

GUJARAT UNIVERSITY
Syllabus for Second Year B.Sc.: Semester – IV
Effective from June 2024
DSC-C-PHY-241T (4 Credit)
Indian Astronomy, Heat & Thermodynamics, Electronics and Atomic Spectroscopy

Learning objectives

To enable learners to

- Time in Indian astronomy, calendars and Indian panchanga
- comprehend of fundamental thermodynamics concepts and principles
- study in detail, transistor circuits and number system
- understand basics of atomic spectroscopy and its applications

Learning outcomes

On successful completion of the course, the learners would gain the knowledge of

- Indian Astronomy, Calendars and Indian panchanga
- thermodynamics and its applications to real life problems
- the biasing and stability of transistor circuits and 'h' parameters
- binary, hexadecimal, ASCII, Excess 3 and Gray code
- atomic spectra, electron spin, quantum numbers and applications of spectroscopy

UNIT – I: INDIAN ASTRONOMY

[15 Hours]

Time in Indian Astronomy

Introduction, Civil day and Sidereal day, Solar year and Civil calendar, Solar month and Lunar month, Lunar year, Adhikmasa and Ksayamasa, Yuga system, Indian eras, Time on a microcosmic scale

Calendars and Indian Pancanga

Introduction, Gregorian calendar, Hindu calendar, Islamic calendar, Indian calendar and Pancanga, What is Pancanga, Tithi, Naksatra, Yoga, Karan, Vara

Reference Book:

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

Articles: 5.1 to 5.10, 6.1 to 6.11

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

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

UNIT - II: HEAT AND THERMODYNAMICS

[15 Hours]

Entropy

Reversible part of the second law (Clausius theorem), Entropy, Principle of increase of entropy, TS diagram, Application of the Entropy principle

Pure substances

Volume expansivity: Cubic Expansion coefficient, Compressibility

Mathematical methods in thermodynamics

Characteristics functions, Enthalpy, Helmholtz & Gibb's functions, two mathematical theorems, Maxwells relations, Tds equations, Internal energy equations, Heat Energy equations, Heat capacity equations.

Open Systems

Joule-Thomson expansion, Liquefaction of gases by the Joule-Thomson expansion

Reference Book:

1. Heat & Thermodynamics by Mark W. Zemansky and R.H. Dittman, McGraw Hill, Int. (7th Edition)
Article: 8.1, 8.2, 8.5, 8.11 and 8.12, 9.6, 9.7, 10.1 to 10.8, 11.1, 11.2
2. Thermal Physics by A. B. Gupta, H. P. Roy (New central Publication)

UNIT - III: ELECTRONICS

[15 Hours]

Transistor Circuits

Transistor Biasing: Factors contributing to thermal stability, effect of temperature increase, stability factor S, common base stability, collector to base bias, disadvantage of collector to base bias, emitter bias, voltage divider bias with emitter bias, emitter bypass capacitor, summary of stabilization circuit, additional stability factors, bias compensation

Hybrid equivalent circuit for a transistor

Conversion of a transistor to a standard form, general Black box theory, Hybrid h' parameters, obtaining the hybrid h parameters, typical h parameter value, Amplifier equation, voltage and current gains taking into account R_g of source, dependence of amplifier characteristics on R_L and R_g, comparison of CB, CC and CE

Number system

Binary number system, Binary to decimal conversion, decimal to binary conversion, Hexadecimal numbers, ASCII codes, The Excess 3 code, Gray code

Reference Book:

1. Electronics Devices and Circuits By Allen Mottershed, PHI
Article no. 12.1 to 12.12, 14.1 to 14.10
2. Digital principle and Application By Malvino, Leach and Saha (6th edition)
Article no. 5.1 to 5.3, 5.5 to 5.8
3. Electronic Principles (7th Edition) by A. Malvino & D.J. Bates, TMcGHill Pub.
4. Electronic Devices and Circuit Theory (8th Edition) by Robert Boylestad and L. Nashelsky, PHI
5. Fundamentals of Digital Circuits by A. Anandkumar, PHI (2nd Edition)

UNIT – IV: ATOMIC SPECTROSCOPY**[15 Hours]**

Hydrogen atom spectrum, Orbital magnetic moment of hydrogen, Larmor precession, Stern-Gerlach experiment, Electron spin, The vector atom model, Spin-orbit interaction and fine structure, Paulis exclusion principle and electronic configuration, Total angular momentum in many electron atoms, L-S coupling, j-j coupling, Hund rules, Energy levels and transitions of Helium, Alkali spectra, Shielding of core electrons, Spectral terms of equivalent electrons, Normal Zeeman effect, experimental arrangement and theory, Anomalous Zeeman effect, Paschen-Bach effect, Stark effect, Characteristics X-ray spectrum, Moseley's law, Width of spectral lines

Reference books:

1. Modern Physics by G. Aruldhas and P. Rajagopal, PHI Learning Pvt. Ltd.
Article: 7.1 to 7.19
2. Principles of Modern Physics by A. K. Saxena, Narosa Publishing House
3. Modern Physics (2nd Edition) by Kenneth Krane, John Wiley & Sons
4. Atomic & molecular spectra by Rajkumar, Kedarnath Ramnath Prakashan Meerut

GUJARAT UNIVERSITY
Syllabus for Second Year B.Sc.: Semester – IV
Effective from June 2024
DSC-C-PHY-242T (4 Credit)
Sound, Optics, Dielectric, Magnetostatics, Special theory of Relativity and
Quantum Mechanics

Learning objectives

To enable learners to

- understand architectural acoustics
- acquire detailed knowledge on the polarization phenomenon of wave optics
- study polarization of dielectric materials in the presence of electric field
- gain knowledge of basic concepts of magnetostatics
- understand the basic concepts of special theory of relativity

Learning outcomes

On successful completion of the course, the learners would gain the knowledge of

- distribution of sound waves in an auditorium
- various kinds of polarization of light waves and their analysis
- polarization of polar and non-polar materials in electric field
- the laws of magnetostatics and properties of magnetic field
- the non-existence of ether and Michelson -Morley experiment
- the variation of physical quantities due to relativistic motion of the object

UNIT – I: SOUND AND OPTICS

[15 Hours]

Sound

Architectural Acoustics, Sabine's formula, Reverberation time-theoretical treatment, Reverberation time of a live room, Reverberation time of a dead room, optimum reverberation time.

Polarization of light & double refraction

Plane polarized light, pictorial representation of light vibrations, method to produce plane polarized light (only names), double refraction or birefringence, geometry of calcite crystal, Optical axis principal section & principal plane, Nicol prism, Parallel & Crossed Nicol prism,

Huygen's theory of double refraction in uniaxial crystals, refractive indices for o- rays & e-rays, Polaroids.

Production & Analysis of Polarized light

Introduction, superposition of two plane polarized waves having perpendicular vibrations, The elliptically & circularly polarized light, quarter wave plate, half wave plate, production of plane elliptically & circularly polarized light, detection of plane elliptically & circularly polarized light, systematic analysis of polarized light

Reference book:

1. A textbook on oscillations, waves & acoustics by M. Ghosh, D. Bhattacharya, S. Chand Publishers
Article: 24.1 to 24.5
2. Optics & atomic physics by Singh, Agrawal (Pragati Prakashan, Meerut)
Article: 10.2 to 10.4, 10.9 to 10.12, 10.14 to 10.16, 10.18, 10.21, 11.1 to 11.17
3. Optics by Ajoy Ghatak, Tata McGraw Hill Ltd.
4. A Textbook of Optics by N. Subrahmanyam & Brij Lal (S. Chand & Company Ltd.)

UNIT - II: DIELECTRICS & MAGNETOSTATICS

[15 Hours]

Electrostatics in dielectrics

Polarization, Laws of electrostatics field in presence of dielectrics, Energy of the field in the presence of a dielectric, Boundary conditions, Gaseous non polar dielectrics, Gaseous polar dielectrics, non-polar liquids

Magnetostatics

Magnetic effects, The magnetic field, force on a current, Biot Savart law, The laws of magnetostatics, the magnetic potentials, Magnetic dipole in non-uniform magnetic field, Magnetic vector potential due to a small current loop, Magnetic media, Magnetisation, Magnetic field vector, Magnetic susceptibility & permeability

Reference Book:

1. Electromagnetics by B. B. Laud, Willey Eastern Limited
Article: 2.7 to 2.13, 4.1 to 4.9, 4.11 to 4.17
2. Introduction to Electrodynamics by D. J. Griffith (3rd edition), PHI learning
3. Electromagnetic Theory & Electrodynamics by Satya Prakash, Kedar Nath Ram Nath, Meerut

UNIT – III: SPECIAL THEORY OF RELATIVITY

[15 Hours]

Postulates of Special Relativity, Time Dilation, Doppler Effect, Length Contraction, Twin Paradox, Electricity and Magnetism, Relativity of mass, Mass and Energy, Massless Particles, Lorentz Transformation, Velocity addition, Michelson-Morley Experiment.

Reference Book:

1. Concepts of Modern Physics by Arthur Beiser, 4th edition, McGraw Hill Pub. Co.
Articles: 1.1 to 1.11, Appendix – I
2. Modern Physics by R. Murugesan and K. Sivaprasath, (S. Chand & Company Ltd.)

UNIT – IV: QUANTUM MECHANICS**[15 Hours]****Expectation values**

Ehrenfest's Theorem, Admissibility conditions on the wave functions, stationary states : The time dependent Schrodinger equation, A particle in a square well potential, bound states in a square well ($\epsilon < 0$) (a,b,c,d), The square well : Nonlocalized states ($E > 0$), square potential Barrier

General Formalism of wave mechanics: The Schrodinger equation & the probability interpretation for an N- particle system, the fundamental postulates of wave mechanics. The adjoint of an operator & self adjointness. The Eigen value problem, Degeneracy, Eigen values & Eigen functions of self- adjoint operators, The Dirac delta function, observables: Completeness & normalization of Eigen functions, closure, physical interpretation of Eigen values, Eigen functions & Expansion coefficients.

Reference Books:

1. A Textbook of Quantum mechanics by PM Mathews & K. Venkatesan, Tata McGraw Hill
Article: 2.7 to 2.14, 3.1 to 3.9
2. Quantum Mechanics by G. Aruldas, PHI Limited
3. Quantum Mechanics by H. C. Verma, Surya Publications
4. Quantum Mechanics- A text book for Undergraduates by Mahesh C. Jain, PHI Ltd.

GUJARAT UNIVERSITY
Syllabus for Second Year B.Sc.: Semester – IV
Effective from June 2024
DSC-C-PHY-243P (4 Credit)
General Physics, Optics and Electronics
[120 Hours]

Course objectives

To enable the learners to

- understand the physical phenomena and fundamentals of general physics
- perform experiments in the field of general physics, electronics, heat and thermodynamics
- interpret the practical results to corroborate the theory

Course outcome

After successful completion of course learners will

- develop the ability to analyse the basic experiment
- conduct experimental investigation on mechanical, electrical and optical physics.
- be familiar with basic electronic circuits
- correlate the theory and experimental results
- practice recording of experimental work and data graphing

Group A:

1. Searl's goniometer.
2. To study double refraction in calcite prism.
3. Resolving power of grating.
4. Diffraction by single slit.
5. Wavelength of light by Biprism.
6. Numerical Study of Oscillatory Motion. (Calculator/computer preferable using Excel)
7. Identification of elements in line spectra.
8. Analysis of elliptical polarized light using photocell.
9. Wavelength of light by Adser's 'A' pattern.
10. e/m using Thomson method. (Integral to be find by Simpson's rule)
11. Study of phase transition and interpretation of cooling curve for paraffin wax.
12. Determination of specific heat capacity of a liquid using the method of cooling.

Group B:

1. FET Characteristics.
2. C by ballistic galvanometer.
3. Gray to binary and binary to Gray code conversion.
4. High Resistance by leakage method.
5. To study the variation of I_c & V_{ce} with temperature in fixed bias circuit & collector to

- base bias circuit for CE configuration.
6. To study the variation of I_c & V_{ce} with temperature in fixed bias circuit & potential divider circuit for CE configuration.
 7. L by Anderson's bridge.
 8. To understand the various functions of CRO
 9. To find the permeability of free space
 10. Material constant (η) and reverse saturation current (I_0) of PN junction diode.
 11. Dielectric constants of given materials.
 12. Decimal to BCD conversion and BCD to seven segment decoder.

Reference book:

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