# SAURASHTRA UNIVERSITY

## RAJKOT, 360005.

# **Syllabus for the Subject of PHYSICS**

## under the Faculty of SCIENCE



# Accredited Grade A by NAAC

# B.Sc.-Sem: 3&4 (Physics)

In force from June - 2017.

# SAURASHTRA UNIVERSITY

At: RAJKOT, State: Gujarat, Pin: 360005.

## B.Sc. Semester -3 P-301 : Physics Theory

(In force from June-2017)

## (Electricity, Magnetisam, & Semiconductor Electronics)

### 60 hour 70 Marks

### **UNIT 1: (12 hour : 14 Mark)**

**Vector Analysis:** Review of vector algebra – scalar and vector product, gradient, divergence, curl and their significance, vector integration, line, surface and volume integration of Vector fields, Gauss- divergenc e theorem and Stoke's theorem of vectors ( only statement) Numerical Examples.

#### UNIT 2: (12 hour: 14 Mark)

**Electrostatics:** Electric field, Lines of electric force, Electric potential , Electric potential due to point charge, Relation Between Electric field and potential , Electric dipole Torque on an electric dipole placed in an electric field, potential energy of a dipole placed in an uniform electric field, Electric flux, Gauss's theorem of electrostatics, 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, Numerical Examples.

### UNIT 3: (12 hour : 14 Mark)

**Magnetism:** Magnetic field, Relation between Electric field and magnetic field, motion of a charged particle in uniform magnetic field, Biot-Savart;s law and its applications – straight conductor, circular coil, solenoid, toroid carrying current, Divergence and curl of magnetic field, Ampere's circuital law, Magnetic properties of material, magnetic intensity, magnetic induction, permeability, magnetic susceptibility, brief introduction of dia, para and fero magnetic materials. Numerical Examples.

#### UNIT 4: (12 hour : 14 Mark)

#### Electrostatic and electro magnetic induction:

Electric potential due to point charge, electric dipole, uniformly charged spherical shell and solid sphere, Capacitor and Capacitance, Calculation of Capacitance – parallel plate capacitor, Spherical Capacitor, Cylindrical Capacitor, Energy stored in Capacitor, Dielectric medium, polarization, parallel plate capacitor with a dielectric,

Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of ingle coil, M of two coils, energy stored in magnetic field. Numerical Examples.

#### UNIT 5: (12 hour : 14 Mark)

**Transistor Biasing :** review of transistor connection, load line analysis of Transistor, D.C. load line and Q-point, inherent variation of the transistor parameters, stabilization, stability factors, methods of transistor biasing- base resistor method, feedback resistor method, voltage divider biasing, Numerical Examples.

**Transistor amplifier circuit:** introduction to the single stage transistor amplifier, how does an amplifier work?, practical circuit of the amplifier, phase reversal, voltage gain, class A,B and C amplifiers, frequency response and bandwidth of CE amplifier, Numerical Examples.

#### **Reference books :**

- Concept of physics By H C Verma part 1 Publisher: Bharati Bhawan
- Sears and Zemansky's University Physics with modern physics
   By H D Young Publisher: PEARSON
- 3 Principles of electronics Rv V K Mehta Publisher: S Chand

- 4. Electronic Device And Circuits By Allen Mottershead Pub: PHI
- Basic electronics and linear circuits By N N BhargavA, D C Kushreshtha & S C Gupta , Publisher: Technical Teachers Training Institute Chandigarh.
- Elements of Electronics By Bagde & Singh Publisher : S.chand

## LIST OF EXPERIMENTS

## **B.Sc. Semester-3**

- To Study of errors in observation Using Vernier Caliper, Micrometer Screw.
- 2. To determine 'g' and radius of gyration using Bar Pendulum,
- 3. To determine the Moment of Inertia of rectangular body & prove law of perpendicular axis by Bifilar Suspension.
- 4. To determine the Moment of Inertia & Modulus of rigidity by Torsional pendulum.
- To determine the Young's Modulus of long wire by Searl's method.
- 6. To determine the Poisson's ratio of rubber tube.
- 7. To study of Charging and Discharging of Capacitor and RC time constant.
- 8. To determine Low resistance by Projection method.
- To study of Tangent galvanometer (Constant of T.G. & Verification of Ohm's law, to find reduction factor of TG)
- 10. To determine Low resistance by Potentiometer.
- 11.To study Semiconductor Diode Characteristics.
- 12. To study Zener diode Characteristics

#### **Reference Books:**

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

## **Instruments** List

Practical 1: Vernier Caliper, Micrometer Screw, A wooden piece.

- Practical 2: Bar Pendulum, Spirit level, Stop-watch, Telescope, Meter Scale.
- Practical 3: Bifilar Suspension Apparatus, A rectangular wooden piece (lamina), stand with meter scale, stopwatch.
- Practical 4:Torsion pendulum, Right Circular Cylinder( Regular Body), Irregular Body(Rings of different radii), Spirit Level, Micrometer screw, Vernier Callipers, Stop-watch, Weight Box, Long thin wire.

Practical 5: Searle's Apparatus for Young Modulus, Stop-Watch, telescope,

Meter Scale, Vernier Caliper, Micrometer Screw, Two identical wire.

- Practical 6: Rubber Tube with metal sleeves and rubber stoppers, Metal Stand to hold rubber tube, Graduated tube, Hanger with Slotted Weight, Meter Scale, Measuring Cylinder, Thread
- Practical 7: R-C Circuit with Transformer OR Step Down Transformer of 25 V with Variable adjustment , Capacitance ( $C = 10\mu$ F)and Resistance (300 $\Omega$ ) of different values, A.C MiliAmeter, A.C Voltmeter.
- Practical 8: Wheastone'sBridge Wooden Apparatus, Resistance Box, Low resistance, Battery (0-10 Volt), Sensitive Galvanometer, Jockey, Key, four way key, Rheostat.

- Practical 9: Tangent galvanometer, Battery, Resistance Box, Reversing Key, Rheostat, Voltmeter, Plug key.
- Practical 10: Potentiometer Apparatus, Rheostat, Two Way Key, Plug Key, Resistance Box, Low resistance, Battery (0-10 Volt), Sensitive Galvanometer, Jockey, Key.
- Practical 11: Semiconductor Diode, Battery(0 -100 V) , Milliammeter (0-500 ma),Voltmeter(0-3V),Microammeter(0-100µA),Or Diode Characteristic Circuit Board With Meters.
- Practical 12: Zener Diode Characteristic Circuit Board with metersOr Zener Diode and same as per practical 11.

# B.Sc. Semester -2 B.Sc. Semester -4 P-401 : Physics Theory

(In force from June-2017)

(Wave, Optics & Semiconductor Devices) 60 hour 70 marks UNIT -1: (12 hour: 14 Mark)

Laws of thermodynamics: Description of System, Zeroth law of thermodynamics and temperature, First law and internal energy, conversion of heat into work, various thermodynamics processes, Application of first law, work done during isothermal and adiabatic processes, reversible and irreversible processes, second law and entropy, Carnot's cycle and theorem, change in entropy in reversible and irreversible processes, third law of thermodynamics, Numerical Examples.

#### UNIT -2: (12 hour: 14 Mark) Thermodynamic potentials: Er

Thermodynamic potentials: Enthalpy, Gibbs Helmholtz and internal energy functions, Maxwell's relations and applications, Joule- Thompson Effect, Clausius- Clapeyron Equation, expression for Cp- Cv, Cp/ Cv, Tds Equations, Numerical Examples.
Theory of Radiation: Black Body Radiation, Spectral distribution, concept of Energy Density, Plank's Law, Wien's Distribution Law, Rayleigh- Jeans Law, Stefan Boltzmann Law and Wien's Displacement Law from Plank's Law, Numerical Examples.

## UNIT -3: (12 hour: 14 Mark)

Semiconductor device (Transistor Base): Field Effect transistor, Types of Field effect transistor, JFET - Construction and Working and principle of JFET, Advantage of JFET and difference between JFET and BJT, output Characteristics of JFET, Parameters of JFET, Construction of MOSFET, Uni junction Transistor, Equivalent circuit of UJT, Characteristics of UJT, Advantages & Applications of UJT, Photo Transistor(Principle, Working).

Semiconductor device (P-N Juncation Diode Base): Principle, Working and Construction of - LED, Photo Diode, Solar Cell, Application of LED, Advantage of LED, Multicolour LED, Aplication photo-diode, Thermistor, vractor diode, LDR UNIT -4: (12 hour: 14 Mark)

**Digital Circuit:** Difference Analong and Digital Signal , Binary Number, Different Digit system, Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates using Diode and Transistor, NAND and NOR Gate as a universal gate, XOR and XNOR Gates, De Morgan's Theorems, Simplification of Logic Circuit using Boolean Algebra, Multiplexer and Demultiplexer, Numerical Examples.

### **UNIT -5: (12 hour: 14 Mark)**

**D.C. circuit and A.C. Circuit:** L-R circuit with D.C. source, L-C-R series with A.C. Source, L-C-R series and parallel resonance, Maximum power transfer theorem.

**A.C. & D.C. Bridge Circuit** : what is bridge circuit, what equivalent condition, different types of D.C. Bridge , different types of A.C. Bridge

**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.

## **Reference Books for unit 3,4,5 :**

- 1. A Text Book Of OPTICS By N.Subrahmanyam, Brijlal, M.N. Avadhanulu Publisher: S.chand.
- 2. Principle of OPTICS By B.K.Mathur Publisher: Gopal Printing
- 3. Fundamentals of OPTICS By Jenkins and White Publisher: McGraw-Hill
- 4. Fundamentals of OPTICS By Gulati and Khanna Publisher: R.Chand

## LIST OF EXPERIMENTS

## **B.Sc. Semester-4**

- To determine the unknown frequency of Tuning Fork By Melde's Experiment
- 2. To Verify the Laws of vibrating strings by Melde's Experiment.
- 3. To Study the Resonator and to determine unknown frequency of tuning fork.
- 4. To Calibrate a Spectrometer.
- 5. To Study Dispersive curve, and to determine the dispersive power of the material of a prism for different colours.
- 6. To determine wavelength of light using Newton's Ring.
- 7. To study the CB Characteristic of Transistor.
- 8. To study the CE Characteristic of Transistor.
- 9. To study Half-Wave Rectifier.
- 10. To study Full-Wave Rectifier (Centre tap).
- 11. To study Bridge Rectifier.
- 12. To Study of a Transformer.
- 13. To study Characteristics of Photo diode.
- 14. To study Deflection magneto meter (one magnet and two magnets).

## **Reference Books:**

- 1. B.Sc. Practical physics By C.L.Arora Pub: S.chand
- A text book of Practical Physics By Indu Prakash & Ramkrishna Pub: Kitab Mahal, New Delhi.
- Practical Physics By S.L.Gupta and V. Kumar Pub: Pragati Prakashan, Meerut.
- 4. B.Saraf et aI-Physics through experiments Vol. I & II

## **Instruments** List

- Practical 1: Tuning Fork, Stand with Clamp, Pulley, Weight Box, Light Weight Pan, String.
- Practical 2: Tuning Fork, Stand with Clamp, Pulley, Weight Box, Light Weight Pan, String.
- Practical 3: A resonator, rubber tubing, pinch cock, clamp stand, set of tuning forks, graduated cylinder
- Practical 4: Prism, Spectrometer, Spirit Level, Mercury Vapour Lamp, Wooden Box with Aperture, Eye Piece, Lamp.
- Practical 5: Prism, Spectrometer, Spirit Level, Mercury Vapour Lamp, Wooden Box with Aperture, Eye Piece, Lamp.
- Practical 6: Travelling Microscope, Sodium vapour Lamp, Newton's Rings apparatus Consisting optically plane glass and a convex lens of about 100 Cm focal length placed in box having an optically plane glass plate inclined at an angle of 45<sup>0</sup>, Spectrometer or microscope, convex lens of Short Focal Length.
- Practical 7: P-N-P Transistor OR N-P-N Transistor CB Characteristic Circuit Board, Battery(0-3 Volt & 0-10 Volt), Two MiliAmeter ( 0-25mA), Voltmeter (0-3 volt & 0-10Volt)
- Practical 8: P-N-P Transistor OR N-P-N Transistor CE Characteristic Circuit Board,

Battery (0-3 Volt & 0-10 Volt), MiliAmeter ( 0-25mA), Micrometer, Voltmeter (0-3 volt & 0-10Volt)

- Practical 9: Half Wave Rectifier Circuit Board, MiliAmeter (0-100mA), A.C. Voltmeter, D.C. Voltmeter OR VTVM.
- Practical 10: Full Wave Rectifier Circuit Board, MiliAmeter (0-100mA), A.C. Voltmeter, D.C. Voltmeter OR VTVM.

- Practical 11: Half Wave Rectifier Circuit Board, MiliAmeter (0-100mA), A.C. Voltmeter, D.C. Voltmeter OR VTVM.
- Practical 12: Step-down Transformer, Rheostat, A.C. Milliammeter (0-500 ma), A.C. Voltmeter (0- 10 V).
- Practical 13: Photo Diode, Battery, Light Source, Milliammeter, Voltmeter.

Practical 14: Bar Magnets, Deflection Magnetometer, Scale

## PAPER STYLE For Semester -3 & 4

- 1. B. Sc. Physics Syllabus for Semester 3 & 4 consists of 5 units:
- 2. All units carry 14 marks
- 3. 70 Marks for theory and 30 marks for Internal Examinations.
- 4. Total 5 questions one question from each unit.
- 5. Each question of 14 mark
- 6. Time duration:  $2\frac{1}{2}$  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]