डॉ0 शकुन्तला मिश्रा राष्ट्रीय पुनर्वास विश्वविद्यालय, लखनऊ

Dr. Shakuntala Misra National Rehabilitation University, Lucknow

Structure and Syllabus of M.Sc. Physics (Four Semesters) Course

(Effective from the Academic Session 2015-16)

Department of Physics
Dr. Shakuntala Misra National Rehabilitation University
LUCKNOW-226017
Uttar Pradesh (INDIA)

MEETING OF BOARD OF POST GRADUATE STUDIES

Agenda: Syllabus and Programme Structure of M.Sc.Physics

Members:-

- **Dr. C. K. Dixit** — Chairman — 23/8/15
  Professor & Head
  Department of Physics
  DSMNRU, Lucknow

- **Dr. Poonam Tondon** — External Expert Member — 25/8/15
  Professor
  Department of Physics
  Lucknow University

- **Dr. Ashok K. Mishra** — Internal Member — 25/08/15
  Assistant Professor
  Department of Physics
  DSMNRU, Lucknow

- **Dr. D. B. Singh** — Internal Member — 25/8/15
  Assistant Professor
  Department of Physics
  DSMNRU, Lucknow

The attached Syllabus and programme Structure of M.Sc. Physics has been accepted for the Study of **M. Sc. Physics I and II Semester**.

ACADEMIC PROJECTIONS

Sl.No.	Name of Department	Name of Programme	Duration Year/ Semester	Total Credit	Total Intake	ESE/ each Sub.	Continuous Assessment
1.	Physics	M.Sc. Physics	2/4	96	40	70	30

ADMINISTRATIVE PROJECTIONS

S. No.	Name of Programme	Mode of Admission	Reservation (GEN/OBC/ SC/ ST/PH)	Period of Completion	Eligibility	Tuition fee Per Semester
1.	M.Sc. Physics	on the basis of merit / Marks obtained in B.Sc. & P.I	as per U.P. Govt./ University/UGC norms	5 yrs.	Minimum 50% marks at graduation level from recognized University	10,000

2. **Period of Completion –** **M.Sc. Physics Programme- 5 years,**
3. **Nature of Programme-** **Face to Face /Regular**
4. **Mode of Teaching -** **Class Room learning by use of Educational Technology.**
5. **Nature of Class -** **Lecture –Tutorial-- Practical**

PROJECTIONS OF ORDINANCES

(Details of Ordinances attached)

21.8.15

25/8/15

25/8/15

25/08/15

Department of Physics

M.Sc. in Physics

Total Credit-48

Semester-1 Credit- 24

Code of Course	Name of Subject	Credit
PHM 101	Classical Mechanics	5
PHM 102	Mathematical Physics	5
PHM 103	Quantum Mechanics I	5
PHM 104	Electronics	5
PHM 105	Laboratory - I : General Physics ~~Electronics~~	2
PHM 106	Electronics Lab – I	2

Semester – 2 Credit- 24

Code of Course	Name of Subject	Credit
PHM 201	Quantum Mechanics- II	5
PHM 202	Electromagnetic Theory	5
PHM 203	Statistical Physics and Thermodynamics	5
PHM 204	Condensed Matter Physics	5
PHM 205	Laboratory - II : General Physics ~~Electronics~~	2
PHM 206	Electronics Lab – II	2

Chaudhuri 25.8.15 25/8/15 25/8/15 25/8/15

M.Sc. Physics I – Semester Theory
PHM 101 : Classical Mechanics

1.2 Classical Mechanics

Unit I **(12 Hours)**

The Lagrangian Formalism

Mechanics of a system of particles, constraints of motion, generalized coordinate, Hamilton's variational principle and Lagrange equations, Lagrangian of a free practical and a system of particles with interaction, Lagranges equations from 'D' Alembert's principle, velocity dependent forces, dissipative function, Generalised momentum, conservation of momentum, cyclic coordinates and conservation of energy.

Unit II **(12 Hours)**

Hamiltonian Formalism

Hamiltonian and its physical significance, Hamilton's equations, Hamilton's equations in different coordinate systems. Examples: Harmonic oscillator, motion of a particle in central force field, charged particle in an electromagnetic field. Compound pendulum, Routh's procedure, the Routhian, Poisson brackets, angular momentum and Poisson brackets, a modified variational principle, canonical transformation's, Poisson brackets and canonical transformations.

Unit III **(14 Hours)**

Rigid Body Dynamics

Fixed and moving coordinate systems of a rigid body, The Eulerian angles, angular momentum and kinetic energy of rigid body, equations of motion of a rigid body, Euler's equations, free rotation and precession of a symmetrical top, motion of a charged rotating particle in a uniform magnetic field.

Theory of Small Oscillations : Formulation of problem. The eigenvalue equation.Frequencies of free vibrations and normal coordinates.Free vibrations of a linear triatomic molecule.Forced vibrations and the effect of dissipative forces.

Unit IV **(12 Hours)**

Hamilton-Jacobi Theory

TheHamilton-Jacobi equation for Hamilton's principle function, the harmonic oscillator problem, Hamilton-Jacobi equation from Hamilton's characteristic function, Separation of variables in the Hamilton-Jacobi equation, Action-angle variables in a system of one degree of freedom, action-angle variables for completely separable system of one degree of freedom, action-angle variables for completely separable systems. The Kepler problem in action-angle variables for completely separable systems.The Kepler problem in action-angle variables, Hamilton-Jacobi theory- application to geometrical optics and wave mechanics.

Text and reference books:

1. Classical Mechanics- **Goldstein** (Narosa Publishing House)
2. Classical Mechanics- **JC Upadhyaya** (Himalaya Publishers)
3. Classical Mechanics- **N.C Rana & P.S. Joag** (Tata. McGraw Hill)

25/8/15

23.8.15 25/08/15 25/8/15

PHM 102 : Mathematical Physics

Unit-I **(10 Hours)**

Vector analysis in curved coordinates and Tensors
Review of vector algebra and calculus, Gauss and Stokes theorems, Orthogonal coordinates, differential vector operators, special coordinate systems, circular cylindrical coordinates, spherical polar coordinates, tensor analysis, contraction, direct product, quotient rule, psuedotensors, dual tensors, non-Cartesian tensors, covariant differentiation, tensors differentiation operators.

Unit-II **(12 Hours)**

Special Functions
Second order ordinary differential equations, Frobinus method for solving second order linear ODEs, Beta & Gamma functions, Legendre's equation, Legendre polynomials and their properties, Bessel's equation, Bessel function and their properties, confluent hyper geometric equation, its solutions, Laguerre's equation, its solutions and properties, Hermit equation, Hermit Polynomials and their properties. Green's function.

Unit-III **(12 Hours)**

Matrices and Complex Analysis
Different types of matrices, orthogonal, Hermitian, Unitary and normal, eigenvalues and Eigen functions of matrices, diagonalization of matrices, properties of analytic functions, Cauchy's integral theorem, Cauchy integral formula, Laurent expansion, singularities, Cauchy's residue theorem, evaluation of definite integrals, dispersion relations.

Unit-IV **(10 Hours)**

Integral Transforms
Laplace Transform (LT), first and second shifting theorems, LT of derivative and integral of a function, Inverse LT by partial fractions, Solution of initial value problems by using LT.
Fourier Series and Fourier Transform: Fourier series, Half range expansion, Arbitrary period, Fourier integral and transforms, FT of delta and Gaussian function.

Text and References Books:

1. Mathematical Method for Physicists,-**Arfken& Weber** (Elsevier Academic Press)
2. Mathematical Method for Physics and Engineers- **K.F. Reily, M.P. Hobson &S.J. Bence** (Cambridge University Press)
3. Advanced Engineering Mathematics-**E. Kreyszig** (John Wiley & Sons)
4. Special Functions- **E.D. Rainville** (Chelsea Publication Co.)
5. Special Functions for Scientists and Engineers- **W.W. Bell** (Dover Publications)
6. Functions of complex variable- **R.V. Churchill** (McGraw Hill)

23/8/15

Chandra 31.8.15 25/08/15 23/8/15

PHM- 103 Quantum Mechanics-I

Unit- I **(Hours-12)**

Bra and Ket Notation

Dirac's.Bra and KetNotations, Hilbert space, linear operators.Hermitian conjugate. Eigen values and Eigen vector of Hermitian operators. Complete set of states. Complete set of commuting operators. Continuous spectrum of Eigen values Orthogonality, Principles of Quantum mechanics.

Unit- II **(Hours-14)**

Representations

Properties of Dirac – Delta function. Orthogonal basis.Representation for ket, bra and operator.Wave function as a representation of ket, position and momentum representations.Poisson's brackets, Quantum conditions.Equation of motion, Ehrenfesttheorem.Matrix theory of harmonic oscillator, uncertainty relations, Schrodinger, Heisenberg and Dirac Representations..

Unit- III **(Hours-12)**

Motion in three Dimensions: Angular Momentum

Spherically symmetric potentials in 3 dimensions, orbital angular momentum operator. Commutation relations, Eigen vectors and Eigen values of L^2 an L_z Pauli spin operators atom problem, Vibrating rotator, rigid rotator and 1D harmonic oscillator.

- Addition of Angular momenta, Clebsch- Garden Coefficients.

Unit- IV **(Hours -12)**

Second Quantization of Non-Relativistic Fields:

Non-Covariant Derivation of Lagrangian equations for fields, Canonically Conjugate Momentum Density for Schrodinger Field. Quantum Conditions based on Commutation Relations and Second Quantization, Annihilation and Creation Operators, Second Quantization based on Anti-Commutation Relations, Simple Problems on Algebra of Annihilation and Creation Operators.

Text and Reference books:

1. Quantum Mechanics- **AjoyGhatak& S. Loknathan**(Macmillan India Ltd.)
2. The Principles of Quantum Mechanics – **P.A.M. Dirac** (Oxford University Press).
3. Quantum Mechanics – **L.I. Schiff** (McGraw Hill).
4. A Text Book of Quantum mechanics – **P.M. Mathews & K. Venkatesan** (Tata McGraw Hill).
5. Introduction of Quantum Mechanics- D.J. Grifith(**Pearson Publication).**

23·8·15

25/08/15

25/8/15

25/8/15

PHM 104: Electronics

Unit I **(10 Hours)**

Physics of Devices

p-n junction, abrupt junction-band structure-thermal equilibrium- depletion region depletion capacitance current and voltage characteristics BJT-band structure-transistor action static characteristics. MOS structure MOSFET working MOSFET characteristics width of depletion region junction capacitance threshold voltage. Metal semiconductor contacts:osmic and schottky contacts. Principle of operation of photo electronic devices: photoconductor efficiency current gain response time. Effect of light on I-V characteristics of a junction photo device, principle and working of a photodiode, light emitting diode(LED): principle, working and factors affecting the efficiency.

Unit II **(10 Hours)**

Transistor Circuits

Common base configuration-IV characteristics, alpha equivalent, circuit-Common collector configuration (the emitter follower) input and output impedances gain; Common emitter configuration- IV characteristics, beta of a transistor base bias with single supply gain. Load lines for CE connection, dc load line, ac load line, optimum operating point.Push-pull amplifier.The Darlington pair.Astablemultivibrator using transistors, voltage regulator using transistors, transistor difference amplifiers four configurations, analysis of dual input and dual output configuration, CMRR- common mode gain, difference mode gain.

Unit III **(12 Hours)**

Operational Amplifiers

Introduction,block diagram,idealcharacteristics, comparison with 741 Operational amplifier as a open loop amplifier, Limitations of open loop configuration, Operational amplifier as a feedback amplifier, Closed loop again, input impedance, output impedance of inverting and non-inverting amplifiers, Voltage follower, Differential amplifier, voltage gain. Applications of op-amp: Linear applications Phase and frequency response of low pass, high pass and band pass filters (first order), inverting and non-inverting configurations, summing amplifier,subtraction, ideal and practical differentiator and integrator. Non-linear applications: comparators, positive and negative clippers.

Unit IV **(12 Hours)**

Digital Circuits:-

Review of gates (AND, OR, NAND, NOR, NOT, EX-OR), Boolean laws and theorems simplification of SOP equations, Simplification of POS equations, Simplification using Karnaugh Map technique (4 variables), conversion of binary to Grey code, Flip flops: Latch using NAND and NOR gates, RS flip flop, clocked RS flip flop, JK flip flop, JK master slave Flip Flop—racing- Shift Registers, Counters: Ripple counters- truth table, timing diagram, Synchronous counters-truth table, timing diagram, Decade counter.

Chandra 21.8.15 25/08/15 25/8/15 27/8/15

Text and References Books:

1. P. Horowitz and W. Hill, The Art of Electronics.
2. J. Millman and A. Grabel, Microelectronics.
3. J.J. Cathey, Schaum's Outline of Electronic Devices and Circuits.
4. M. Forrest, Electronic Sensor Circuits and Projects.
5. W. Kleitz, Digital Electronics: A Practical Approach.
6. J.H. Moore, C.C. Davis and M.A. Coplan, Building Scientific Apparatus

I-Semester Practical's

PHM 105 :General Physics – I Laboratory

1. Specific heat of a solid (Cylindrical graphite sample)
2. Diffraction grating – Determination of wavelengths of different lines of Mercury.
3. Measurement of Dielectric Constant.
4. Determination of Rydberg's constant.
5. Band Gap of Semiconductor
6. Study of characteristics of Solar cell
    a. Illumination characteristics
    b. I-V characteristics
    c. Areal and spectral characteristics
    d. Illumination characteristics vs distance.
7. Measurement of wavelength of He-Ne laser light:-
    a. using ruler
    b. using slit
8. Michelson Interferometer: Determination of λ and d λ of sodium D_1 and D_2 lines.

PHM 106 :Electronics – I Laboratory

1. V-I characteristics of FET- Determination of parameters.
2. Transistor RC Coupled amplifier.
3. Collector coupled astablemultivibrator.
4. Emitter Follower.
5. Operational Amplifiers – Measurement of
   a)Bias current and offset voltage b) CMRR.
6. Operational Amplifiers – Measurement of
   a)Slew rate. b) Output impedance.
7. Operational Amplifiers – study of gain frequency response
   a) Inverting Operational Amplifiers – study of gain frequency response.
   b) Non- inverting operational amplifiers – study of gain frequency response.
8. IC 555 timer- Monostablemultivibrator.
9. IC 555 timer- Schmitt trigger.
10. IC 555 timer- a) AstableMultivibrator, b) Voltage controlled oscillator.
11. Digital experiments : Coder & Decoder
12. Multiplexer and De multiplexer
13. Adders and Subtractors.
14. Study of RC coupled and feedback amplifier
    a. Frequency response of RC coupled amplifier using transistor
    b. Gain of feedback amplifier using opamp in various modes of operation.

21.8.15 25/08/15 25/8/15 25/8/15

Text and reference books:

1. Advanced practical Physics- **Wornsop& Flint**.
2. Advanced practical Physics vol.1- **S.P. Singh** (PragatiPrakashan).
3. A Text Lab manual in Electronics- **ZBAR** (Tata McGraw Hill).
4. Liner Integrated Circuits – **Shail B. Jain &B.RayChoudhary** (New Age International Publishers, 2 nd edition).
5. Liner Integrated Circuits – **Shalivahanan& VS Bhaaskaran** (Tata McGraw Hill, 2008).

Chandra 21.8.15 25/08/15 25/8/15 25/8/15

M.Sc. Physics II – Semester, Theory

PHM 201 :Quantum Mechanics – II

Unit – I **(Hours -12)**

Approximate methods:

i) Time independent perturbation theory: Non-degenerate levels. Application to normal he atom and an harmonic oscillator. Degenerate levels-application to first order stark effect in hydrogen atom with n=2 and to normal Zeeman effect.

ii) Time dependent perturbation theory: Transition amplitude in first and second order, first order transition constant perturbation, Fermi golden rule, harmonic perturbation. Emission and absorption probabilities. Einstein A and B Coefficients.

Variation method, application to normal Helium, atom, WKB approximation.

Unit – II **(Hour-14)**

Scattering Theory

The scattering cross-section.Wave mechanical picture of scattering – the scattering amplitude, Green's functions.Formal expression for scattering amplitude. The Born andEikonal approximations. Partial wave analysis.Scattering amplitude in terms of phase shifts.Optical theorem. Exactly solvable problems – scattering by a square well potential, hard sphere and Coulomb potential.

Unit – III **(Hours-12)**

Relativistic Quantum Mechanics

Klein – Gordon equation – plane wave solution – charge and current densities.Interaction with electromagnetic field for hydrogen like atom.Non- relativistic limit.Dirac equation.Dirac matrices.Plane wave solution and energy spectrum.Properties of Dirac spinors.Positive and Negative energy states. Free Dirac particle in an external electromagnetic field. Spin – orbit interaction.

Unit – IV **(Hours-12)**

Many – Particle system

Identical particles, permutation operator, symmetrisation, slater determinant. Pauli exclusion principle. Central field approximation.Thomas Fermi statistical model.Evaluation of the potential.Hartreeself consistent field – connection with variation method.

Molecular bonding

Bonding, anti – bonding and non- bonding orbitals.Fundamental principles of molecular orbital theory.LCAO approximation.Molecular orbital theory of hydrogen molecular ion and hydrogen molecule.Discussion of improved wave functions for H_2^+ion; Valence bond theory of hydrogen molecule. Comparison of molecular orbital and valence bond theories.

Chandra 21.8.15 25/08/15 25/8/15 25/8/15

Text and Reference Books:

1. Quantum Mechanics – **L.I. Schiff** (McGraw Hill, New York).
2. A Text Book of Quantum Mechanics – **P.M. Mathews & K. Venkatesan**(TMH).
3. Quantum Mechanics- **A.K. Ghatak& S. Lokanathan** (MacMillan).
4. Introduction to Molecular Orbital Theory- **Turner** (PHI).
5. Molecular structure and Spectroscopy- **G. Aruldas** (PHI).
6. A Text book of Quantum Mechanics – **G. Aruldas** (PHI).
7. Quantum Mechanics – **Max Born**

Chandra 21.8.15 25/08/15 25/8/15 25/8/15

PHM 202: Electromagnetic Theory

UNIT I **(13 Hours)**

Electrostatics

Differential equation for electric field, Poisson and Laplace equations, formal solution for potential with Green's functions, boundary value problems, examples of image method and Green's function method, solutions of Laplace equation in cylindrical and spherical coordinates by orthogonal functions, dielectrics, polarization of a medium, electrostatic energy.

Magnetostatics

Biot-Savart law, differential equation for static magnetic field, vector potential, magnetic field from localized current distributions, examples of magnetostatic problems, Faraday's law of induction, magnetic energy of steady current distributions.

UNIT II **(14 Hours)**

Maxwell's Equations

Displacement current, Maxwell's equations, vector and scalar potentials, gauge symmetry, Coulomb and Lorentz gauges, electromagnetic energy and momentum, conservation laws, inhomogeneous wave equation and Green's function solution.

Electromagnetic Waves

Plane waves in a dielectric medium, reflection and refraction at dielectric interfaces, frequency dispersion in dielectrics and metals, dielectric constant and anomalous dispersion, wave propagation in one dimension, group velocity, metallic wave guides, boundary conditions at metallic surfaces, propagation modes in wave guides, resonant modes in cavities.

UNIT III **(10 Hours)**

Radiation

Field of a localized oscillating source, fields and radiation in dipole and quadrupole approximations, antenna, radiation by moving charges, Lienard-Wiechert potentials, total power radiated by an accelerated charge, Lorentz formula.

UNIT IV **(7 Hours)**

Concepts of Plasma Physics

Formation of plasma, Debye theory of screening, plasma oscillations, motion of charges in electromagnetic fields, magneto-plasma, plasma confinement, hydromagnetic waves.

Chandra 25.8.15 25/08/15 25/8/16 25/8/15

Text and ReferencesBooks :

1. **J.D. Jackson,** Classical Electrodynamics.
2. **D.J. Griffiths,** Introduction to Electrodynamics.
3. **J.R. Reitz, F.J. Milford and R.W. Christy,** Foundations of Electromagnetic Theory.
4. **W.K.H. Panofsky and M. Phillips,** Classical Electricity and Magnetism.
5. **F.F. Chen,** Introduction to Plasma Physics and Controlled Fusion.

25.8.18 25/08/15 20/8/15 25/8/15

PHM 203: Statistical Physics and Thermodynamics

Unit-I **(12 Hours)**

Introduction to statistical physics, phase space and phase space trajectory, concept of a statistical ensemble, distribution function, mean value of a physical quantity, statistical equilibrium, statistical independence and quasi-closed systems. Liouville's theorem (no derivation) and its significance, Entropy and law of increase of entropy. Thermodynamic quantities: temperature, pressure, free energy and thermodynamic potential. Theorem of small increments (no derivation), dependence of thermodynamic quantities on number of particles.

Unit-II **(12 Hours)**

Microcanonicaldistribution in classical statistics.Gibb's canonical distribution, free energy in Gibb's distribution.Partition function, grand canonical distribution.Statistical distribution in quantum statistics.

Energy fluctuation in canonical and concentration fluctuation in grand canonical ensembles.Fluctuations and its dependence on number of particles.

Unit-III **(10 Hours)**

Boltzmann distribution, free energy and the equation of state of an ideal gas, chemical potential of a monoatomic ideal gas.Fermi-Dirac and Bose-Einstein distribution equation of state of ideal.F-D and B.E gases of elementary particles.The electron gas in metals, Degenerate electron gas-equation of state, degeneracy temperature, specific heat.Degenerate Bose Gas-Specific heat and pressure, B-E condensation. Black body radiation: Planck's formula and Boltzmann's law.

Unit-IV **(10 Hours)**

Thermodynamic laws and basic statistical relations.Entropy and second law of Thermedynamics, Adiabate expansion or compression, Heat engines and Refrigerator, Third law of Thermograry phase transitions.

Text and Reference Books:

1. **F. Reif,** Fundamentals of Statistical and Thermal Physics.
2. **K. Huang,** Statistical Mechanics.
3. **R.K. Pathria,** Statistical Mechanics.
4. **D.A. McQuarrie,** Statistical Mechanics.
5. **S.K. Ma,** Statistical Mechanics.
6. **Zymansky,** Thermal Physics.

Chandra 23-8-15 25/08/15 25/8/15 25/11/15

PHM 204: Condensed Matter Physics

UNIT-I **(12 Hours)**

Basic Crystal Physics
Crystalline solids, unit cell and direct lattice, Bravais lattice in two dimensions (plane lattice) and three-dimensional(space lattice), Closed packed structures.

Symmetry elements

Proper rotation axis, improper rotation axis, rotoreflection, rotoinversion, glide planes, screw axes.

Diffraction from crystals and crystal structure study
Determination of crystal structureby X-ray diffraction,Bragg's lawof X-ray diffraction, Bragg's X-ray Spectrometer,Laue formulation, diffraction conditions, Ewald construction, Laue equations.Miller indices of planes and directions, Relation between Miller Indices of a family of planes and interplanar spacing for an orthorhombic crystal.Concept of Brillouin zone; reciprocal lattice, its significance, relationships between direct and reciprocal primitive translation vectors.Construction of reciprocal lattices; determination of reciprocal lattice of SC,BCC, FCC.

UNIT-II **(12 Hours)**

Lattice Vibrationsand Phonons
Lattice Vibrations, Elastic vibrations of continuous media, Group velocity of harmonic wave trains, Wave motion of one dimensional atomic lattice, Group velocity and phase velocity, Force constants, Brillouin zones, Normal modes of vibration in one dimensional atomic lattice of finite length, Lattice with two atoms per primitive cell, Optical properties in the infrared, Phonons, Momentum of phonons, Inelastic scattering of photons by long wavelength phonons, Local phonon model.

Crystal imperfections
Point defects-Schottky Defects and Frenkel Defects, line defects and stacking faults, Volume imperfections, Liquid crystals, Anisotropy.

UNIT-III **(12 Hours)**

Free electron theory of Metals
Free electron Fermi Gas: Review of Sommerfeld model of free election gas; Band Theory of Solids, The Kroning-Penney Model, Motion of electrons in a one-dimensional periodic potential, Distinction between Metals, insulators and intrinsic semiconductors.

Transport Properties
Boltzmann transport equation, Boltzmann transport equation for electrons and Lorentz Solution, Sommerfeld's theory of electrical conductivity.

Fermi surface
Fermi surface and Brillouin zones, de Hass van Alphen effect, Magnetoresistance, Hall Effect in semiconductors.

28.8.15 25/8/15 28/8/15 28/8/15

UNIT-IV (8 Hours)

Magnetism

Origin of magnetism in metallic and ceramic materials, paramagnetism, diamagnetism, antiferro magnetism, ferromagnetism, ferrimagnetism, magnetic hysterisis.

Superconductivity

Occurrence of superconductivity, Meissner effect, London equation, effect of magnetic field, type I and type II superconductors. Cooper pairs and elementary discussion of BCS model.

Text and References Books:

1. **C. Kittel,** Introduction to Solid State Physics.
2. **N.W. Ashcroft and N.D. Mermin,** Solid State Physics.
3. **J.M. Ziman,** Principles of the Theory of Solids.
4. **A.J. Dekker,** Solid State Physics.
5. **G. Burns,** Solid State Physics.
6. **M.P. Marder,** Condensed Matter Physics.
7. **S.O. Pillai,** Solid State Physics.
8. **S.L. Kakani,** Materials Science

25/08/15

25/8/15

M.Sc. Physics II- Semester Practical's

PHM 205 General Physics – II Laboratory

1. Determination of Cauchy's constants for a) Glass b) Quartz c) Calcite.
2. Velocity of ultrasonic waves in organic liquids – using Interferometer
3. Magnetic susceptibility
4. Hysteresis loop.
5. Compton scattering
6. Hall effect:Determination of
    a. Hall coefficient,
    b. Mobility
7. Fabry – perot interferometer.
8. Photoelectric effect
9. Simulation tools : Scrodinger

    : MATLAB

    : VASP Modules

    : VIEN2K

PHM 206 Electronics – II Laboratory

1. Operational Amplifier I
    a. Design and study of
        i. Inverting
        ii. Non inverting
        iii. Summing
    b. Study of frequency of
        i. Differential
        ii. Integral
2. Operational Amplifier II: Design and study of
    a. Clipping and clamping circuits
    b. Comparators, Schmidt trigger
3. Operational Amplifier III
    a. Design & build square wave generator using IC –741.
    b. Design & build triangular wave generator using IC –741.
    c. Design & build sine wave generator using IC –741.
4. Operational Amplifier IV
    a. Design and study frequency response of Notch filter using IC-741
    b. Design and study frequency response of single feedback, low/high/band pass and active filter .
5. Digital electronics: Design and verify truth table of-
    a. Flip Flops
        i. Latch, D-type, T-type using RS flip flop
        ii. JK, JK master slave flip flop

25/8/15

Chaudhry 25-8-15 25/08/15 25/8/15

iii. D- & T-type using JK flip flop IC7476

6. 4-bit register using JK flip flop
7. 4-bit counters and modified counters using IC7490 and 7493
8. Design of a function generator
9. Operational Amplifiers as differentiator, b)Operational Amplifiers as Integrator.
10. Phase shift oscillator using IC 741.
11. A/D Converter.

Text and references books:

1. Advance Practical physics – **Wornsop& Flint**.
2. Advance Practical Physics vol.1 – **S.P Singh** (PragatiPrakashan).
3. A Text lab manual in Electronics – **ZBAR** (Tata McGraw Hill).
4. Liner Integrated Circuits – **Shail B. Jain & B. Ray Choudhury** (New Age International Publishers, 2nd Edition) .
5. Liner Integrated Circuits – **Shalivahanan& VS Bhaaskaran** (Tata McGraw Hill, 2008).