**Dr.Babasaheb Ambedkar Marathwada University, Aurangabad**

**B. Sc. I Year Physics Syllabus**

**Semester I & II**

**(Revised syllabus Effective from June 2013)**

**B. Sc. I Year Physics (Semester-I)**

**Paper – II** **- Heat and Thermodynamics**

**Course Code – Phy102**

**Periods – 45 Marks – 50**

**1) Thermal Conductivity: -                              10 periods**

Transference of heat, Coefficient of thermal conductivity, Rectilinear flow of heat along a metal bar, Methods of radial flow of heat-(i)spherical shell method and (ii)Flow of heat along the wall of a cylindrical tube, comparison of conductivities of different metals.

**2)  Real Gases and Transport Phenomena: - 12 periods**

**Real Gases** – Introduction, Reason for modification of gas equation, Vander Waals equation of state , comparison with experimental curves, critical constants, constants of Vander Waals equation.

**Transport phenomena**–Introduction, Mean free path, sphere of influence, and expression for mean free path, variation of mean free path with temperature and pressure, transport phenomena, viscosity, Thermal conductivity (their interrelationship, dependence on temperature and pressure).

**3) Thermodynamics: - 12 periods**

 Adiabatic process, Adiabatic equation of a perfect gas, Isothermal process, Indicator diagram, work done during isothermal process and adiabatic process, reversible and irreversible process, Second law of thermodynamics (Kelvin and Clausius statement), Heat engines, Carnot’s ideal heat engine, Carnot’s cycle (work done and Efficiency).

**4) Entropy and Thermodynamic relations: - 11 Periods**

General notation of entropy, change of entropy is independent of path, change of entropy in reversible and irreversible process, Formulation of second law in terms of entropy, Maxwell’s  thermodynamical relations, Applications of Maxwell’s relations –i) Clausius – Clapeyron equation , ii) T-dS equations.

**Reference Books:-**

1. Heat Thermodynamics and Statistical Physics - Brijlal, N.Subrahmanyan , P.S. Heme

( S.Chand , 2007 Edition ) .

2) Text Book of Heat and Thermodynamics–J. B. Rajam, C.L. Arora (S. Chand, 9th Edition)

3) Heat and Thermodynamics– S. S. Singhal, J. P. Agarwala,  S.Prakash (Pragati Prakashan)

4) Thermodynamics & Statistical physics-S. L. Kakani

**B. Sc. I Year Physics (Semester- II)**

**Paper – IV-Geometrical and Physical Optics**

**Course Code – Phy104**

**Periods – 45 Marks – 50**

**1)  Geometrical Optics and Optical Instruments**: - **12 periods**

Cardinal points of optical system - Focal points, Principal points, Nodal points and corresponding planes, coaxial lens system - equivalent focal length and cardinal points.

Huygens’s Eyepiece, Ramsden’s eyepiece and their cardinal points,

**2) Interference**: -               **10  periods**

Interference in thin film due to reflected and transmitted light, wedge shaped thin film, Newton’s rings by reflected light, determination of wavelength, Michelson’s Interferometer, type of fringes, determination of wavelength and difference in wavelength.

**3) Diffraction**:         **13 periods**

Introduction, Diffraction at a thin wire , Fraunhofer diffraction at double slit (Interference and diffraction maxima, minima), Plane Transmission diffraction grating, Determination of wavelength (Normal incidence), Resolving power of optical instruments (Rayleigh’s criterion), R. P. of prism and grating.

**4) Polarization**: -                **10 periods**

Introduction, Malus law, Double refraction,Huygens’s theory of double refraction in uniaxial crystal, Nicol prism.

Optical activity, Fresnel’s theory of optical rotation, specific Rotation, Laurentz’s half – shade polarimeter, Determination of specific rotation of sugar solution.

**Reference Books:-**

1) Text Book of optics – N. Subrahmanyam & Brijlal (S. Chand, 1987 Edition)

2) Optics and Spectroscopy – R.Murugeshan, K. Sivaprasath( S. Chand , 7 th Revised Edition )

3) A text book of optics- D. S. Mathur.

4) Optics- Ghatak. IInd edition.

**B. Sc. I Semester**

**Physics paper III (Phy103)**

**List of experiment**

* 1. Determination of acceleration due to gravity by Kater’s pendulum.
  2. Y by bending of a beam loaded at center.
  3. Determination of Y by Cantilever (Oscillation method)
  4. η by Maxwell’s needle.
  5. M.I. by bifilar suspension.
  6. Determination of Y and ɳ of the material of a flat spiral spring.
  7. S.I. by Jaeger’s method.
  8. Determination of coefficient of viscosity by Poisseuille’s method.

**Note**: - At least six experiments should be performed.

**B.Sc. II Semester**

**Physics Paper VI (Phy106**)

**List of experiment**

* 1. Y by Searle’s apparatus.
  2. M.I. of fly wheel.
  3. Thermal conductivity of bad conductor by Lee’s disc method.
  4. Study of CRO

(Measurement of frequency and voltage sensitivity AC/DC.)

* 1. Field along axis of circular coil.
  2. I-H curve.
  3. Calibration of spectrometer.
  4. Dispersive power of prism.

**Note**: - At least six experiments should be performed.

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**B.Sc. IInd year Physics Syllabus**

**(Semester-III and IV)**

**Revised Syllabus from June 2014**

**B.Sc. IInd year Physics (Semester-III)**

**Paper-VIII- Modern and Nuclear Physics**

**Course code PHY-202**

**Period-45 Marks-50**

1. **Photoelectric Effect :**

Introduction, Lenard’s method to determine e/m for photoelectrons, Richardson and Compton experiment, Relation between photoelectric current and retarding potential, Relation between velocity of photoelectrons and frequency of light, photoelectric cells- (1) Photo- emissive cell (2) Photo- voltaic cell (3) Photoconductive cell, Applications of photoelectric cells.

1. **X-rays :**

Introduction, The absorption of X-ray’s, Laue’s experiment, Bragg’s Law, The Bragg’sX-ray spectrometer, powder crystal method, The Laue method, x-ray spectra , Main features of continuous x-ray spectrum, Characteristics x-ray spectrum.

1. **Nuclear forces and models :**

Introduction, Binding energy, Nuclear stability, Nuclear forces , Meson theory of nuclear forces, liquid drop model, shell model, Energy released in Fission , Chain reaction, Atom bomb, Nuclear Reactors, Nuclear fusion, Source of stellar energy.

1. **Particle Accelerators and Detectors :**

Linear accelerator, Cyclotron, Synchrocyclotron, Betatron, Ionisation chamber, proportional counter, Geiger – Muller counter.

**Reference Books:**

1. ModernPhysics-J.B.Rajan

2. Modern Physics- R.Murugeshan, Er.Kirutyhiga, Sivaprasath. S.Chand Publication

3. NuclearPhysics- Kaplan

4. NuclearPhysics- B.N.Srivastava

5. Atomic and nuclear physics-N.Subramanyan and Brijlal.

**B.Sc. IInd year (Semester-III)**

**Physics Practical**

**Course code PHY-203**

**Paper-IX**

**Marks-50**

1. ‘h’ by Photo cell

2. e/m by Thomson’s tube method.

3. Determination of absolute value of BH and BV using Earth Inductor

4. Stefan’s constant by using thermo couple

5. Measurement of low resistant using potentiometer.

6. Determination of A.C. mains using sonometer.

7.Specific rotation by Laurent’s half shade polarimeter.

8. Cauchy’s constant by spectrometer

**Note:** At least six experiments should be performed.

**B.Sc. IInd year (Semester-III)**

**Physics Practical**

**Course code PHY-204**

**Paper-X**

**Marks-50**

1 Thermal conductivity of rubber tube.

2. Study of temperature dependence of total radiation.

3. To draw the histogram of theoretical Gaussian curve.

4. Comparison of capacities by Desauty’s method.

5 Velocity of sound using Helmholtz resonator.

6 Surface tension by Ferguson’s method.

7 R.P. of Telescope.

8. Wave length by Newton’s ring

**Note:** At least six experiments should be performed.

**B.Sc. IInd year Physics (Semester-IV)**

**Paper-XII- Solid State Physics**

**Course code PHY-206**

**Period-45 Marks-50**

1. **Crystal Structure :**

Introduction, Crystal lattice- plane lattice, space lattice, translation vectors, Unit cell, (primitive ,non primitive Wigner . Sietz primitive cell) Basis, symmetry operations, point groups and space groups, type of lattices (two dimensional and three dimensional lattices), lattices directions and planes , Miller indices , Inter planer spacing, simple crystal structure.

1. **Bonding and Band theory of solids :**

Introduction, concept of inter – atomic forces, cohesive energy and types of bonding, primary bonds- (ionic bonds, covalent bond and metallic bond), secondary bonds, ( Vander Walls bonds and hydrogen bonds).

The Kroning - Penney model, Energy versus wave vector relationship,different representations(Brillouin zone)

1. **Thermal properties of solids :**

Classical theory of lattice heat capacity ( Concept and comparison with experimental values), Einstein’s theory of lattice heat capacity, Debye’s model of lattice heat capacity, density of modes, limitations of Debye’s model.

1. **Free electron theory of metals and Transport properties:**

Drude-Lorentz’s classical theory, electrical conductivity, thermal conductivity, Wiedemann Franz law, significance of Fermi energy level, Hall effect, Hall voltage and Hall coefficient, experimental determination of Hall coefficient, Importance of Hall effect.

**Reference Books :**

1. Physics for degree student – C.L.Arora& Dr. P.S.Hemne – S.Chand publication

2. Solid State Physics and Electronics – R.K.Puri& V.K. Babbar- S.Chand publication

3. Fundamentals of Solid State Physics- Saxena, Gupta, Saxena – Pragatiprakashan, Meerat)

4. Solid State Physics , Revised VI th Editions, S.O. Pallai.

5. Introduction to Solid State Physics, VII th Edition., C.Kittel.

**B.Sc. IInd year (Semester-IV)**

**Physics Practical**

**Course code PHY-207**

**Paper-XIII**

**Marks-50**

1. Energy band gap of semiconductor using thermister.

2. I.V. Characteristics of solar cell.

3. Calibration of bridge wire using Carry-Foster’s bridge.

4. Determination of absolute capacity of condenser using B.G.

5. Full wave rectifier with ∏ filter.

6. Viscosity of liquid using Searle’s viscometer.

7. High resistance by leakage through condenser.

8 **V**iscosity of liquid by oscillating disc method

**Note:** At least six experiments should be performed.

**B.Sc. IInd year (Semester-IV)**

**Physics Practical**

**Course code PHY-208**

**Paper-XIV**

**Marks-50**

1 Transistor characteristics in CE configuration.

2. Transistor characteristics in CB configuration

3. Study of CE amplifier

4.Hartly Oscillator using transistor.

5 Wien bridge Oscillator using transistor/ Op-Amp

6 Op-Amp as adder/substractor

7 JFET characteristics .(rp, gm and μ)

8. Self-inductance by Owen’s Bridge

**Note:** At least six experiments should be performed.

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**B. Sc. IIIrd year Physics Syllabus**

**(Semester-V and VI)**

**Revised syllabus from June 2015**

**B.Sc. IIIrd year Physics (Semester-V)**

**Paper-XV- Classical and Quantum Mechanics**

**Course code PHY-301**

**Period-45 Marks-50**

**Chapter 1. Classical Mechanics [11]**

Mechanics of Particle, Mechanics of system of particles Constraints, Classification of Constraints, Virtual Work, D’Alembert’s principle, Lagrange’s equation, Simple application of Lagrangian formulation –Simple Pendulum, Particle in space, Linear Harmonic Oscillator, Atwood’s Machine .

**Chapter 2. Origin of Quantum theory [12]**

Introduction, Failure of Classical mechanics, Black body Radiation (Distribution of Energy), Plank’s Quantum theory-Plank’s Quantum postulates, linear momentum of photon in terms of wave vector, Plank’s radiation law-Wein’s law and Rayleigh’s law, Einstein’s equation: Quantum theory of photoelectric effect, Quantum effect.

**Chapter 3. Wave Particle duality [12]**

Introduction, de-Broglie’s hypothesis for matter waves, de-Broglie’s wavelength in terms of energy and temperature, de-Broglie phase velocity and particle velocity (relation between them), Group velocity, Relation between group velocity and phase velocity, Davisson-Germer Experiment, Heisenberg uncertainty principle, Applications of Heisenberg uncertainty principle (1) Nonexistence of electrons in nucleus (2) Binding energy of an electron in an atom.

**Chapter 3. The Schrodinger Equation and its applications [10]**

Wave Function (Ψ) of a moving particle, Time dependent Schrodinger’s wave equation, Expectation value, Operators, Time independent Schrodinger equation (steady state form), particle in one dimensional box, Quantization of energy and momentum.

**Reference Books**

1. Classical Mechanics- H- Goldstein
2. Classical Mechanics – N.C. Rana and P.S. Joag
3. Classical Mechanics – Gupta, Kumar and Sharma
4. Introduction of Classical Mechanics – R.G. Takwale& P.S. Puranik.
5. Physics for degree student – C.L. Arora, P.S. Hemne (Ist edition S. Chand Publication).
6. Quantum Chemistry- Donald Allan Macquarie (Viva-Books Pvt. Ltd.).
7. Mathematics for Chemistry- Donald Allan Macquarie (Viva Books Pvt. Ltd.).
8. Concepts of Modern Physics - Arthur Beiser, ShobhitMahajan, S. RaiChoudhary (VIth Edition- Mc- Graw Hill).
9. Perspective of Modern Physics – Arthur Beiser.

**B.Sc. IIIrd year Physics (Semester-V)**

**Practical**

**Course code PHY-303**

**Paper-XXI**

**Period-45 Marks-50**

**List of experiments**

1. Measurement of the focal length of a given convex lens using laser
2. Spectral response of photoconductor (LDR)
3. Diffraction of grating using laser beam
4. e by Millikan’s oil drop method
5. Study of thermocouple (Fe-Cu) and to find inversion temperature
6. Refractive Index R.I. of Optical fiber
7. constant of B.G. by standard condenser method
8. study of absorption spectra of iodine and determination of its wavelength using grating

**Note :-** At least Six experiments should be performed.

**B.Sc. IIIrd year Physics (Semester-V)**

**Practical**

**Course code PHY-304**

**Paper-XXII**

**Marks-50**

**List of experiments**

1. Beam divergence of a diode laser
2. Determination of the diameter of a thin wire using laser
3. To study the interference of light using optical fibers
4. Determination of wavelength of He-Ne laser by transmission grating and reflection grating
5. Y by Koenig’s method
6. Edser’s A pattern
7. e/m by Thomson methods by Excel
8. Surface tension by Ripple’s method

**Note :-** At least Six experiments should be performed.

**B.Sc. IIIrd year Physics (Semester-VI)**

**Paper-XIX- Atomic, Molecular Physics and LASER**

**Course code PHY-305**

**Period-45 Marks-50**

**Chapter 1. The Atom model [10]**

Introduction, Thomson atom model, the Rutherford nuclear atom model, drawbacks of Rutherford atomic model, the Bohr’s atom model, Bohr’s theory of origin of spectral lines, diagrammatic representation of the series spectrum of the H-atom in the light of Bohr’s theory.

**Chapter 2. Vector Atom Model [15]**

Introduction-vector atom model, Quantum numbers associated with the vector atom model, L-S coupling, j-j coupling, The Pauli’s exclusion principle, Selection rules, Intensity Rules, Interval Rule, Normal Zeeman effect, Anomalous Zeeman effect, Stark effect and its experimental study.

**Chapter 3. Molecular spectra [15]**

Introduction, origin of pure rotational spectrum of a molecule, origin of vibration-rotation spectrum of a molecule, Rayleigh’s law of scattering, Raman effect-Discovery, experimental study, Applications of Raman effect-molecular structure, Nature of liquids, Crystal Physics, Nuclear Physics, Chemical effects.

**Chapter 4. LASER [10]**

Introduction, induced absorption, spontaneous emission, stimulated emission, population inversion, properties of laser beam, laser pumping, Types of laser-Ruby laser, He-Ne laser, carbon dioxide (CO2) laser, Applications of laser-Biological, medical and industrial.

**Reference Books**

* 1. Atomic Physics – J.B. Rajam, S. Chand & Company Ltd.
  2. Physics for degree students – C.L. Arora, Dr. P.S. Hemne, S. Chand

Publication

* 1. Modern Physics – R. Murugeshan, Er. KiruthigaSivaprasath, S. Chand

Publication

* 1. Introduction of Atomic Spectra-white.
  2. Fundamentals of Molecular Spectroscopy- C.N. Banwell and E.M. McCash (McGraw Hill International Edition)

**B.Sc. IIIrd year Physics (Semester-VI)**

**Practical**

**Course code PHY-307**

**Paper-XVII**

**Marks-50**

**List of experiments**

1. Thermal conductivity by Forb’s method
2. Rydberg constant
3. B-H curve using magnetometer
4. Determination of Debye’s temperature (e.g. Tin)
5. Determination of dielectric constant of liquid/solid
6. Resistance measurement of semiconductor by Vaders Pau’s method
7. I-H Curve by Excel
8. Rydberg constant Excel

**Note:-** At least Six experiments should be performed.

**B.Sc. IIIrd year Physics (Semester-VI)**

**Practical**

**Course code PHY-308**

**Paper-XVIII**

**Marks-50**

**List of experiments**

1. Temperature coefficient of resistance of semiconductor
2. Measurement of thickness of thin film by gravimeter/optical/electrical method
3. Temperature of sodium flame
4. Hartmann’s dispersion formula
5. Maxwell’s bridge (measurement of inductance using impedance at different frequency)
6. λ by grating (normal incidence)
7. Transistorized Regulated power supply using Zener diode.
8. Bridge Rectifier

Note:- At least Six experiments should be performed.