. Subrahmanyam, Jiven Seshan, S. Chand Articles: 15.5, 15.6, 15.7
3. Electricity and Magnetism, D. C. Tayal Articles: 13.3
4. Electronics Devices and Circuits, Allen Mottershed Articles: 2.1, 2.3, 2.8, 3.1, 3.4, 3.9, 3.10, 3.13, 4.1, 4.4, 4.6
5. Basic Electronics and Linear Circuits, Bhargva Kulshreshtha and Gupta TMH Edition Articles: 4.6, 4.6.1, 4.6.2, 4.7.2, 4
6. Electronics Devices and Circuit Theory (7th Edition), Robert Boylestead Article: 2.9

UNIT – IV: ELECTROSTATICS**[15 Hours]**

Differential form of Gauss law, Poisson and Laplace Equation, Field between Two concentric spheres which have equal and opposite charges. A useful Theorem in electrostatics, electrostatic potential, Determination of potential Due to uniformly charged spherical shell. Determination of potential and field by a ring of charges at a point on the axis of the ring. Determination of field of a semicircular uniform distribution of line charge of linear charge density. Determination of a potential and field on the axis and rim of a uniformly charged disc. Electrostatic energy of a continuous distribution of charges, field of a dipole In plane polar coordinate, spherical polar coordinate, Cartesian coordinate System, electric dipole in a non-uniform electric field, Mutual potential Energy of two dipoles.

Reference Books:

1. Electromagnetics by B. B. Laud, Wiley Eastern Limited
2. Introduction to electrodynamics by David J. Griffiths; Pearson education India learning private limited
3. Classical electromagnetism by H. C. Verma; Bharati Bhavan Publishers & Distributors

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Effective from June 2023

DSC-C-PHY-122P (4 Credit)
Indian Astronomy, General Physics, Optics and Electronics
[120 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.
- Thermal radiation using Stefan Boltzmann fourth power law
- Simulation of radioactive decay using calculator, data fitting least square method and probability distribution of two-coin system
- Interference in wedge shape film and calibration of spectrometer
- The magnetic moment using deflection and vibration magnetometer
- The phase transition in paraffin and to find the acceleration due to gravity using spring mass system
- Discharging of the capacitor
- Construction of ammeter and voltmeter
- Activation energy, I-V characteristics and load line analysis of diode and rectifier circuits
- AC and DC bridges and its applications
- Universal logic gates NAND and NOR

GROUP: A

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. Stefan Constant
To verify the Stefan Boltzmann's fourth power law by using dc power source.
6. Radioactive decay
Simulation of Nuclear Radioactive decay using Calculator.
7. Deflection Magnetometer
To determine the magnetic moment (M) of given bar magnet using deflection magnetometer in Gauss A and B position.
8. Spectrometer
Calibration of spectrometer and find the wavelength of unknown line of

- a mercury spectrum
9. Decay Constant
To verify the exponential law for the decay of a charged capacitor and determine the decay constant of the capacitor.
 10. Least Square Method
 11. Study of phase transition and interpretation of cooling curve for paraffin wax.
 12. Study of probability distribution for two option system (coins)
 13. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
 14. Vibration magnetometer
Compare the magnetic moments of two bar magnets

GROUP: B

1. Newton's rings
To find the wave length of light of given monochromatic source
To find the radius of curvature of given lens.
2. Activation energy of a diode.
- 3 Study of motion of a spring-mass system
Determine the spring constant and acceleration due to gravity.
4. Conversion of galvanometer in to voltmeter.
5. Conversion of galvanometer in to ammeter
6. Projection Method
To find the value of low resistance by the method of projection of potential.
7. Absorption coefficient of liquid using photocell.
8. LDR Characteristics
Obtain IV characteristics of given LDR and calculate its resistance (for at least three different light levels).
9. Full-wave Rectifier
Obtain load characteristic and % regulation of Full-wave rectifier without filter and with capacitor filter. Determine ripple factor also.
10. Bridge Rectifier
Obtain load characteristic and regulation for Bridge rectifier without using filter circuit and by using capacitor filter circuit. Obtain ripple factor without filter circuit.
11. Owen's Bridge
To find the value of an inductance of an unknown inductor by using Owen's bridge circuit.
12. I-V Diode characteristics of a PN-junction diode and its load line analysis.
13. Parallel Resonance
To determine the frequency of a.c. emf by series resonance circuit by varying capacitor.
14. Universal Logic Gates NAND, NOR (Using discrete components)
Verification of truth tables and giving understanding of voltage level for '0' and '1' level.

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