

SAURASHTRA UNIVERSITY

RAJKOT

**Accredited Grade “A” by NAAC
(CGPA 3.05)**



FACULTY OF SCIENCE

SYLLABUS FOR

B.Sc.

PHYSICS

(Semester- 3 & 4)

According to Choice Based Credit System

Effective from June – 2017

B.Sc. (Physics)

Semester -3

Paper: Physics-301

(Electricity, Magnetism, & Semiconductor Electronics)

Course duration:

Theory: 60 hours, 6 hours a week, Credit: 4

External Marks: 70, Internal Marks: 30, Total: 100

Practical: 60 hours, 6 hours a week, Credit: 3

External Marks: 35, Internal Marks: 15, Total: 50

PAPER STYLE For Semester -3

1. B. Sc. Physics Syllabus for Semester 3 consists of 5 units:
2. All units carry 14 marks
3. Total 5 questions one question from each unit.
4. Each question of 14 mark
5. Time duration:2.5 Hours

Question:1 from Unit 1 : Mark 14

Question:2 from Unit 2 : Mark 14

Question:3 from Unit 3 : Mark 14

Question:4 from Unit 4 : Mark 14

Question:5 from Unit 5: Mark 14

Each Question divide in a,b,c and d sub question as shown below

(a) Shorts questions 4 [4 Marks]

(One word, one line, explanation, definition, true or false, fill up the blanks, etc.)

(b) Answer any 1 numerical out of 2 [2 Marks]

(c) Answer any1 out of 2 [3Marks], one question should be numerical.

(d) Answer any1 out of 2 [5 Marks]

Paper: Physics-301

(Electricity, Magnetism, & Semiconductor Electronics)

UNIT 1: (12 hours: 14 Mark)

Vector Analysis: Review of vector algebra, scalar and vector product, Triple product, How vectors transform, Gradient, The operator Del (∇), The Divergence, The Curl and their significance, Product rules, Integral Calculus – Fundamental theory for Gradient, Fundamental theorem for Divergences- Gauss's theorem, Fundamental theorem for Curls- Stokes theorem, Relations between fundamental theorems, Numerical Examples.

UNIT 2: (12 hour: 14 Mark)

Electrostatics: Introduction, Coulomb's law, Electric field, Continuous charge distributions, Field Lines and Gauss's law, Divergence and Curl of Electrostatic field, Application of Gauss theorem - electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor, Electric potential, Poisson's and Laplace equation, Potential of a charged distribution, Summary: Electrostatic Boundary Conditions, Work done in moving charge, The energy of point charge distribution, The energy of continuous charge distribution, Numerical Examples.

UNIT 3: (12 hour: 14 Mark)

Magnetostatics: Magnetic fields, Magnetic forces: Cyclotron and Cycloid motion, Current, Biot-Savart's law: Steady currents and the magnetic field of steady current, Straight line current, The divergence of B, The Curl of B, Ampere's law with examples, Comparison of Electrostatics and Magnetostatics, The Vector Potential, Summary: Magnetostatic Boundary Conditions, Numerical Examples.

UNIT 4: (12 hour: 14 Mark)

Electrostatic and Magnetostatics fields inside matter:

Dielectrics, Induced dipoles with examples, Alignment of Polar molecules, Polarization, The field of Polarized object: Bound charges, Physical interpretation of bound charges with examples, Field inside the dielectrics, The Electric displacement: Gauss's law in the presence of dielectrics, Susceptibility, Permittivity, and Dielectric Constant.

Magnetization: Diamagnets, Paramagnets, Ferromagnets, Torques and Forces on magnetic dipoles, Effect of magnetic field on atomic orbits, Magnetization, The field of magnetized objects: Bound currents, Physical interpretation of bound currents, The magnetic field inside matter, Ampere's law in magnetized materials, Magnetic Susceptibility & Permeability, Numerical Examples.

Basic Reference books for unit 1 to 4:

- 1) Introduction to electrodynamics By David J Griffiths, Publisher: PHI.
- 2) Electricity and Magnetism By D.C. Tayal, Publisher: Himaliya publishing House.

UNIT 5: (12 hour : 14 Mark)

Transistor Biasing & Stabilization of operating point:

Review of transistor connection, Load line analysis, Operating point, Transistor amplifier performance, Cutoff and Saturation regions, Power rating of transistor, Transistor lead identification and testing, Faithful Amplification, Transistor Biasing, Inherent variation of the transistor parameters, stabilization, Stability factors, Methods of transistor biasing- base resistor method, Emitter Bias Method, feedback resistor method, voltage divider biasing, Low power transistor biasing circuit designing, Numerical Examples.

Single Stage Transistor amplifier circuit:

Introduction to the single stage transistor amplifier, How Transistor amplifies?, Graphical Explanation, Practical circuit of transistor amplifier, Phase reversal, voltage gain, Load line analysis, Classification of Amplifiers, Frequency response and bandwidth of CE amplifier, Numerical Examples.

Basic Reference books for unit-5:

- 1) Principles of electronics By V.K.Mehta & Rohit Mehta, Publisher: S.Chand
- 2) Basic Electronics By B.L.Thereja, Publisher : S.Chand.

Other Reference books for semester 3 :

- 1) Electromagnetics by B. B. Laud, Publisher: Willey Eastern Limited.
- 2) Electricity and Magnetism By Edward M. Purcell, Publisher: McGraw-Hill
- 3) Electricity and Magnetism By J.H. Fewkes & J.Yarwood, Publisher: Oxford University Press
- 4) University Physics By Ronald Lane Reese, Publisher: Thomson Brooks
- 5) Concept of physics By H C Verma part 1, Publisher: Bharati Bhawan
- 6) University Physics with modern physics By Sears ,Zemansky & H D Young, Publisher: PEARSON
- 7) Basic electronics and linear circuits By N N Bhargava, D C Kushreshtha, S C Gupta, Publisher: Technical Teachers Training Institute Chandigarh.
- 8) Elements of Electronics By Bagde & Singh, Publisher: S.chand
- 9) Electronic Device And Circuits By Allen Mottershead, Publisher: PHI

LIST OF EXPERIMENTS for B.Sc. (Physics)

semester -3

1. To determine the Young's modulus (Y) of material by Cantilever method
2. To determine the Young's modulus (Y) of material by bending of beam.
3. To determine the viscosity of liquid by Searl's co-axial cylinder.
4. To determine the Moment of Inertia of a Fly wheel.
5. To determine resolving power of prism.
6. To determine resolving power of telescope.
7. To determine refractive index of liquid by using liquid lens method.
8. To determine radius of curvature of a given lens and refractive index of glass using optical lever method.
9. Study of Zener Diode as voltage regulating characteristics.
10. To study the Characteristics of Photo Transistor and verify inverse square law.
11. To determine Q point and Load line for BJT.
12. To determine the figure of merit & volt sensitivity of ballistic galvanometer.
13. To study the Frequency response & Bandwidth of R.C.Coupled Amplifier.
14. To study the variation of magnetic field of Solenoid.
15. Experimental measurements by Multimeter, (Power Supply, Resistor, Transistor, Diode, Capacitor).
16. To determine e/m by Thomson's method.
17. To verify the Thevenin's theorem.
18. To verify the Maximum Power transfer theorem.
19. To determine the capacity 'C' of Capacitor. (verification of Series & Parallel connection of capacitor).
20. To determine the self inductance 'L' of inductor (verification of series & Parallel connection of inductor).

Reference Books for practicals:

- 1) B.Sc. Practical physics By C.L.Arora, Publisher: S.chand.
- 2) A text book of Practical Physics By Indu Prakash & Ramkrishna
Publisher: Kitab Mahal, New Delhi.
- 3) Practical Physics By S.L.Gupta and V. Kumar
Publisher: Pragati Prakashan, Meerut.
- 4) B.Saraf et al-Physics through experiments Vol. I & II.
- 5) B.Sc. Practical physics By Harnam Singh, Dr P.S. Hemne
Publisher: S.chand

B.Sc. (Physics)
Semester -4
Paper: Physics-401
(Thermodynamics & Electronics)

Course duration: Theory: 60 hours, 6 hours a week, Credit: 4
Practical: 60 hours, 6 hours a week, Credit: 3
Theory: External Marks: 70, Internal Marks: 30, Total: 100
Practical: External Marks: 35, Internal Marks: 15, Total: 50

PAPER STYLE For Semester -4

1. B. Sc. Physics Syllabus for Semester 4 consists of 5 units:
2. All units carry 14 marks
3. Total 5 questions one question from each unit.
4. Each question of 14 mark
5. Time duration:2.5 Hours

Question:1 from Unit 1 : Mark 14

Question:2 from Unit 2 : Mark 14

Question:3 from Unit 3 : Mark 14

Question:4 from Unit 4 : Mark 14

Question:5 from Unit 5: Mark 14

Each Question divide in a,b,c and d sub question as shown below

(a) Shorts questions 4 [4 Marks]

(One word, one line, explanation, definition, true or false, fill up the blanks, etc.)

(b) Answer any 1 numerical out of 2 [2 Marks]

(c) Answer any1 out of 2 [3Marks], one question should be numerical.

(d) Answer any1 out of 2 [5 Marks]

Paper: Physics-401
(Thermodynamics & Electronics)

UNIT -1: (12 hour: 14 Mark)

Laws of thermodynamics: Thermodynamic System, Thermal equilibrium and Zeroth law of thermodynamics, Thermodynamic Equilibrium, Internal energy, Concept of Heat, First law, Specific heat of the gas – Mayer's formula, Various thermodynamics processes [only Definition], work done during isothermal and adiabatic processes, Cooling due to adiabatic reversible process, Joule Thomson expansion -the Porus Plug experiment, Heat engine and efficiency, Reversible and Irreversible processes, Carnot's ideal Engine and Carnot's cycle, Reversible and irreversible engine, second law of thermodynamics, Carnot theorem, Numerical Examples.

UNIT -2: (12 hour: 14 Mark)

Entropy: Concept of Entropy, Entropy change in - Adiabatic ,Reversible and Irreversible processes, Principle of increase of Entropy, The T- S Diagram, The calculation of Entropy , Third law of Thermodynamics, Unattainability of absolute Zero, Application of the Entropy principle, Entropy and Disorder, Numerical Examples.

Theory of Radiation: Thermal Radiation, Black Body and Black Body Radiation , Kirchhoff's Law, Stefan Boltzmann Law, Distribution of Energy in Black Body Spectrum, Wien's Displacement Law & Wien's law of energy distribution, Rayleigh- Jeans Law, Plank's Law, Wien's law and Rayleigh – Jeans law in relation to Planck's law, Numerical Examples.

UNIT -3: (12 hour: 14 Mark)

Thermodynamic potentials: Thermodynamic potentials and their relationships with thermodynamic variables- [Enthalpy, Gibbs, Helmholtz and internal energy functions, Maxwell's relations] , Applications of Maxwell's relations – Clausius- Clapeyron Equation, Specific Heat Equation, Joule-Thompson Effect & Joule- Thompson Coefficient , TdS Equations, Numerical Examples.

Basic reference book for unit 1 to 3:

- 1) Heat thermodynamics and statistical Physics By Singhal, Agrawal & Prakash, Publisher: Pragati Prakashan.
- 2) Heat thermodynamics and Statistical Physics By Brijlal, N. Subrahmanyam & P.S. Hemne, Publisher: S.Chand

UNIT -4: (12 hour: 14 Mark)

Semiconductor device: Principle, Working and Construction of - LED, Advantages of LED, Multicolor LED, Application of LED, Principle, Construction, Working and Applications of - Photo Diode, Varactor diode, Solar Cell, Thermistor.

FET- Types of FET, Construction and Working JFET, Advantage of JFET and difference between JFET and BJT, Output Characteristics of JFET, Parameters of JFET, J-FET Biasing, Construction & Working of UJT, Equivalent circuit of UJT, Characteristics of UJT, Advantages & Applications of UJT, Numerical Examples .

Digital Circuit: Analog and Digital Signal, Introduction to Number Systems, Decimal to Binary and Binary to Decimal Conversion, Binary Coded Decimal Code, Logic Gates- AND, OR and NOT Gates using Diode, NAND & Nor Gate , NAND and NOR Gate as a universal gate , X-OR Gates, Boolean Algebra and Theorems, De Morgan's Theorems, Simplification of Logic Circuit using Boolean Algebra, Numerical Examples.

Basic Reference Books:

- 1) Principles of electronics By V.K.Mehta & Rohit Mehta Publisher: S.Chand
- 2) Basic Electronics By B.L.Thereja Publisher : S.Chand

UNIT -5: (12 hour: 14 Mark)

A.C. Circuit: L-R circuit, R-C Circuit, L-C Circuit, L-C-R series and parallel Circuit with resonance, Numerical Examples.

A.C Bridge & their applications : A.C. Bridge –Condition for Bridge Balance (Impedance Bridge), Maxwell's Impedance & L/C Bridge, Owen's Bridge, De Sauty's Bridge, Wien's Bridge, Schering Bridge, Kohlraush's Bridge, , Numerical Examples.

Oscillators : Sinusoidal oscillators, Positive feedback, Barkhausen Criterion, Different types of transistor oscillators, Colpitt's Oscillator, Hartley Oscillator, Phase Shift Oscillator, Wein Bridge Oscillator, Numerical Examples.

Basic Reference books :

- 1) Electricity and Magnetism By D.C. Tayal Publisher : Himaliya publishing House.
- 2) Modern Electronics instrumentation and Measurement techniques By Albert D Helfrick & William D Cooper Publisher : PHI
- 3) Principles of electronics By V.K.Mehta & Rohit Mehta Publisher: S.Chand

Other Reference books for semester 4 :

- 1) University Physics By Ronald Lane Reese Publisher: Thomson Brooks
- 2) Concept of physics By H C Verma part 1 Publisher: Bharati Bhawan
- 3) University Physics with modern physics By Sears ,Zemansky & H D Young Publisher: PEARSON
- 4) Basic electronics and linear circuits By N N Bhargava, D C Kushreshtha, S C Gupta Publisher: Technical Teachers Training Institute Chandigarh.
- 5) Elements of Electronics By Bagde & Singh, Publisher: S.chand
- 6) Electronic Device And Circuits By Allen Mottershead, Publisher: PHI
- 7) Thermodynamics, kinetic theory & Statistical thermodynamics By F.W.Sears & G.L.Salinger, Publisher: Narosa
- 8) Thermal Physics By S.garg, R.Bansal & C. Ghosh, Publisher: TMG
- 9) Heat & Thermodynamics by Mark W. Zemansky and R.H. Dittman, Publisher:McGraw Hill, Int. 7th edition.

LIST OF EXPERIMENTS for B.Sc. (Physics)

semester -4

1. To Verify Stefan's Law.
2. To determine the thermal conductivity of cardboard by Lee's Method.
3. To determine the wavelength of using Diffraction grating.
4. To determine high resistances by method of leakage.
5. To compare the capacities of two capacitors by De Sauty's bridge.
6. To determine specific resistance of electrolyte by Kohlrauch's bridge.
7. To determine the self induction by Maxwell Bridge.
8. To determine the modulus of rigidity by Maxwell's needle.
9. To determine the modulus of rigidity by Statistical method (Barton's apparatus).
10. To study the resistance temperature characteristics of Thermistor & Determine energy band gap of semiconductor material by Thermistor.
11. To study of characteristics of Solar Cell.
12. To study the characteristics of FET & Determination of parameters of FET.
13. To study Characteristics of Uni Junction Transistor.
14. Verification of truth table of AND, OR, NOT, NAND & NOR gate.
15. To study NAND gate & NOR gate as Universal gate.
16. Construction of FET as Voltmeter.
17. Obtain IV characteristics of given LDR and calculate its resistance (for at least three different light levels).
18. To study L-R and R-C circuit
19. To study a series resonant L-C-R circuit & Determine resonate frequency and quality factor.
20. To study a parallel resonant L-C-R circuit & Determine resonate frequency and quality factor.

Reference Books for Practicals:

- 1) B.Sc. Practical physics By C.L.Arora, Publisher: S.chand.
- 2) A text book of Practical Physics By Indu Prakash & Ramkrishna
Publisher: Kitab Mahal, New Delhi.
- 3) Practical Physics By S.L.Gupta and V. Kumar
Publisher: Pragati Prakashan, Meerut.
- 4) B.Saraf et al-Physics through experiments Vol. I & II.
- 5) B.Sc. Practical physics By Harnam Singh, Dr P.S. Hemne
Publisher: S.chand