Gujarat University
Ahmedabad

B. Sc. Semester – III
Syllabus for Physics Theory & Practical
(Effective from June 2018)

Unit	Physics Theory PHY – 201 4 Credit Total 100 Marks Internal : 30 Marks External : 70 Marks	Physics Theory PHY – 202 4 Credit Total 100 Marks Internal : 30 Marks External : 70 Marks	Physics Practical PHY – 203 2.5 Credit Total 100 Marks Internal : 30 Marks External : 70 Marks
Unit – I	Solid State Physics	Mathematical Physics	A, B & C three groups : Each group consists of 06 experiments. Total 18 experiments. External Examination: 70 Marks Group B : 23 Marks Group C : 24 Marks Practical batch size: Maximum 15 students.
Unit – II	Electronics	Classical Mechanics	
Unit - III	Modern Physics and Elementary Quantum Mechanics	Nuclear Physics	
Unit - IV	Wave Optics	Dielectrics & Magnetostatic	

In order to give exposure of industry, research institute and higher learning in the field of Physics, Industrial / Institutional visit may be arrange. It is expected that students of S. Y. B. Sc. with Physics as one of the subject must visit the Industry / Research Institute / Institute of higher learning during either III or IV semester.

GUJARAT UNIVERSITY
B. Sc. (PHYSICS) Semester III
PHYSICS : PHY – 201
(4 Credit)

UNIT-I: Solid State Physics

A. The crystalline State: Crystalline, polycrystalline and glassy materials; Basis of crystal structure; Unit cell-Primitive cell structures; Symmetry operations- translation, point, hybrid operations; Classification of Crystal types-two dimensional crystal lattice and three dimensional crystal lattices; Indices of a lattice direction and a lattice plane (Miller indices); Crystal point groups and space groups, space groups, space groups; Common crystal structures, simple cubic structure, BCC, FCC, closed packed and hexagonal close-packed structure, diamond structure.

B. Reciprocal lattice and Crystal Diffraction : Reciprocal lattice; Bragg Law, Laue's interpretation of X-ray diffraction by crystals, Construction of reciprocal lattice, Relationship between a, b, c and a*, b*, c*, Experimental Diffraction Methods, Laue method, Rotating crystal method, powder method, Determination of lattice constants; Selection of incident beam.

Text book: Elements of Solid State Physics (2 Edition) by J. P. Srivastava, PHI Learning
For A - Chapter 1. Art No. 1.1 to 1.7
For B - Chapter 3. Art. No 3.1, 3.2, 3.3, 3.4, 3.5, 3.8.2, 3.9, 3.10

Reference Books:
1. Solid State Physics (6th Edition) by S.O. Pillai, New Age International Publishers
2. Solid State Physics (4th Edition) by S.L Kakani & C. Hemrajani, Sultan Chand & Sons
3. Introduction to Solid State Physics (7th Edition) by C. Kittle, Wiley (India)

UNIT-II: Electronics

Basic characteristics of the Transistor: Basic Transistor amplifier, Two diode analogy for a transistor, Transistor input characteristics, Transistor collector characteristics, collector cut off current I_{CEO}, Forward current transfer ratio CE , Permissible operating area of a transistor CE, The basic common base amplifier, CB, Forward current transfer ratio CB, relation between α and β, collector cut off current I_{CBO}, physical explanation of CB and CE amplifying action, reduction of CE leakage current to I_{CO}, common collector amplifier, identifying the transistor leads

The common emitter amplifier: Graphical analysis of CE class A amplifier, input and output resistance, effect of adding a class A amplifier, conversion efficiency of class A amplifier with a direct coupled resistive load, phase relationship in CE amplifier, input waveform consideration, comparison of basic transistor amplifier

Solid state electronics Devices: Zener diode, Zener diode specification, the voltage regulator circuit, design of a voltage regulator circuit, effect of supply voltage variation, Zener break down mechanism, the tunnel diode, application of tunnel diode ,Introduction of silicon controlled rectifier and Uni junction transistor

Text Book: **Electronics Devices and Circuits By Allen Mottershed, PHI**
Article no, 9.1 to 9.15, 9.18, 11.1 to 11.6, 11.9, 6.1 to 6.6, 6.11, 6.12, 28.1, 28.5

Reference Book: Electronic Principles (7^{th} Edition) by Albert Malvino & David J. Bates, TMcGHill Pub.
Electronic Devices and Circuits by Sanjeev Gupta, Dhanpatrai & Sons

UNIT- III: Modern Physics and Elementary Quantum mechanics

A. Historical origins of quantum theory, Difficulties with Classical: models, optical spectra Black body radiation, Frank- Hertz experiment, Stationary states of atoms. The correspondence principle, Bohr atom, Spectroscopic series, Quantization of the orbits. The Elliptic Orbits, Particle in a box, rigid rotator, Harmonic oscillator, Compton effect, particle diffraction, Wave packets and Einstein De Broglie relation

Text book: Quantum Mechanics by Powel and Crasemann, Addison and Wesley
Articles Nos.: 1.1, 1.2, 1.3, 1.5, 1.7 to 1.10, 1.12 to 1.16, 2.1, 2.2, 2.7

Concept of Modern Physics, Arthur Beiser, TMH Edition

B. The Schrodinger equation and stationary states, a free particle in one dimension, Generalization to three dimensions, Operator correspondence And the Schrodinger equation for a particle subjected to force, Physical Interpretation of wave function, Normalization, Non normalizable wave functions and box normalization, conservation of probability.

Text book: A textbook of Quantum Mechanics, P.M. Mathews, K. Vankatesan
Article Nos. : 2.1 to 2.6

Reference books:
1. Concept of Modern Physics by Arthur Beiser, Tata McGraw Hill Edition
2. Principles of Modern Physics by A.K. Saxena, Narosa Publishing House
3. Modern Physics by Kenneth Krane, Jon Wiley & Sons

UNIT – IV: Wave Optics

A. Diffraction of Light (Fresnel class): Frensnel's half period zones, zone plate, difference between interference & diffraction,

B. Fraunhofer class: Fraunhofer diffraction at two slits, diffraction at N slits, Plane diffraction grating, Dispersive power of grating, Grating at oblique incidence.

C. Resolving power of optical Instrument: Resolving power, Rayleigh's criterion of resolution, resolving power of telescope, relation between magnifying power & the resolving power of telescope, Resolving power of a plane diffraction grating, difference between resolving power & dispersive power of grating, comparison of prism & grating spectra.

Text Book: Optics & atomic physics by Singh, Agrawal (Pragati Prakashan, Meerat)
For A - Chapter 7. Article Nos. : 7.3 and 7.5
For B - Chapter 8. Article Nos. : 8.6 to 8.8, 8.15,8.16
For C - Chapter 9. Article Nos. : 9.1 to 9.4, 9.8 to 9.10

Reference Books:
1**.** Optics by Ajay Ghatak, Tata McGraw Hill Ltd.
2. A Textbook of Optics by N. Subrahmanyam & Brij Lal (S. Chand & Company Ltd.)

GUJARAT UNIVERSITY
B. Sc. (PHYSICS) Semester – III
PHYSICS : PHY – 202
(4 Credit)

UNIT - I: Mathematical Physics

Fourier series: Introduction, Simple Harmonic motion & wave motion – Periodic functions, Applications of fourier series, Average value of a function, Fourier co-efficients, Dirchlet conditions, complex form of fourier series, other intervals, Even & odd functions, Parsevel's theorem, Applications/Numericals on Fourier series.

Text book: Mathematical Methods in Physical Sciences by Mary L. Boas (John Willey & Sons)
Article Nos. : 7.1 to 7.8. 7.11

Reference Book:
1. Mathematical Physics by H.K. Das, S. Chand Publishing Co.
2. Mathematical Physics by Satya Prakash, Pragati Prakashan

UNIT – II: Classical Mechanics

Motion in a Central force field: General features of the motion, Motion in an inverse square law force field, Equation of the orbit, Kepler's laws of planetary motion

Collision of particles : Elastic & inelastic scattering, Elastic Scattering : Laboratory & Centre of mass system, Kinematics of elastic scattering in the laboratory system, inelastic scattering, cross-section, The Rutherford formula

Text Book: Classical mechanics by R.G. Takewale & P.S. Puranik, Tata McGraw Hill
Article Nos. : 5.2 to 5.6, 7.1 to 7.6

UNIT – III: Nuclear Physics

A. Physical tools: Introduction, Interaction between particles & Matter, brief survey, Detectors for Nuclear particles (i) Proportional counter (ii) The Geiger counter (iii) Scintillation counter (iv) Solid state or semi-conductor detectors (v) Cloud & Bubble chambers (vi) Spark chamber; Particle Accelerators : Need for an accelerator of charged particles, (i) Van de Graff Generator (ii) The cyclotron (iii) Synchrotron (iv) The Betatron; Beta ray spectrometer.

Text book: Nuclear physics, An introduction by S. B. Patel, New Age International (P) Ltd.
For A - Chapter 1: Article Nos.: 1.1.1 to 1.1.5

Reference Book: 1. Nuclear Physics by D.C. Tayal, Himalaya Publishing House

UNIT – IV: Dielectrics & Magnetostatics

A. 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,

B. 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, Boundary conditions, Uniformly magnetized sphere in external magnetic field, A comparison of static electric & magnetic fields

Text Book: Electromagnetics by B. B. Laud, Willey Eastern Limited
For A - Chapter 2: Article Nos. : 2.7 to 2.13
For B - Chapter 4: Article Nos. : 4.1 to 4.9, 4.11 to 4.20

Reference books:

1. Introduction to Electrodynamics by D. J. Griffith (3rd edition), PHI learning
2. Electromagnetic Theory & Electrodynamics by Satya Prakash,
Kedar Nath Ram Nath, Meerut

GUJARAT UNIVERSITY
B. Sc. (PHYSICS) Semester – III

PHYSICS PRACTICAL : PHY – 203
(2.5 Credit)

Group A:

1. Y-by Koening's method.
2. Wavelength of prominent spectral lines by diffraction grating.
3. Flatness of plate by Newton's ring.
4. Resolving power of telescope.
5. Numerical Study of Oscillatory Motion.
6. Wavelength of light using Hartmann formula.

Group B:

1. Figure of Merit of a mirror galvanometer.
2. C1/C2 by Desauty's method.
3. Zener diode as a voltage regulator.
4. h-parameters of CE transistor.
5. UJT.
6. Load line and determination of Q point for BJT.

Group C:

1. Absorption coefficient of liquid using photocell.
2. Study of electron diffraction pattern.
3. Resonance pendulum.
4. Fourier Analysis.
5. L by Maxwell's bridge.
6. Liquid Lens.

A, B & C three groups: (Total 100 Marks: Internal 30 marks, External 70 Marks)

Each group consists of 06 experiments.

Total 18 experiments.

External Examination: 70 Marks

Group A : 23 Marks
Group B : 23 Marks
Group C : 24 Marks

Practical batch size: Maximum 15 students.