# Scheme of Examination
# B. Sc. (Hons.) Physics Semester I to II w.e.f. 2016-17

**Semester-I**

| Paper No. | Title | Periods per week | Total Marks | Internal Assessment | Max. Marks |
|---|---|---|---|---|---|
| Phy-101 | Mathematical Physics-I | 3 | 50 | 10 | 40 |
| Phy- 102 | Mechanics-I | 3 | 50 | 10 | 40 |
| Phy-103 | Electricity | 3 | 50 | 10 | 40 |
| Phy-104 | Mathematics-I | 3 | 50 | 10 | 40 |
| Phy-105 | Chemistry-I | 3 | 50 | 10 | 40 |
| Phy-106 | Linear & Digital Integrated Circuits & Instruments-I | 3 | 50 | 10 | 40 |
| Q-101 | English (Qualifying)-I | 3 | 50 | 10 | 40 |
| Phy-107 | Physics Lab. –I | 3 | 75 | | |
| Chem-108 | Chemistry Lab. –I | 3 | 75 | | |
| | | Total | 450 | | |

**Semester-II**

| Paper No. | Title | Periods per week | Total Marks | Internal Assessment | Max. Marks |
|---|---|---|---|---|---|
| Phy-201 | Mathematical Physics-II | 3 | 50 | 10 | 40 |
| Phy- 202 | Mechanics-II | 3 | 50 | 10 | 40 |
| Phy-203 | Electricity | 3 | 50 | 10 | 40 |
| Phy-204 | Mathematics-II | 3 | 50 | 10 | 40 |
| Phy-205 | Chemistry-II | 3 | 50 | 10 | 40 |
| Phy-206 | Linear & Digital Integrated Circuits & Instruments-II | 3 | 50 | 10 | 40 |
| Phy-207 | Physics Lab. –II | 3 | 75 | | |
| Chem.-208 | Chemistry Lab. –II | 3 | 75 | | |
| Q-201 | English (Qualifying)-II | 3 | 50 | 10 | 40 |
| | | Total | 450 | | |

# B. Sc. (Hons.) Physics Semester III to IV w.e.f. 2017-18

**Semester-III**

| Paper No. | Title | Periods per week | Total Marks | Internal Assessment | Max. Marks |
|---|---|---|---|---|---|
| Phy-301 | Mathematical Physics III | 3 | 50 | 10 | 40 |
| Phy-302 | Thermal Physics -I | 3 | 50 | 10 | 40 |
| Phy-303 | Vibrations & Wave Optics-I | 3 | 50 | 10 | 40 |
| Phy-304 | Quantum Mechanics | 3 | 50 | 10 | 40 |
| Phy-305 | Mathematics III | 3 | 50 | 10 | 40 |
| Phy-306 | Computer Fundamentals and Programming-I | 3 | 50 | 10 | 40 |
| Phy-307 | Physics Lab-III | 3 | 75 | | |
| Phy-308 | Digital, Microprocessor & Computer lab-I | 3 | 75 | | |
| | | **Total Marks** | **450** | | |

**Semester – IV**

| Paper No. | Title | Periods per week | Total Marks | Internal Assessment | Max. Marks |
|---|---|---|---|---|---|
| Phy-401 | Mathematical Physics- IV | 3 | 50 | 10 | 40 |
| Phy-402 | Thermal Physics- II | 3 | 50 | 10 | 40 |
| Phy-403 | Vibrations & Wave Optics - II | 3 | 50 | 10 | 40 |
| Phy-404 | Atomic & Nuclear Physics | 3 | 50 | 10 | 40 |
| Phy-405 | Mathematics -IV | 3 | 50 | 10 | 40 |
| Phy-406 | Computer Fundamentals and Programming-II | 3 | 50 | 10 | 40 |
| Phy-407 | Physics Lab-IV | 3 | 75 | | |
| Phy-408 | Digital, Microprocessor & Computer lab-II | 3 | 75 | | |
| | | **Total Marks** | **450** | | |

The Internal Assessment Comprises of

I) Attendance - 2.50
II) Unscheduled test- 2.50
III) Assignments- 5.00
**Total- 10**

# Scheme of Examination
# B. Sc. (Hons.) Physics Semester-V & VI for the sessions 2018-19

## Semester-V

| Paper No. | *Title* | Periods Per week | Total Marks | Internal Assessment | Max. Marks |
|---|---|---|---|---|---|
| Phy-501 | Mathematical Physics V | 3 | 50 | 10 | 40 |
| Phy-502 | Electro-magnetic Theory-I | 3 | 50 | 10 | 40 |
| Phy-503 | Statistical Physics-I | 3 | 50 | 10 | 40 |
| Phy-504 | Physics of Materials -I | 3 | 50 | 10 | 40 |
| Phy-505 | Electronics Devices: Physics and Application -I | 3 | 50 | 10 | 40 |
| Phy-506 | Any one of the following<br>(a) Nano Technology<br>(b) Environmental Physics | <br>3<br>3 | <br>50<br>50 | <br>10<br>10 | <br>40<br>40 |
| Phy-507 | Physics Lab. V | 6 | 75 | -- | 75 |
| Phy.508 | Physics Lab.VI And Project | 6 | 75 | -- | 75 |
| | | Total Marks | 450 | | |

## Semester-VI

| Paper No. | *Title* | Periods Per week | Total Marks | Internal Assessment | Max. Marks |
|---|---|---|---|---|---|
| Phy-601 | Mathematical Physics VI | 3 | 50 | 10 | 40 |
| Phy-602 | Electro-magnetic Theory-II | 3 | 50 | 10 | 40 |
| Phy-603 | Statistical Physics-II | 3 | 50 | 10 | 40 |
| Phy-604 | Physics of Materials –II | 3 | 50 | 10 | 40 |
| Phy-605 | Electronics Devices: Physics and Application –II | 3 | 50 | 10 | 40 |
| Phy-606 | Any one of the following<br>(a) Nano Technology<br>(b) Environmental Physics | <br>3<br>3 | <br>50<br>50 | <br>10<br>10 | <br>40<br>40 |
| Phy-607 | Physics Lab. VII | 6 | 75 | --- | 75 |
| Phy.608 | Physics Lab.VIII And Project | 6 | 75 | --- | 75 |
| | | Total Marks | 450 | | |

**B.Sc.(H) Physics**
**Phy 101 Semester –I**
**Mathematical Physics-I**

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :
1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit 1. Vector Algebra and Analysis**

Review of vector algebra- addition, subtraction and product of two vectors. Polar and axial vectors and their examples from physics. Triple and quadruple product (without frenet-Serret formulae).

Scalar and vector fields, differentiation of a vector w.r.t. a scalar . Unit tangent vector and unit normal vector (without Frenet- Serret formulae).

Directional derivatives, gradient, divergence, curl and Laplacian operations and their meaning. Idea of line, surface and volume integrals. Gauss, Stokes and Green's theorems.

**Unit II Orthogonal Curvilinear Coordinates and Multiple integrals**

Orthogonal curvilinear coordinates, Derivation of gradient, divergence, curl and Laplacian in Cartesian, spherical and cylindrical coordinate systems. Change of variables and Jacobian. Evaluation of line surface and volume integrals.

**Calculus of Variations**

Constrained maxima and minima. Method of Lagrange undetermined multipliers and its application to simple problems in physics.

Variational principle Euler-Lagrange equation and its application to simple problems.

References:


1. Mathematical Physics by P. K. Chattopadhyay ( T)
2. Mathematical Physics by B. S. Rajput
3. Mathematical Physics by Mathews and Walkers
4. Mathematics for Physicists by Mary L Boas.
5. Matrices and Tensors for Physicists by A. W. Joshi

## Phy-102 Semester-I Mechanics-I

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two question from each unit. A student has to attempt five question in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I : Fundamentals of Dynamics:**

Motion of charged particle in electric and magnetic fields.

Dynamics of a system of particles. Centre of mass Conservation of momentum. Idea of conservation of momentum from Newton's third law impulse. Momentum of variables mass system: motion of rocket, Work-energy theorem. Potential energy. Energy diagram. Stable and unstable equilibrium. Conservative and non-conservative forces. Force as gradient of potential energy. Particle collisions. Centre of mass frame and laboratory frame.

**Unit II Rotational Dynamics:**

Angular momentum of a particle and system of particles. Torque, Conservation of angular momentum, Rotation about a fixed axis Moment of inertia; its calculation for rectangular and cylindrical bodies; idea of calculation for spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation.

Oscillatory Motion:

Motion of simple and compound pendulum. Loaded spring, Energy considerations. Time average of energy. Damped harmonic oscillator Resonance in a lightly damped system.

References:


1. Mechanics By B. S. Agarwal
2. Introduction to Classical Mechanics by R. G. Takwale and P. S. Puranic
3. Classical Mechanics of Rigid Bodies by Kiran C. Gupta
4. Electrodynamics by Gupta S. L., Singh S. P. and Kumar V.

## Phy 103 Semester –I Electricity

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I Electric Circuits:**

Kirchhoff's laws for A.C. circuits, Series and parallel resonant circuits, A.C. bridges. Thevenin's theorem and Norton's theorem and their applications to D.C. circuits.

**Electric Field:**

Electric charge: conservation and quantisation. Coulomb's law and superposition principle. Electric field and electric lines. Gauss's law. Field of spherical, linear and plane charge distributions. Line integral of electric field. Electric potential. Potential and electric field of a dipole, a charged wire and a charged disc. Multipole expansion of potential due to arbitrary charge distribution. Fore and torque on a dipole. Laplace's equation: uniqueness theorem. Conductors in an electrostatic field. Description of a system of charged conductors. An isolated conductor and capacitance. Methods of images and its-application to simple electrostatic problems, plane infinite sheet and sphere.

**Unit II Electrostatic Energy**

System of point charges, a uniform sphere a condenser, an ionic crystal, nuclear electric field, point charge.

Dielectric Properties of Matter:

Dielectric polarization and polarization charges, Gauss's law in dielectrics. Field vectors D and E and their boundary conditions. Capacitors filled with dielectrics.

References:


1. Electricity and Magnetism by ***Benjamin Crowell .***
2. Electricity and Magnetism by ***A. S. Mahajam and Abbas A. Rangwala***.
3. Introduction to Electromagnetic Theory by ***Georage E. Owen***
4. Electromagnetic Theory by ***U. A. Bakshi and A. V. Bakshi***
5. Electromagnetic Theory and Electrodynamics, by ***Satya Prakash***

## Phy 104 Semester-I Mathematics-I

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

Unit-I

Sequences of real number Convergent. Cauchy, monotonic and bounded sequences. Subsequences. Limit superior and limit inferior of a sequence. Infinite series and their convergence.

Unit-II

Comparison test, Cauchys root test, d Alembert's ratio test, Raabe's test. Cauchy's integral test. Alternating series and Lelnit test. Absolute and conditional convergence.

## Phy-105 Semester-I Chemistry-I

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit-I**

Bonding : Qualitative approach to valence bond theory and its limitations. Hybridisation, equivalent and non-equivalent hybrid orbitals, Bent's rule and applications.

Molecular orbital theory, symmetry and overlap. Molecular orbital diagrams of diatomic and simple polyatomic systems ($O_2$, $C_2$,$B_3$, CO,NO, and their ions; HCI, $BeF_2$ $CH_4$,$BCI_3$) (ideal of $Sp_3$ mixing and orbital interaction to be given.

Organisation of solids:

(i) Packing of ions in crystals, close packed structures. Spinel, ilmenite and perovskite structures of mixed metal oxides. Size effects, radius-ratio rules and their limitations. Lattice energy, Born equation (calculations of energy in ion pairs and ion pairs square formation), Madelung constant, Kapustinskii, equation and its applications. Born – Haber cycle and its application.

(ii) Solvation energy. Packing of atoms in metals, qualitative idea of valence bond and band theories. Semiconductors and insulators. Defects in solids. Conductance in ion solids. Introduction to superconductors.

(iii) Weak chemical forces: van der Walls forces, hydrogen bonding. Effects of chemical forces on m.p., b.p. and solubility. Energetics of dissolution process.

Unit-II

**Coordination compounds and Inorganic Reaction Mechanisms:**

Crystal field theory- measurement of 10 Dq CFSE in weak and strong fields. Pairing energies, factors affecting the magnitude of 10 Dq. Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral symmetry. The Jahn-Teller theorem, square-planar coordination Ligand field and molecular orbital theories.

The trans effect, mechanism of the trans effect, kinetics of square planar substitution reactions. Thermodynamic and kinetic stability. Labile and inert complexes.

Kinetics of octahedral substitution reaction. Mechanism of substitution in octahedral complexes. Mechanism of electron transfer reactions (inner and outer sphere mechanism).

## Phy-106 Semester-I Linear and Digital Integrated Circuits & Instrumentation-I

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :
1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I Basic Concepts of Integrated Circuits:**

Active and passive components, discrete component circuits, water, chip, advantages of integrate circuits, MSI, LSI and VLSI (basic idea and definitions only). Operational Amplifiers (Op-Amp)

Basic characteristics without detailed internal circuit of IC: Requirement of ideal voltage amplifier, characteristics of ideal operational amplifier, feedback in amplifier (black box approach), open loop and close loop gain, inverting and non-inverting amplifier, zero crossing detector.

Application of op-amps: Mathematical operations addition, multiplication, integration and differentiation. Electronic circuits – oscillator (Wien's bridge), rectangular and triangular wave generators (all circuit analysis based on Kirchhoff's laws).

**Unit II Digital Circuits**

Difference between analog and digital circuits, binary numbers, binary to decimal conversion, AND, OR and NOT gates (realization using diodes and transistor), Boolean algebra, Boolean equations of logic circuits, de Morgan theorem, NOR and NAND gates.

Combinational logic: Boolean laws and theorems, sum of products method of realizing a circuit for a given truth table, truth table to kamaugh map and simplification (elementary idea).

Data processing circuits: Multiplexes, demultiplexers, decoders, encoders, exclusive OR gate, parity checker, read-only memories (ROM), PROM, EPROM.

Arithmetic circuits: Binary addition and subtraction (only 2's complement method), half adders and full adders and sub tractors (only upto eight bitts).

References:


1 **Integra**ted Electronics by ***J. Millman and C. C. Halkias (Tata MC. Garaw Hill)***
*2* Digital Electronics by ***William Gothmann (Parentice Hall of India)***
**3** Digital Logic by ***J. M Yarbrough (Thomson* Publication )**
**4** Electrical circuits and Basic Semiconductor Electronics **by *Agarwal J. P. Agarwal Amit.***

**Phy-107 Semester-I Physics laboratory-I**

**Max Marks 75**
**Period per week: 6 Hrs.**
**Time 3 Hrs**

The distribution of marks in laboratory papers will be as follows:

| | |
|---|---|
| Laboratory Report | 15 |
| Viva | 20 |
| Practical | 40 |

Unit-I

1. Methodology and Familiarization:
   - i) crude estimation, ungraduated and graduated scales.
   - ii) Triangulation method.
   - iii) Vernier calipers, screw gauge, traveling microscope.
   - iv) Indirect methods, e.g. for estimation of atomic size.
2. Familiarisation with basic electronic components.
3. Familiarisation with operation of basic measuring and test equipment (power supplies, analog and digital multimeters, function generator and CRO).
4. To test a diode and transistor using multi-meter and CRO.

**Unit II**

1. To study the random error in observations.
2. Experiments for generation of data in linear and non linear regions for the following systems: -
   - i) flow of liquid through capillary tube.
   - ii) Diode characteristics (I – V ).
   - iii) Pendulum with large amplitude.
3. Frequency and phase measurements using CRO.
4. Spring constant and mass from vertical oscillations of a spring and determination of modulus of rigidity.

   To find moment of inertia of an irregular body using torsion pendulum.

   To study characteristics of zener diode.

   To find high resistance by substitution method.

   To find frequency of A.C. mains using electrical vibrator.

**Chem.-108 Semester-I Chemistry Laboratory-I**

Max. Marks 75
Time 6 Hrs.

1. Separation of cations and anions by paper chromatography.
2. Preparation of
   i) Manganese (iii) Phosphate, Estimation of Mn content in the above complex colorimetrically (periodate oxidation). Estimation of oxidizing equivalents in the abov complex titrimetrically (titration of liberated iodine).
   ii) Tetramine copper (ii) sulfate and estimation of copper as CuCNS gravimetrically in the above complex.
3. Preparation of :
   i) Aspirin (ii) Hippuric acid (benzoylglycine) (iii) Methyl orange or phenolphthalein. Characterisation by mp, mmp, and TLC.
4. Two-step preparations:
   i) Nitrobenzene from benzene, purification of nitrobenzene and characterization by refractive index, further nitration.
   ii) P-bromoacetanllide from aniline.
5. Preparation of lactose and casein from milk or isolation of caffeine from tea leaves (mp, colour test).
6. Estimation of glucose, specification value or iodine value of a fat or oil.

**Eng.-101 Semester-I English**

# LITERATURE AND LANGUAGE-I

**SEMESTER-I**

**SESSION 2016-17**

## SCHEME OF EXAMINATION

| | |
|---|---|
| **Max. Marks** | **50** |
| **Theory** | **40** |
| **Internal Assessment** | **10** |
| **Time** | **3 Hours** |

**Part-A Poetry**

The following poems from The Chronicles of Time edited by Asha Kadyan (Oxford University Press)

**Part-A: Poetry**

The following poems from The Chronicles of Time edited by Asha Kadyan (Oxford University Press)

a) " Let Me Not to the Marriage of True Minds" by William Shakespeare
b) "Death Be Not Proud" by John Donne
c) "On His Blindness" by John Milton
d) "Shadwell" by John Dryden
e) "Know Then Thyself" by Alexander Pope
f) "The Little Black Boy" by William Black
g) "Three Years She Grew in Sun and Shower" by William Wordsworth

**Part-B Phonetics and Grammar**

i) **Phonetics:** Introduction to the Sound System of English : Phonetics Symbols, Organs of Speech, Transcription of Words (Oxford Advance Learners' Dictionary by Hornby to be followed).

ii) **Grammar:** parts of Speech, Types of Sentences, Common Errors, Technical Writing (application writing, business letter)

**Instruction for the paper-setter and the students**

Q. No. 1 Explanation with reference to the context. The students will be required to attempt two passages out of the given four from the book of poems 4X2=8

Q. No. 2 Two questions (with internal choice) will be asked based on theme, central idea, message and narrative technique of the poem. 4X2=8

Q. No. 3 The question will be based on Sound System of English Language having internal choice. 8

Q. No. 4 The question will be based on grammar. There will be internal choice with 16 sentences out of 24 to be attempted. 8

Q. N. 5 The question will be based on technical writing. There will be internal choice. 8

**Suggested Reading:**

*High School Grammar* ***by Wren and martin***
*Remedial English Grammar for Foreign Students by* ***F. T. Wood***
*Essentials of Communication by* ***D. G. Saxena***

## Phy 201 Semester -II Mathematical Physics-II

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I Differential Equations:**

Classification of differential equations: linear and nonlinear, homogeneous and non-homogenous equations.

**Linear ordinary Differential Equations:**

First order: Separable and exact equations. Integrating factor.

Second Order: Homogeneous equations with constant coefficient's. Wronskian and general solution Statement of Existence and Uniqueness theorem for initial value problems. Solution of non-homogeneous equations by operator (D) method. Particular integral. Method of undetermined coefficients and variation of parameters Equations reducible to those with constant coefficient.

**Unit II Fourier Series**

Fourier series, Dirichlet conditions (Statement only). Orthogonality of sine and cosine functions. Sine and cosine series. Distinctive features of Fourier expansions. Half-range expansions. Applications Square wave triangular wave, output of full wave rectifier and other simple functions Summary of infinite series

**Theory of Errors:**

Systematic and random errors. Propagation of errors. Standard and probable error. Least square fitting of data (linear case).

References:


1. Mathematical Physics by **P. K. Chattopadhyay ( T)**
2. Mathematical Physics by ***B. S. Rajput***
3. Mathematical Physics by ***Mathews and Walkers***
4. Mathematics for Physicists ***by Mary L Boas***.
5. Matrices and Tensors for Physicists by ***A. W. Joshi***

## Phy 202 Semester –II Mechanics –II

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I: Gravitation and Central Force Motion:**

Law of gravitation. Inertial and gravitational mass. Potential energy and field due to spherical shell and solid sphere.

Self-energy. Motion of a particle under central force field Angular momentum conservation one body problem two body problem and its reduction to one body problem and its solution. The energy equation and energy diagram. Kepler's laws. Satellites.

**Unit II Non-Inertial Systems:**

Inertial frame and Galilean transformation, Non-inertial frame and fictitious forces. Uniformly accelerating system. Physics in rotating coordinate systems, centrifugal and Coriolis forces.

Michelson-Morley experiment and its outcome. Postulates of special theory of relativity. Lorentz transformations. Simultaneity and order of events. Lorentz contraction and time dilation. Relativistic transformation of velocity, frequency and wave number. Velocity dependence of mass and equivalence of mass and energy. . Relativistic Doppler effect, Relativistic Kinematics, Transformation of energy and momentum

References:


1 Mechanics By ***B. S. Agarwal***
2 Introduction to Classical Mechanics by ***R. G. Takwale and P. S. Puranic***
3 Classical Mechanics of Rigid Bodies by ***Kiran C. Gupta***
4 Electrodynamics by ***Gupta S. L., Singh S. P. and Kumar V.***

## Phy -203 Semester-II Magnetism

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I Magnetic Field:**

Magnetic force between current elements and definition of B. Properties of B Amphere's Circuital Law, Curl and divergence of B, Vector potential. Magnetic flux. Calculation of B for circular and solenoid currents. Torque on a current loop in a uniform magnetic field. Magnetic dipole. Forces on an isolated moving charge.

**Magnetic Properties of Matter**:

B, H and their relation. Magnetic susceptibility. Stored magnetic energy in matter, Magnetic circuit B-H curve and energy loss in hysteresis.

**Unit II : Electromagnetic Induction:**

A conducting rod moving through a uniform magnetic field. A loop through on-uniform magnetic field.. A stationary loop with field source moving. Faraday's law of induction. Curl E-D B/dt. Mutual induction – reciprocity theorem ($M_{12} = M_{21}$) Self-induction, energy stored in magnetic field.

References:


1 Electricity and Magnetism by ***Benjamin Crowell .***
2 Electricity and Magnetism by ***A. S. Mahajam and Abbas A. Rangwala***.
3 Introduction to Electromagnetic Theory by ***Georage E. Owen***
4 Electromagnetic Theory by ***U. A. Bakshi and A. V. Bakshi***
5 Electromagnetic Theory and Electrodynamics, by ***Satya Prakash***

## Phy-204 Semester-II Mathematics-II

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

Unit-I

Functions of a real variable. Limits, continuity and differentiability of functions. Uniform continuity on (a.b) implying uniform theorem for analytic functions. Intermediate value theorems and Taylor's theorem and analytic functions. Taylor's and Maclaurin's series of elementary analytic functions. Functions of two and three reals variables their continuity and differentiability. Schwarz and Young theorem, implicit function theorem.

Unit-II

Definition and examples of Riemann integral of a bounded function. Riemann integrability of continuous and monotonic functions. Riemann integral as the limit of a sum. The fundamental theorem of integral calculus. Mean-value theorems.

Integration of rational and irrational functions. Integration by partial functions. Properties of definite integral. Reduction formulae.

References:

## Phy-205 Semester-II Chemistry-II

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit-I**

**General Organic Chemistry:**

Bonding in organic molecules and its effects on shape, chirallty and RS nomenclature as applied to chiral centers. Treatment of chirallty upto three chiral centers. Conformation of acrylic and cyclic systems, conformational analysis of disubstituted cyclohexanes. Geometrical isomerism and E-2 nomenclature.

Electronic displacements in organic molecules. Aromaticity. Reactivity of organic molecules. Heterolytic and hemolytic fission. Nucleophiles, electrophiles, acids and bases and their relative strengths (including carbon acids). Addition, elimination and substitution reactions (including electrophonic, nucleophilic and aromatic types).

**Unit-II**

Arynes and carbons as reaction intermediates.

Functional Group Chemistry:

Rationalisation of functional group reactivity on mechanistic basis of the following groups: hydroxyl, carbonyl, carboxyl and its derivatives such as ester and amide, cyano, nitro and amino, Orientation effect in aromatic substitution, polymerisationa and overview of polymers, Organic reactions as synthetic tools: Claisen, Cannizzaro, Grignard, Michael, Mannich, Darzen, aldol, Diekmann, Perkin etc.

## Phy-206 Semester-II Linear and Digital Integrated Circuits & Instrumentation-II

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :
1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I**

Sequential circuits: flip-flops – RS, JK , D, clocked, preset and clear operation, race-around conditions in JK Flip-flop, master slave JK flip-flop as building block of sequential circuits.

Shift registers: Serial-in-serial-out, serial-in-parallel-out, parallel-in-parallel-out, parallel-in-paralleled-out (only upto 4 bits).

Counters: Asynchronous counters, synchronous counter, decade counter.

D/A and A/D conversion: D/A converter-resistive network, accuracy and resolution. A/D converter (only counter method) – accuracy and resolution.

**Unit II Electronic Instruments:**

Timer: Simple applications of 555 timer circuits.

Power supply: requirement of ideal voltage and current source, voltage source, half-wave and full-wave rectifier, bridge rectifier, L and C filters, some idea of ripple.

Oscilloscope: Input attenuators, DC, AC and ground, horizontal and vertical deflecting system, time base generation and synchronization: measurement of positive, positive-negative wave shape, rise time and fall time; frequency, amplitude and phase of sinusoidal waves.

References:


1 **Integra**ted Electronics by ***J. Millman and C. C. Halkias (Tata MC. Garaw Hill)***

*2* Digital Electronics by ***William Gothmann (Parentice Hall of India)***

**3** Digital Hogic by ***J. M Yarbrough (Thomson Publication )***

**4** Electrical circuits and Basic Semiconductor Electronics **by** ***Agarwal J. P. Agarwal Amit.***

**Phy-207 Semester-II Physics Laboratory-II**
**Max. Marks 75**
**Period per week : 6 Hrs.**
**Time 3 Hrs.**

The distribution of marks in laboratory papers will be as follows:

| | |
|---|---|
| Laboratory report | 15 |
| Viva | 20 |
| Practical | 40 |

**Unit I : Electronics and Instrumentation:**

1. To design an amplifier of given gain using op-amp 741 in inverting and non-inverting configurations and to study its frequency response.
2. To design a precision differential amplifier of given I/O specification using 741.
3. To design an astable oscillator of given specifications using 555.
4. To design a monostable oscillator of given specifications using 555.

**Unit II: Measurement of Resistance and Voltage:**

1. Precise measurement of a low resistance using Carey Foster's bride potentiometer.
2. To calibrate a Resistance Temperature Device (RTD) to measure temperature in a specified range using null method/off-balance bridge with galvanometer based measurement.
3. To calibrate a thermocouple to measure temperature in a specified range using null method/direct measurement using an op-amp difference amplifier and to determine neutral temperature.
4. To determine the acceleration due to gravity using bar pendulum.
5. To determine the acceleration due to gravity using Kater's pendulum.
6. To determine the acceleration due to gravity and velocity for a freely failing body, using digital timing techniques.

:

7. To investigate the motion of a simple or physical pendulum with
   i) variation of moment of inertia and
   ii) viscous, frictional and electro-magnetic damping (e.g. motion of coil of a B.G.).
8. To investigate the motion of coupled oscillators.
9. To investigate the forced oscillations of an LCR circuit in series and parallel configurations and calculate quality factor Q.

**Chem.-208 Semester-II Chemistry Laboratory-II**

Max. Marks 75
Time 6 Hrs.

1. Potentiometer titration of Mohr's salt with $K_2C_{rx}O_7$ or $KmnO_4$ using digital multi-meter or low cost potentiometer.
2. Conduct metric titration of a solution of HCl or $CH_3$ COOH with NaOH by a direct reading conduct meter.
3. Determination of molecular mass of a polymer by measurement of viscosity.
4. The effect of detergent on the surface tension of water (Variation of surface tension with concentration to be studied).
5. Determination of the rate law for one of the following reactions. All solutions needed to be provided.
    a. Persulphate-iodide reaction.
    b. Iodination o acetone.
6. To study the kinetics of inversion of cane sugar (polar metrically).

**Eng.-201 Semester-II English**

**LITERATURE AND LANGUAGE-II**
**SEMESTER-II**
**SESSION 2016-17**

**SCHEME OF EXAMINATION**

| | |
|---|---|
| **Max. Marks** | **50** |
| **Theory** | **40** |
| **Internal Assessment** | **10** |
| **Time** | **3 Hours** |

**Part-A: Short Stories**

The following Stories from ***The Pointed Vision*** : An Anthology of Short Stories By Uaha Bande and Krishan Gopal (Oxford University Press, New Delhi):

1. ' The Bet' by Anton Chekhov
2. 'Gift of the Magi' by O Henry
3. 'The Postmaster' by Rabindranath Tagore
4. 'Three Questions' by Leo Tolstoy.
5. 'Three Dying Detective 'by Arthur Conan Doyle.
6. 'Under the Banyan Tree' by R. K. Narayan.

**Part- B**: (i) Grammar and Writing Skills

(a) Synonyms and Antonyms
(b) Prefix-Suffix
(c) Homophones and Homonyms
(d) One word substitution

(ii) (a) Developing writing skills through theme base paragraphs
(b) Technical writing: E-mail writing, Reporting, Resume writing, Re- viewing T. V. Programmes

**Instructions to the Paper Setter and the Students**

Q, No. 1 Explanation with reference to the context. The student will be required to attempt two passages (with internal choice) from the book of Stories. 4X2=8

Q. No. 2 Two essay type questions (with internal choice) from the book of Stories 4X2=8

Q. No. 3 this question will be based on grammar. Students will be required to attempt 16 sentences out of the given 24 8

Q. No. 4&5 Question No. 4 & 5 will be based on writing skills and technical writing. 4X2=8 each

**Suggested Reading:**

*High School Grammar by* ***Wren and Martin***
*Remedial English Grammar for Foreign Students by* ***F. T. Wood***
*Essentials of Communication by* ***D. G. Saxena***

## Phy-301 Semester-III Mathematical Physics III

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

NOTE :
1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

### Unit I: Complex Variables:

Importance of complex numbers and their graphical representation. De Moivre's theorem. Roots of complex numbers. Euler's formula. Functions of complex variables. Examples. Cauchy-Riemann conditions. Analytic functions. Singularities. Differentiation and integration of a function of a complex variable. Cauchy's theorem Cauchy's integral formula. Morera's theorem. Cauchy's inequality. Liouville's theorem. Fundamental theorem of algebra. Multiple valued functions, simple ideas of branch points and Riemann surface. Power series of a complex variable, Taylor and Laurent series, Residue and residue theorem. Multiple valued functions.

### Unit II

Contour integration and its application to evaluation of integrals.
Series Solution of Linear Second order Ordinary Differential Equations:
Singular points of second order differential equations and their importance.
Series methods (Frobenius) Legendre. Bessel, Hermite and Laguerre differential equations.

## Phy-302 Semester-III Thermal Physics-I

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

**NOTE :**

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

### Unit I : Kinetic Theory of Gases:

Derivation of Maxwell law of distribution of velocities and its experimental verification. Mean free path. Transport phenomena, viscosity, conduction and diffusion. Brownian motion. The theories of Langevin and Einstein and experimental determination of Avogadro's number. Examples of Brownian motion in physics (galvanometer mirror, sedimentation, Johnson's noise).

### Unit II

Ideal gases: Equation of state, internal energy, specific heats, entropy, Isothormal and adiabatic processes. Compressibility and expansion coefficient. Adiabatic lapse rate. Real gases: Deviations from the ideal gas equation. The virial equation, Andrew's experiments on $CO_2$ gas, continuity of liquid and gaseous state. Van der Wall's equation. Critical constants and law of corresponding states. Free expansion, Joule-Thomson effect.

## Phy-303 Semester-III Vibrations and Wave Optics-I

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

**NOTE:**

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

### Unit I : Vibrations

Free oscillations of system with one degree of freedom; Linearity and superposition principle. Superposition of (i) two and (ii) N collinear harmonic oscillations; beats System with two degrees of freedom (coupled oscillators). Normal coordinates and normal modes. Energy relation and energy transfer. Normal modes of N coupled oscillators. Normal modes of stretched string, Energy of vibrating string. Plucked and struck strings waves.

Wave equation. Traveling waves, Plane and spherical waves. Superposition of two harmonic waves. Standing waves on a string. Superposition of N harmonic waves. Pulses and wave packets.

### Unit II : Wave Optics

Introduction to different models, light waves, electromagnetic nature of light waves.
Coherence and Interference: Interaction of independent light sources. Classification in terms of division of amplitude and division of wave front. Young's double slit experiment, Lloyd's mirror and Fresnel's biprism. Interference in thin films parallel and wedge-shaped films. Fringes of equal inclination (Haidinger fringes) and fringes of equal thickness (Fizeau fringes).

Michelson's interferometer: Theory, form of fringes (mention only), applications, visibility of fringes.
Theory of partial coherence. Coherence time and coherence length, i.e. temporal and spatial coherence.
Fabry-Perot interferometer: Theory, Airy's formula, sharpness of fringes, finesse, visibility of fringes

## Phy-304 Semester-III Quantum Mechanics

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

**NOTE:**

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

### Unit I

Photoelectric effect. Compton effect. Reduced mass correction. De Broglie hypothesis. Wave particle duality. Davisson-Germer experiment. Wave packets. Two Slit experiment with electrons. Wave amplitude and wave functions, Probability. Uncertainty principle.

Basic postulates and formalism: Schrodinger equation, wave function, eigenvalues, probabilistic interpretation, conditions for physical acceptability of wave functions. Free particle. Time independent Schrodinger equation, stationary states. Particle in one-dimensional box, quantization of energy. Franck-Hertz experiment.

### Unit II

Scattering problem in one dimension : Reflection and transmission by a finite potential step. Stationary solutions, Attractive and repulsive potential barriers. Gamow theory of alpha decay. Quantum phenomenon of tunneling. Tunnel diode-qualitative description. Spectrum for a square well (mention upper bound-no calculation).

Bound state problems: General features of a bound particle system. One-dimensional simple harmonic oscillator. Particle in a spherically symmetric potential rigid rotator. Orbital angular momentum and azimuthal quantum numbers and space quantization. Physical significance. Radial solutions and principal quantum number. Hydrogen atom.

## Phy-305 Semester-III Mathematics III

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

**NOTE:**

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit-I : Analysis**

Sequences and series of functions of real variable. Point wise and uniform convergence. Welerstrass M-test Uniform convergence and continuity. Uniform convergence and differentiation. Uniform convergence and integration. Weterstrass approximation theorem. Power series and their convergence and uniform convergence. Definition of exponential, logarithmic and trigonometric functions by means of power series. Improper integrants and their convergence comparison, Abel's and Dirichlet's tests. Beta and Gamma functions and their properties. Differentiation under the sign of integration.

**Unit-II : Statistics:**

Probability Classical, relative frequency and axiomatic approaches to probability. Theorems of total and compound probability. Conditional probability. Independent events. Bayes theorem. Random variables. Discrete and continuous random variables distinction function. Expectation of a random variable. Moments, moment generating function and probability generating function.

**Phy-306 Semester-III Computer Fundamentals and Programming-I**

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

**NOTE:**

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I**

Basic components of computer system, their function and inter-types of computer systems. Brief idea of data storage and input/output devices Hexadecimal number system and arithmetic.

Microprocessor architecture and operations (Intel 8085/8086)

Basic concepts, functional block diagram, memory, memory organization and addressing, memory interfacing, input/output instruction cycle (timing diagram) Microprocessor programming algorithm and flowcharts, assembly language, 8085 instruction set and format: data transfer, arithmetic, logical and control operations, RIM and SIM Addressing modes (register, immediate, direct and indirect). Simple programming exercises (addition and multiplication, both 8 and 16 bit etc.)

**Unit II : Introduction of Fortran, Problem solving using Fortran**

Data types: Integer and Floating point arithmetic; Fortran variables; Real and Integer variables; Input and Output statements; Formats; Expressions; Built in functions; Executable and non-executable statements; Control statements; Go To statement; Arithmetic IF and logical IF statements; Flow charts; Truncation errors, Round off errors; Propagation of errors.

Block IF statement; Do statement; Character DATA management; Arrays and subscripted variables; Subprogrammes: Function and SUBROUTINE; Double precision; Complex numbers; Common statement.

**Phy-307 Semester-III Physics Laboratory I**

**Max. Marks 75**

**Periods per week : 6 Hrs**

**Time : 3 Hrs.**

The distribution of marks in laboratory papers will be as follows:

| | |
|---|---|
| Laboratory report | 15 |
| Viva | 20 |
| Practical | 40 |

**Unit I: Familiarisation with Devices**

1. Measurement of focal length of a lens; combination of lenses. Familiarisation with eyepieces.
2. Familiarisation with spectrometer : Schuster's focusing: determination of angle of prism.
3. Familiarisation with ballistic galvanometer : determination of charge sensitivity, current sensitivity, time period, logarithmic decrement and critical damping resistance.
4. Investigation of factors, which affect induced voltages in a coil using a CRO.
5. Investigation of factors, which determine secondary emf and current in, coupled cells.

**Unit II: Optics**

1. Experiments on prism-Resolving power/dispersive power/Determination of wavelength/Cauchy's constants.
2. Experiments on grating-Resolving power/dispersive power/Determination of wavelength.
3. Determination of wavelength using Fresnel's biprism.
4. Determination of wavelength using Newton's rings.
5. Determination of wavelength using Michelson's Interferometer.

**Phy-308 Semester-IV Digital Micro Processors and Computer Lab-I**

Max. Marks 75
Periods per week 6 Hrs.
Time: 3 Hrs.

The distribution of marks in laboratory papers will be as follows:

| | |
|---|---|
| Laboratory Report | 15 |
| Viva | 20 |
| Practical | 40 |

**Unit I : Use of Microprocessor kit and Elements of assembly Language.**

1. Use of hardware.
2. Addition and subtraction of numbers using direct and indirect addressing modes.
3. Multiplication by repeated addition.
4. Division by repeated subtraction.
5. Handling of 16-bit numbers
6. Use of CALL and RETURN interdictor.
7. Block data handling.
8. Other exercises (e.g. parity check etc.)

**Unit II: Elements of FORTRAN Programming.**

1. To evaluate a polynomial (e.g. converting Fahrenheit to Celsius, area of a circle, volume of sphere etc.)
2. to find roots of a quadratic equation (real and distinct, real and repeated and imaginary).
3. To find sum and average of a list of numbers, both with and without the use of arrays.
4. To calculate powers of a number.
5. (i) To locate a number in a given list (linear search)
   (ii) To check whether a given name is in a list.
6. (i) To find the largest of three numbers.
   (ii) To find the largest number in a given list of numbers.
7. (i) To check whether a given number is a prime number.
   (ii) To calculate the first 100 prime numbers.
8. To rearrange a list of numbers in ascending and descending order.
9. (i) To calculate factorial of a number.
   (ii) To calculate the first factorials.
10. Manipulation of matrices.
    (i) Addition, subtraction and multiplication.
    (ii) Trace of a matrix
    (iii) Sum of elements of a row and a column.

Solution of simultaneous equations.
Programming exercises based on numerical methods.

## Phy-401 Semester-IV Mathematical Physics IV

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

**NOTE:**

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two question from each unit. A student has to attempt five question in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

### Unit I : Special Functions

Gamma and Beta functions.

Legendre, hermite and Laguerre Polynomials: Rodrigues formulae, generating functions, recurrence relations, orthogonality.

Series expansion of a function in terms of a complete set of Legendre functions. Bessel functions : first and second kind, generating function, recurrence formulas, zeros of Bessel functions and orthogonality Fraunhofer, diffraction integral for circular aperture.

### Unit II: Partial Differential Equations:

General solution of wave equation in 1 dimension. Transverse vibration of stretched string. Oscillation of hanging chain. Wave equation in 2 and 3 dimensions. Vibrations of rectangular and circular membrane.

Derivation of the equation of heat conduction. Heat flow in one-two-and three-dimensional rectangular systems of finite boundaries, Temperature inside circular plate. Laplace equation in Cartesian, cylindrical and spherical coordinate systems. Problems of steady flow of heat in rectangular and circular plate. Gravitational potential of a ring.

## Phy-402 Semester-IV Thermal Physics-II

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

**NOTE :**

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I : Thermodynamics:**

Zeroth and first law of thermodynamics. Reversible and irreversible processes. Conversion of heat into work. Carnot theorem Second law of thermodynamics. Thermodynamic temperature. Clausius inequality. Entropy, Entropy changes in reversible and irreversible processes. Temperature-entropy diagrams. The principle of increase of entropy & its applications.

**Unit II**

Thermodynamic potentials: Enthalpy, Gibbs and Helmholtz functions. Maxwell relations and their applications. Magnetic work. Magnetic cooling by adiabatic demagnetization, approach to absolute zero, change of phase, equilibrium between a liquid and its vapour. Clausius-Clapeyron equation. The triple point with examples from physics. Second order phase transitions.

## Phy-403 Semester-IV Vibration and Wave Optics-II

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

**NOTE :**

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two question from each unit. A student has to attempt five question in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I Diffraction**

Kirchhoff's integral theorem. Fresnel-Kirchhoff integral formula and its application to diffraction problems.

Fraunhofer diffraction: Single slit, rectangular and circular aperture. Multiple slit. Plane diffraction grating. Resolving power and depressive power of a plane diffraction grating.

**Unit II**

Fresnel diffraction: Fresnel's integrals, Cornu's spiral, Fresnel diffraction pattern at a straight edge, a slit and a wire (qualitatively using Cornu's spiral).

Holography : Principle of holography, recording and reconstruction method and its theory as interference between two plane waves.

## Phy-404 Semester-IV Atomic and Nuclear Physics

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

**NOTE :**

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two question from each unit. A student has to attempt five question in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I**

Atoms in electric and magnetic fields: Electron spin. Stern-Gerlach experiment. Orbital angular momentum, dipole moment and energy in magnetic field from classical viewpoint. Zeeman effect. Spin-orbit coupling. Fine structure. Total angular momentum.

Many-electron atoms: Pauli exclusion principle, Many particles in one-dimensional box, Symmetric and antisymmetric wave functions. Atomic shell model and periodic table, Spectral notations for atomic states. Vector model. L-S and jj coupling Doublet Structure of alkali spectra. Empirical evidence of multiplets, Selection rules.

**Unit II : Nucleus**

Properties: mass, size, angular momentum, constituents, binding energy, stability.

Models: Liquid drop model. Mass formula. Shell model, nuclear forces.

Radioactivity : Law of radioactive decay. Theory of successive radioactive transformations. Radioactive series (mention the series-diagram not needed)

## Phy-405 Semester-IV Mathematics IV

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

**NOTE :**

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two question from each unit. A student has to attempt five question in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit-I**

Discrete and continuous distribution, Binomial, Poisson, geometric, normal and exponential distributions. Bivariate distribution, conditional distribution and marginal distribution. Correlation and regression for two variables only, Weak law of large numbers. Central limit theorem for independent and identically distributed random variables.

**Unit-II : Statistical inference:**

definitions of random sample, parameter and statistic. Concept of sampling distribution and standard error sampling distribution of mean variance of random sample from a normal population. Tests of significance based on t.f. and chi-square distributions.

**Phy-406 Semester-IV Computer Fundamentals and Programming-II**

Max. Marks : 40
Internal Assessment : 10
Time : 3 Hrs.

**NOTE :**

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two question from each unit. A student has to attempt five question in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I: Errors and Iterative Methods.**

Truncation and round-off errors, floating point computation, overflow and underflow, single and double precision arithmetic, iterative process, solution of non-linear equations: bisection, secant and Newton-Raphson methods. Comparison and error estimation. Program for finding zeros of a given function.

Solution of simultaneous linear equations : Gauss elimination and iterative (Gauss-Seidel) method. Computation of eigenvalues and eigenvectors of matrices using iterative process. Program for finding solution of a given system of three coupled linear equations. Solution of simultaneous linear equations : Gauss elimination and iterative (Gauss-Seidel) method. Computation of eigenvalues and eigenvectors of matrices using iterative process. Program for finding solution of a given system of three coupled linear equations.

**Unit II : Numerical Differential and integral Calculus.**

Interpolation (Newton forward and backward formulas). Program for (a) Interpolating data points and (b) first and second derivative of a given function/data.

Integration: General quadrature formula, trapezoidal and Simpson's rule, Gauss quadrature formulas: Gauss-Hermite, Gauss-Legendre. Program for Integrating a given function using Simpson and Gauss-Legendre methods.

Solution of ordinary differential equations : Euler method and Runge-Kutta method of second order with error estimation, idea of predictor-corrector method. Program for solving initial value problem for a first order differential equation using Runge-Kutta method.

**Phy-407 Semester-IV Physics Laboratory II**

**Max. Marks 75**
**Periods per week : 6 Hrs.**
**Time 3 Hrs.**

The distribution of marks in laboratory papers will be as follows:

| | |
|---|---|
| Laboratory Report | 15 |
| Viva | 20 |
| Practical | 40 |

**Unit I: Measurement of High Resistance and Charge**

1. Determination of dielectric constant of a dielectric placed inside a parallel plate capacitor using a B.G.
2. Measurement of charge by determination of time of impact.
3. Measurement of high resistance by method of leakage.

**Unit II : Measurement of Self Inductance and Mutual Inductance**

1. Using absolute method.
2. Using A.C. bridge.
3. Determination of heat conductivity of a good conductor by Angstrom method/Searle's method.
4. Determination of heat conductivity of a bad conductor by Lee's method. (Use of heating elements in preference to steam recommended)

5 Measurement of small thickness using Interference or diffraction.

6 Measurement of refractive index of transparent and opaque liquids using total internal reflection.

7 Measurement of Intensity using photo sensor and laser in diffraction patterns of single and double slits.

**Phy-408 Semester-III Digital Micro Processors and Computer Lab-II**

**Max. Marks 75**

**Periods per week : 6 Hrs**

**Time : 3 Hrs.**

The distribution of marks in laboratory papers will be as follows:

| | |
|---|---|
| Laboratory Report | 15 |
| Viva | 20 |
| Practical | 40 |

**Unit I : Combinational logic**

1. Verification and design of AND, OR, NOT and XOR gates using NAND gates.
2. To design a combinational logic system for a specified truth table.
3. To convert a Boolean expression into a logic gate circuit and assemble it using logic gate Ics.
4. To minimize a given logic circuit.
5. To study TTL Ics (binary decoder, 7-segment decoder, Schmitt trigger).
6. To design a seven-segment display driver.

**Unit II: Arithmetic and Logic Units (ALU)**
**(Building of basic ingredients of ALU)**

1. Half adder, full adder and 4-bit binary adder.
2. Half subtract or, full subtract or adder subs tractor using full adder IC
3. To built flip flop circuits using elementary gates (Rs, Clocked RS, D-Type, JK flip-flop).
4. To build a 4-bit counter using D-type/JK flip-flop.
5. To make a shift register from D-type flip-flop.
6. Serial and parallel shifting of data.
7. To design an analog to digital converter of given specifications.
8. To design a digital to analog converter of given specifications

# B.Sc.(Hons) Physics

**Phy-501 (Semester-V) Mathematical Physics-V**

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I (A):Linear Vector Spaces and Matrices.**

Introduction to groups, rings and fields.

Vector spaces and subspaces. Linear independence-basis and dimensions. Linear transformations. Algebra of linear transformations. Non-singular transformations. Isomorphism. Representation of linear transformations by matrices.

**Unit II:**

**Matrix algebra** Addition and multiplication null and unit matrices. Singular and non-singular matrices. Inverse of a matrix Eigenvalues and eigenvectors. Digitalization solution of coupled linear ordinary differential equations.

**Special matrices**: Hermitian and skew symmetric and antisymmetric, orthogonal and unitary matrices Similarly transformations and bilinear and quadratic forms. Trace of a matrix Cayley-Hamilton theorem. Function of a matrix.

**Metric spaces**. Inner product and metric concept.

**Recommended Books**


1 Mathematical Physics by **P. K. Chattopadhyay ( T)**
2 Mathematical Physics by ***B. s. Rajput***
3 Mathematical Physics by ***Mathews and Walkers***
4 Mathematics for Physicists ***by Mary L Boas***.
5 Matrices and Tensors for Physicists by ***A. W. Joshi***

# B.Sc.(Hons) Physics

## *Phy-502 (Semester-V) Electromagnetic Theory-I*

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

### Unit- I

Maxwell equations. Displacement current, Vector and scalar potentials. Gauge transformations : Lorentz and Coulomb gauge. Boundary conditions at interface between different media. Wave equations. Plane waves in dielectric media.

Poynting theorem and Poynting vector. Energy density. Physical concept of electromagnetic (e.m) field momentum density and e.m field angular momentum density.

### Unit -II

Reflection and refraction of a plane wave at a plane interface between dielectrics. Fresnel formulae. Total internal reflection Brewster's angle. Waves in conducting media. Metallic reflection (normal incidence). Skin depth.

Maxwell's equations in microscopic media (plasma) Characteristic plasma frequency. Refractive index. Conductivity of an ionized gas. Propagation of e.m. waves in ionosphere.

### *Book Prescribed*

1 Electromagnetic by **B. B. Laud**
**2** Classical Electricity and Magnetism by **Panofsky and Phillips**
3 Electromagnetic Theory and Electrodynamics by **Satys Praksh.**
4 Electromagnetic fields and Waves by **V. V. Sarwate.**
5 Electrodynamics by **Gupta S. L. , Singh S. P. and Kumar V**

# B.Sc.(Hons) Physics

***Phy-503 (Semester-V) Statistical Physics-I***

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

## Unit- I : Classical Statistics

Entropy and thermodynamic probability. Maxwell Boltzmann distribution law. Partition function. Thermodynamic functions of finite number of energy levels. . Thermodynamic functions of an ideal gas. Classical entropy expression, Gibbs paradox. Law of equipartition of energy – applications to specific heat and its limitations.

## Unit -II : Classical Theory of Radiation

Properties of thermal radiation, Kirchhoff's law, Stefan-Boltzmann law and Wien's displacement law

Quantum Theory of Radiation

Planck's law of black-body radiation. Deduction of Wien's radiation formula, Rayleigh-Jeans law. Stefan-Boltzmann law and Wien's displacement law from Planck's law.

Laser: working principle, thermal equilibrium of radiation, principle of detailed balance, Einstein's A and B coefficients, population inversion. Two-level and three-level systems.

**Book Prescribed**

1 Statistical Mechanics by **K. Hung**
**2** Statistical Mechanics by **R. K. Patharir**
3 Statistical Mechanics by **B. K. Aggarwal and M. Eisner**
**4** Statistical Physics by **Landoan and Lif Shitz**
**5** Statistical Mechanics by **R. Kubo**
6 Elementary Statistical Mechanics by **Gupta and Kumar**

# B.Sc.(Hons) Physics

***Phy-504 (Semester-V) Physics of Materials-I***

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I : Crystal Structure**

Amorphous and crystalline materials.

Lattice translation vectors. Lattice with a basis-central and non-central elements. Unit cell, reciprocal lattice. Types of lattices. Crystal diffraction : Bragg's law, diffraction of X-rays, atoms and geometrical structure factor.

S-ray diffraction methods – measurement of lattice parameter for cubic lattices.

**Unit II: Elementary Lattice Dynamics**

Lattice vibrations. Linear monoatomic and diatomic chains. Acoustical and optical phonons. Qualitative description of the phonon spectrum in solid Brillouin zones. Einstein and Debye theories of specific heat of solids $T^3$ law.

Magnetic Properties of Matter

Response of substances of magnetic field Dia, para and ferri and ferromagnetic materials. Classical Langevin theory of dia and paramagnetic domains. Quantum mechanical treatment of paramagnetism. Curle's law, Weiss's theory of ferromagnetism and ferromagnetic domains and discussionof B.H hysteresis. Qualitative discussion of ferrimagnets and ferrites.

**Book Prescribed**


**1** Introduction to Solid State Physics by **C. Kittel**
**2** Solid State Physics : Structure and Properties of Material by **M. A. Wahab**
**3** Solid State Theory by **W. A. Harrison**
**4** Solid State Physics by **H. E. Hall.**

# B.Sc.(Hons) Physics

***Phy-505 (Semester-V) Electronics Devices : Physics and Applications-I***

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I**

Mesh analysis for d.c. and a.c. circuits: Nodal analysis duallty in networks. To Equivalent of a four terminal network. Thevenin and Norton theorem. Maximum power tranfer, superposition and reciprocity theorems. Z, Y, H parameters.

Basic semiconductor physics – p and n type semiconductors, energy level diagram, conductivity and mobility, pn junction fabrication 9simple idea). Barrier formation in pn junction diode, current flow mechanism in forward and reverse biased diode (recombination, drift and saturation of drift velocity).

**Unit II**

Single pn junction devices (physical explanation, current voltage characteristics and one or two applications0 Two terminal devices-rectifier diode, Zener diode, photo diode, LED, solar cell and varactor diode. Three-terminal devices-junction field effect transistor (FET), unijunction transistor (UJT) and their equivalent circuits.

Two junction devices p-n-p and n-p-n transistors, physical mechanism of current flow, active, cutoff and saturation regions. Transistor in active region and equivalent circuit.

***Book Prescribed***


**1** Introduction to Semiconductor Devices by **M. S. Tyagi**

**2** Semiconductor Electronics by **A. K. Sharma, New Age International Publisher (1996)**

**3** Optical Electronics by **Ajay Ghatak and K. Thygarajan, Cambridge Univ. Press**

**4** Semiconductor Device- Physics and Technology by **S. M. Sze, Wiley (1985)**

**5** Measurement, Instrumentation and Experimental Design, in Physics and Engineering by **M. Sayer and A. Mansingh, Prentice Hall, India (2000)**

# B.Sc.(Hons) Physics

**Phy-506 (a) (Semester-V) Nano Technology**

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

Note:

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit- I**

Free electron theory (qualitative idea) and its features, Idea of band structure, Metals, insulators and semiconductors, Density of states in bands, Variation of density of states with energy, Variation of density of states and band gap with size of crystal.

**Unit -II**

Electron confinement in infinitely deep square well, confinement in two and one dimensional well, Idea of quantum well structure, Quantum dots, Quantum wires.

**Text and Reference Books:**


1. Nanotechnology Molecularly designed materials by **Gan -Moog Chow, Kenneth E. Gonsalves, American Chemical Society**
2. Quantum dot heterostructures by **D. Bimerg, M. Grundmann and N.N. Ledenstov, John Wiley & Sons, 1988.**
3. Nano technology : :molecular speculations on global abundance by **B.C. Crandall, MIT Press 1996.**
4. Physics of low dimensional semiconductors by **John H. Davies, Cambridge Univ. Press 1997.**
5. Physics of Semiconductors nano structures by **K.P. Jain, Narosa 1997**.
6. Nano fabrication and bio system : Integrating materials science engineering science and biology by **Harvey C. Hoch, Harold G. Craighead and Lynn Jelinskii, Cambridge Univ. Press 1996.**
7. Nano particles and Nano structured films ; Preparation characterization and applications Ed. J.H. **Fendler, John Wiley & Sons 1998.**

# B.Sc.(Hons) Physics

## Phy-506 (b) (Semester-V) Environmental Physics

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit -I Essentials of Environmental Physics**

Structure and thermodynamics of the atmosphere, Composition of air, Greenhouse effect Transport of matter, energy and momentum in nature, Stratification and stability of atmosphere. Laws of motion, hydrostatic equilibrium, General circulation of the tropics, Elements of weather and climate of India.

**Unit -II Solar and Terrestrial Radiation**

Physics of radiation, Interaction of light with matter, Rayleigh and Mie scattering, Laws of radiation (Kirchoffs law, Planck's law, Wien's displacement law, etc.), Solar and terrestrial spectra, UV radiation, Ozone depletion problem, IR absorption energy, balance of the earth atmosphere system.

**Text and Reference Books**


1. **Egbert Boeker & Rienk Van Groundelle** : Environmental Physics (John Wiley).
2. **J.T. Hougtion** : The Physics of Atmosphere (Cambridge University Press 1977).
3. **J. Twidell and J. Weir,** Reneable Energy Resources (Elbs, 1988).
4. **Sol Wieder**. An introduction to Solar Energy for Scientists and Engineers (John Wiley, 1982)
5. **R.N. Keshavamurthy and M. Shanker Rao** : The Physics of Monsoons (Allied Publishers, 1992).
6. **G.J. Haltiner and R.T. Williams** : Numerical Weather Prediction (John Wiley , 1980

# B.Sc.(Hons) Physics

**Phy-507 (Semester-V) Physics Laboratory V**

Max. Marks : 75
Periods **per week : 6 Hrs.**
Time : 3 Hrs**.**

| | |
|---|---|
| Laboratory report | 15 |
| Viva | 20 |
| Practical | 40 |

**Unit- I:** Measurement of Magnetic Field and Related Parameters

1. Measurement of field strength B and its variation in a solenoid (determination or dB/dx).
2. Determination of B-H curve using ballistic galvanometer.
3. Determination of magnetic susceptibility for liquids and solids.
4.

**Unit -II: Polarisation**

1. Polarisation of light by simple reflection (determination of variation of percentage reflection and degree of polarization with angle of incidence).
2. Determination of specific rotation for cane sugar solution.
3. Study of elliptically polarized light.
4. To find resolving power of telescope.
5. To find magnifying power of telescope.
6. To find area / height using sextant.

# B.Sc.(Hons) Physics

**Phy-508 (Semester-V) Physics laboratory –VI & Project**

Max. Marks : 75
Periods per week : 6 Hrs.
Time : 3 Hrs.

| | |
|---|---|
| Laboratory report | 15 |
| Viva | 20 |
| Practical | 40 |

**Unit I : Power supply**

1. To design a semiconductor power supply of given rating using half wave a full wave or bridge rectifier and investigate the effect of C-filter.
2. To investigate simple regulation and stabilization circuits using zener diodes and voltage regulator Ics.

**Unit II: Transistor Applications:**

1. to study the various transistor biasing configurations.
2. To design of CE amplifier of a given gain (midgain) using voltage divider bias.
3. To design an oscillator of given specifications.
4. To study the characteristics of a FET and design a common source amplifier.

**Operational Amplifier based Experiments.**

1. To investigate the use of an op-amp as an integrator.
2. To investigate the use of an op-amp a differentiator
3. To design an analog circuit to simulate the solution of first/second order differential equation.
4. To design an op-amp oscillator.

# B.Sc.(Hons) Physics

## Phy-601 (Semester-VI) Mathematical Physics-VI

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

### Unit I: Cartesian Tensors

Transformation of co-ordinates. Tensorial character of physical quantities. Symmetric and anti-symmetric lasers, Contraction and differentiation, Pseudotensors, Kronecker and attemating tensors, Step function and Diract delta function.

Fourier transform . Fourier integral theorem, Sine and cosine transforms.

### Unit II : Integral Transforms:

Convolution theorem, Solution of one dimensional diffusion and wave equations, Heat flow in an infinite and semi-in-finite rod.

Laplace transform, Transform of elementary functions, Derivatives and integrals, Unit step function, Periodic function, Translation substitution and convolution theorem, Solution of first and second order ordinary differential equations Solution of partial differential equations.

Evaluation of integrals using transforms.

### Recommended Books


1 Mathematical Physics by P. K. Chattopadhyay ( T)
2 Mathematical Physics by *B. S. Rajput*
3 Mathematical Physics by *Mathews and Walkers*
4 Mathematics for Physicists *by Mary L Boas*.
5 Matrices and Tensors for Physicists by *A. W. Joshi*

# B.Sc.(Hons) Physics

***Phy-602 (Semester-VI) Electromagnetic Theory-II***

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit -I**

Polarization of e.m. waves. Description of linear, circular and elliptical polarization.

Propagation of e.m waves in anisotropic media Symmetric nature of dielectric tensor. Fresnel's formula. Light propagation in uniaxial crystal. Double refraction. Nicol prism. Production of circularly and elliptically polarized light. Babinet compensator. Analysis of polarized light.

**Unit -II**

Wave guides. Coaxial transmission line. Modes in rectangular wave guide Energy flow and attenuation in wave guides, Rectangular resonant caves.

Planar optical wave guides Planar dielectric wave guide, condition of continuity at interface. Phase shift on total reflection, eigenvalue equations, phase and group velocity of the guided waves, field energy and power transmission. Book Prescribed

1 ***Electromagnetic by*** *B. B. Laud*
2 ***Classical Electricity and Magnetism by*** *Panofsky and Phillips*
3 ***Electromagnetic Theory and Electrodynamics by Satya Praksh.***
4 ***Electromagnetic fields and Waves by V. V. Sarwate.***
5 ***Electrodynamics by Gupta S. L. , Singh S. P. and Kumar V***

# B.Sc.(Hons) Physics

**Phy-603 (Semester-V) Statistical Physics-II**

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit -I : Bose Einstein Statistics**

B.E. distribution law. Thermodynamic functions of an ideal weakly degenerate gas Strongly degenerate Bose gas, Bose-Einstein condensation properties of liquid He (qualitative description). Radiation as photon gas Bose's derivation of Planck's law. Thermodynamic functions of photon gas.

Specific heat of hydrogen: quantization of rotational and vibration motion, ortho and para hydrogen.

**Unit -II : Fermi-Dirac Statistics**.

Fermi-Dirac distribution law, Fermi energy. Thermodynamic functions of an ideal weakly degenerate Fermi gas. Strongly degenerate Fermi gas, Electron gas in a metal, specific heat of metals, Richardson's equation of thermionic emission.

Third law of thermodynamics. Absolute definition of entropy. Consequences of third law, unattainability of absolute zero.

**Book Prescribed**

1 Statistical Mechanics by **K. Hung**
2 Statistical Mechanics by **R. K. Patharia**
3 Statistical Mechanics by **B. K. Aggarwal and M. Eisner**
4 Statistical Physics by **Landoan and Lif Shitz**
5 Statistical Mechanics by **R. Kubo**
6 Elementary Statistical Mechanics by **Gupta and Kumar**

# B.Sc.(Hons) Physics

***Phy-604 (Semester-VI) Physics of Materials-II***

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit I: Dielectric Properties of Materials.**

Polarization, Local electric field at an atom. Depolarization field, Lorentz fields of dipoles inside a cavity.

Dielectric constant and polrizability: Electric susceptibility, polarizability, Clausius-Mosotti equation. Qualitative discussion of ferroelectric properties of materials and P-E hysteresis loop.

**Unit II : Electrical Properties of Materials**

Qualitative description of free electron theory and its inadequacies with reference to Hall effect and specific heat of electrons in a metal.

Elementary band theory-Bloch theorem, Kronig-Penney model, effective mass of electron, concept of hole. Band gaps, difference between conductors, semiconductors and insulators, intrinsic and action, conductivity in semiconductors, mobility of carriers (lattice & semiconductors (qualitative).

**Book Prescribed**

1. Introduction to Solid State Physics by **C. Kittel**
2. Solid State Physics : Structure and Properties of Material by **M. A. Wahab**
3. Solid State Theory by **W. A. Harrison**
4. Solid State Physics by **H. E. Hall**.

# B.Sc.(Hons) Physics

## Electronics Devices : Physics and Applications-II

### *Phy-605 (Semester-VI)*

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit- I**

Amplifiers – Only bipolar junction transistor, CB, CE and CC configurations. Single stage CE amplifier (biasing and stabilization circuits, Q-point, equivalent circuit, input impedance, output impedance, voltage and current gain). Class A, B. C amplifiers (definitions) RC coupled amplifiers (frequency response, Boe plot, amplitude and phase) Class B push-pull amplifier.

Feedback in amplifiers – Voltage feedback and current feedback Effect of negative voltage series feedback on input impedance, output impedance and gain, stability distortion and noise.

**Unit -II**

Oscillators – barkhausen criterion, Colpitts, phase shift and crystal oscillators.
Multivibrators and sweep circuits Basic circuits of astable, bistable and monostable multivibrators, Details of astable multivibrators (Derivation of time period). Sweep circuit using transistor as a switch and UJT (derivation of time period).

***Book Prescribed***


1 Introduction to Semiconductor Devices by **M. S. Tyagi, Tyal Wiley and Sons.**
2 Semiconductor Electronics by **A. K. Sharma, New Age International Publisher (1996)**
3 Optical Electronics by **Ajay Ghatak and K. Thygarajan, Cambridge Univ. Press**
4 Semiconductor Device- Physics and Technology by **S. M. Sze, Wiley (1985**)
5 Measurement, Instrumentation and Experimental Design, in Physics and Engineering by **M. Sayer and A. Mansingh, Prentice Hall, India (2000**)

# B.Sc.(Hons) Physics

**Phy-606 (a) (Semester-VI) Nano Technology**

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

**Unit 1**

Determination of particle size, Increase in width of XRD peaks of nanoparticles, Shift in photoluminescence peaks, Variations in Raman spectra of nano-materials.

**Unit II**

Different methods of preparation of nanomaterials, Bottom up : Cluster beam evaporation, Ion beam deposition, Chemical bath deposition with capping techniques and Top down : Ball Milling.

**Text and Reference Books :**


**1.** Nanotechnology Molecularly designed materials by **Gan -Moog Chow, Kenneth E. Gonsalves, American Chemical Society**

2 Quantum dot heterostructures by **D. Bimerg, M. Grundmann and N.N. Ledenstov, John Wiley & Sons, 1988.**

3 Nano technology: molecular speculations on global abundance by **B.C. Crandall, MIT Press 1996.**

4 Physics of low dimensional semiconductors by **John H. Davies, Cambridge Univ. Press 1997.**

5 Physics of Semiconductors nano structures by **K.P. Jain, Narosa 1997.**

6 Nano fabrication and bio system: Integrating materials science engineering science and biology by **Harvey C. Hoch, Harold G. Craighead and Lynn Jelinskii, Cambridge Univ. Press 1996.**

7 Nano particles and nano structured films ; Preparation characterization and applications Ed. J.H. **Fendler, John Wiley & Sons 1998**.

# B.Sc.(Hons) Physics

**Phy-606 (b) (Semester-VI) Environmental Physics**

Max. Marks : 40
Internal Assesment: 10
Time : 3 Hrs.

NOTE :

1. The syllabus is divided into 2 units. Eight questions will be set up. Four questions from each unit. Student will have to attempt at least two questions from each unit. A student has to attempt five questions in all.
2. 20% numerical problems are to be set.
3. Use of Scientific (non-programmable) calculator is allowed.

## Unit -I Environmental Pollution and Degradation

Elementary fluid dynamics. Diffusion, turbulence and turbulent diffusion. Factors governing air, water and noise pollution. Air and water quality standards. Waste disposal. Heat island effect. Land and see breeze. Puffs and plumes. Gaseous and particulate matters. Wet and dry deposition.

## Unit -II Environmental Changes and Remote Sensing

Energy source and combustion processes Renewable sources of energy. Solar energy, wind energy, bioenergy, hydropower, fuel cells, nuclear energy. Forestry and bioenergy.
Elements of weather and climate. Stability and vertical motion of air. Horizontal motion of air and water. Pressure gradient forces. Viscous forces. Inertia forces. Reynolds number. Enhanced Greenhouse Effect. Energy balance ,a zero dimensional Greenhouse model, Global climate models.

## Text and Reference Books


1. **Egbert Boeker & Rienk Van Groundelle** : Environmental Physics (John Wiley).
2 **J.T. Hougtion** : The Physics of Atmosphere (Cambridge University Press 1977).
3 **J. Twidell and J. Weir, Reneabl**e Energy Resources (Elbs, 1988).
4 **Sol Wieder**. An introduction to Solar Energy for Scientists and Engineers (John Wiley, 1982)
5 **R.N. Keshavamurthy and M. Shanker Rao** : The Physics of Monsoons (Allied Publishers, 1992).
6 **G.J. Haltiner and R.T. Williams** : Numerical Weather Prediction (John Wiley , 1980)

# B.Sc.(Hons) Physics

**Phy-607 (Semester-VI) Physics Laboratory VII**

Max. Marks : 75
Time per week : 6 Hrs.
Time : 3 Hrs.

| | |
|---|---|
| Laboratory report | 15 |
| Viva | 20 |
| Practical | 40 |

**Unit- I: Determination of Fundamental Constants**:

1. Determination of Boltzmann constant by studying forward characteristics of a diode.
2. Determination of e/m by method of magnetic focusing or bar magnet.
3. Determination of Stefan's constant.

**Unit -II: Measurements in Solid State Physics**.

1. Measurement of resistivity as a function of temperature for a Ge crystal using four probe method (from room temperature to 200 C) and determination of energy gap.
2. Determination of Hall coefficient of a given sample.
3. Determination of PE hysteresis of a ferroelectric crystal.
4. measurement of magnetic susceptibility.
5. Ultrasonic grating.
6. Determination of wavelength of H-alpha emission line of hydrogen atom.
7. Determination of absorption lines in the rotational spectrum of iodine vapour.

# B.Sc.(Hons) Physics

**Phy-608 (Semester-VI) Physics laboratory –VIII & Project**

Max. Marks : 75
Time per week : 6 Hrs.
Time : 3 Hrs.

| | |
|---|---|
| Laboratory report | 15 |
| Viva | 20 |
| Practical | 40 |

**Unit -I: Modulation.**

1. To study amplitude modulation using transistor.
2. To study a crystal rectifier.
3. To study pulse width/pulse position and pulse amplitude modulation using Ics.

**Multivibrators and Sweep Circuits**.

1. To study the characteristics of a UJT and design a single relaxation oscillator.
2. To design an astable multivibrator of given time period fail lisecond order).
3. To design a sweep of given amplit ude and true.

**Unit -II**

**Transducers.**

1. To determine the coupling coefficient of a piezo-electric crystal.
2. To determine the characteristics of pn juction of a solar
3. To study the characteristics of a photo-diodes.

**Networks.**

1. To verify the Thevenin, Norton and maximum power transfer theorems.
2. Measurement of input and output impedance of an unknown network and making equivalent T and P circuit