B.Sc. (Hons.) PHYSICS SYLLABUS 2019 BATCH ONWARDS
(UPDATED ON 01.08.2019)

B.Sc (HONS.) PHYSICS: It is an Under Graduate (UG) programme in Physics of 03 years (6 semesters) duration and is in accordance with UGC Choice Based Credit System (CBCS).

ELIGIBILITY FOR ADMISSION: Should have passed 10+2 examination with at least 50% marks with English, Physics, Chemistry, Mathematics / Biology

COURSE STRUCTURE: As per the UGC guidelines, UG degree with Honours in Physics includes Core Courses (CC), Ability Enhancement Compulsory Courses (AECC), Discipline Specific Electives (DSE), Generic Electives (GE), Skill Enhancement Courses (SEC) and Non Credit Courses (NCC). On the basis of these guidelines, the course structure for B.Sc. (Hons.) Physics has been designed as detailed below.

Sem.	Course Type						Contact Hours	Marks	Credits
	CC	DSE	GE	SEC	AECC	NCC			
I	2	0	2	1	1		32	900	25
II	2	0	2		1	1	30	900	23
III	3	0	2				34	900	27
IV	3	0	1			1	30	800	23
V	2	2	0	1			32	700	26
VI	2	2	0				28	600	24
Total	**14**	**4**	**7**	**2**	**2**	**2**	**-----**	**4800**	**148**

STUDY SCHEME

1st Semester			Contact Hrs.			Marks			Credits
Subject Code	Course Type	Subject	L	T	P	Internal	External	Total	
BHUMA0 -001	AECC-I	Communicative English	2	0	0	40	60	100	2
BMATH5-101	GE-I	Mathematics-I	3	1	0	40	60	100	4
BMATH5-102		Basic Mathematics-I*							
BPHYS1-101	CC-I	Electricity and Magnetism	4	0	0	40	60	100	4
BPHYS1-102	CC-II	Mechanics	4	0	0	40	60	100	4
BCHMS1-101	GE-II	Inorganic Chemistry – I	4	0	0	40	60	100	4
BPHYS1-104	CC-I Lab	Electricity and Magnetism Lab	0	0	4	60	40	100	2
BPHYS1-106	CC-II Lab	Mechanics Lab	0	0	4	60	40	100	2
BCHMS1-103	GE-II Lab	Inorganic Chemistry – I Lab	0	0	2	60	40	100	1
BPHYS1-108	SEC-I	Computational Physics Skills	0	0	4	60	40	100	2
		Total	**17**	**1**	**14**	**440**	**460**	**900**	**25**

*Students from Medical stream will study Basic Mathematics – I and Students from Non Medical stream will study Mathematics – I

2nd Semester			Contact Hrs.			Marks			Credits
Subject Code	**Course Type**	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BMNCC0-002	AECC-II	Environmental Sciences	2	0	0	40	60	100	2
BMATH5-201	GE-III	Mathematics-II	3	1	0	40	60	100	4
BMATH5-202		Basic Mathematics-II*							
BPHYS1-201	CC-III	Thermal Physics	4	0	0	40	60	100	4
BPHYS1-202	CC-IV	Waves and Optics	4	0	0	40	60	100	4
BCHMS1-201	GE-IV	Organic Chemistry – I	4	0	0	40	60	100	4
BPHYS1-204	CC-III Lab	Thermal Physics Lab	0	0	4	60	40	100	2
BPHYS1-205	CC-IVLab	Waves and Optics Lab	0	0	4	60	40	100	2
BCHMS1-203	GE-IVLab	Organic Chemistry – I Lab	0	0	2	60	40	100	1
BMNCC0-004	NCC-I	Drug Abuse: Problem, Management and Prevention	2	0	0	40	60	100	
Total			**19**	**1**	**10**	**420**	**480**	**900**	**23**

*Students from Medical stream will study Basic Mathematics–II and Students from Non Medical stream will study Mathematics-II

3rd Semester			Contact Hrs.			Marks			Credits
Subject Code	**Course Type**	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BMATH5-301	GE-V	Mathematics-III	3	1	0	40	60	100	4
BPHYS1-301	CC-V	Analog System and Applications	4	0	0	40	60	100	4
BPHYS1-302	CC-VI	Elements of Modern Physics	4	0	0	40	60	100	4
BPHYS1-303	CC-VII	Quantum Mechanics and Applications	4	0	0	40	60	100	4
BCHMS1-102	GE-VI	Physical Chemistry- I	4	0	0	40	60	100	4
BPHYS1-305	CC-V Lab	Analog System and Applications Lab	0	0	4	60	40	100	2
BPHYS1-306	CC-VI Lab	Elements of Modern Physics Lab	0	0	2	60	40	100	1
BPHYS1-307	CC-VII Lab	Quantum Mechanics Lab	0	0	4	60	40	100	2
BCHMS1-104	GE-VI Lab	Physical Chemistry - I Lab	0	0	4	60	40	100	2
Total			**19**	**1**	**14**	**440**	**460**	**900**	**27**

4Th Semester			Contact Hrs.			Marks			Credits
Subject Code	**Course Type**	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BPHYS1-401	CC-VIII	Mathematics-IV	4	2	0	40	60	100	6
BPHYS1-402	CC-IX	Digital System andApplications	4	0	0	40	60	100	4
BPHYS1-403	CC-X	Solid State Physics	4	0	0	40	60	100	4
BCHMS1-202	GE-VII	Physical Chemistry- II	4	0	0	40	60	100	4
BPHYS1-405	CC-IX Lab	Digital System and Applications Lab	0	0	4	60	40	100	2
BPHYS1-406	CC-X Lab	Solid State Physics Lab	0	0	4	60	40	100	2
BCHMS1-204	GE-VII Lab	Physical Chemistry II Lab	0	0	2	60	40	100	1
BMNCC0-001	NCC-II	Constitution of India	2	0	0	60	40	100	
Total			**18**	**2**	**10**	**400**	**400**	**800**	**23**

5Th Semester			Contact Hrs.			Marks			Credits
Subject Code	**Course Type**	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BPHYS1-501	CC-XI	Mathematical Physics – I	4	2	0	40	60	100	6
BPHYS1-502	CC-XII	Statistical Mechanics	4	0	0	40	60	100	4
BPHYS1-503	CC-XII Lab	Statistical Mechanics Lab	0	0	4	60	40	100	2
BPHYS1-504	SEC-II	Basic Instrumentation Skills	0	0	4	60	40	100	2
Departmental Elective – I (Select any One Subject and Corresponding Lab with total Six Credit)									
BPHYD1-511	DSE-I	Experimental Techniques	4	0	0	40	60	100	4
BPHYD1-512		Experimental Techniques Lab	0	0	4	60	40	100	2
BPHYD1-513		Nano Materials and Applications	4	0	0	40	60	100	4
BPHYD1-514		Nano Materials and Applications Lab	0	0	4	60	40	100	2
BPHYD1-515		Communication System	4	0	0	40	60	100	4
BPHYD1-516		Communication System Lab	0	0	4	60	40	100	2
Departmental Elective – II (Select any One Subject of Six Credit)									
BPHYD1-521	DSE-II	Nuclear and Particle Physics	4	2	0	40	60	100	6
BPHYD1-522		Physics of the Earth	4	2	0	40	60	100	6
BPHYD1-523		Biological Physics	4	2	0	40	60	100	6
Total			**16**	**4**	**12**	**340**	**360**	**700**	**26**

6Th Semester			Contact Hrs.			Marks			Credits
Subject Code		**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BPHYS1-601	CC-XIII	Mathematical Physics – II	4	2	0	40	60	100	6
BPHYS1-602	CC-IV	Electromagnetic Theory	4	0	0	40	60	100	4
BPHYS1-603	CC-IV Lab	Electromagnetic Theory Lab	0	0	4	60	40	100	2
Departmental Elective – III (Select any One Subject of Six Credit)									
BPHYD1-611	DSE-III	Classical Dynamics	4	2	0	40	60	100	6
BPHYD1-612		Astronomy and Astrophysics	4	2	0	40	60	100	6
BPHYD1-613		Applied Dynamics	4	2	0	40	60	100	6
Departmental Elective – IV (Select any One Subject and Corresponding Lab with total Six Credit)									
BPHYD1-621	DSE-IV	Medical Physics	4	0	0	40	60	100	4
BPHYD1-622		Medical Physics Lab	0	0	4	60	40	100	2
BPHYD1-623		Physics of Devices and Communication	4	0	0	40	60	100	4
BPHYD1-624		Physics of Devices and Communication Lab	0	0	4	60	40	100	2
BPHYD1-625		Atmospheric Physics	4	0	0	40	60	100	4
BPHYD1-626		Atmospheric Physics Lab	0	0	4	60	40	100	2
BPHYD1-627		Medical Physics	4	0	0	40	60	100	4
BPHYD1-628		Medical Physics Lab	0	0	4	60	40	100	2
		Total	**16**	**4**	**8**	**280**	**320**	**600**	**24**

Drug Abuse: Problem, Management and Prevention and Introduction and Constitution of India are non-credit courses; however, it is necessary to secure at least E grade in each.

COMMUNICATIVE ENGLISH

Subject Code: BHUMA0 -001 **L T P C** **Duration: 30Hrs.**
2 0 0 2

Course Objectives:

1. To remove the phobia of conversing in English.
2. To make the learners enable to express themselves among peers & teachers.
3. To enable learners, improve their vocabulary.
4. To introduce them with basic communicative skills in real life situations.
5. To enhance learner's writing ability.

UNIT-I

Introduction

Theory of Communication, Types and modes of Communication

Language of Communication

Verbal and Non-verbal, (Spoken and Written), Personal, Social and Business, Barriers and Strategies Intra-personal, Inter-personal and Group communication

UNIT-II

Speaking Skills

Monologue, Dialogue, Group Discussion, Effective Communication/ Mis- Communication, Interview, Public Speech

UNIT-III

Reading and Understanding

Close Reading, Comprehension, Summary Paraphrasing, Analysis and Interpretation, Translation(from Indian language to English and vice-versa), Literary/Knowledge Texts.

UNIT-IV

Writing Skills

Documenting, Report Writing, Making notes, Letter writing

Course Outcomes: At the end of the semester, the learner will be able to

1.Remove fear of speaking in English among peers & teachers.
2.Develop the ability to speak in English.
3.Use vocabulary taught for speaking and writing simple sentence for day to day conversation.
4.Use taught vocabulary for writing applications on common issues.

Recommended Books

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr. Ranjana Kaul,Dr Brati Biswas

MATHEMATICS-I

Subject Code: BMATH5-101 **L T P C** **Duration: 60 Hrs.**
3 1 0 4

Course Objective: To introduce concept of matrices, vector calculus vector integration and differentiation.

UNIT-I (15 Hrs.)

Algebra of matrices, Inverse and rank of a matrix, System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

UNIT-II (14 Hrs.)

Vector Calculus: Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations, Vector product, Scalar triple product and their interpretation in terms of area and volume respectively, Scalar and Vector fields.

UNIT-III (16 Hrs.)

Vector Differentiation: Directional derivatives and normal derivative, Gradient of a scalar field and its geometrical interpretation, Divergence and curl of a vector field, Del and Laplacian operators, Vector identities.

UNIT-IV (15 Hrs.)

Vector Integration: Ordinary Integrals of Vectors, Multiple integrals, Notion of infinitesimal line, surface and volume elements, Line, surface and volume integrals of Vector fields, Flux of a vector field, Gauss' divergence theorem, Green's and Stokes Theorems (Without proofs) and their applications.

Course Outcome: The students will be able to use and solve the problems related to matrices, vector calculus vector integration and differentiation.

References Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. T. Veerarajan, 'Engineering Mathematics for First Year', Tata McGraw Hill, New Delhi, 2008.
3. Murray R. Spiegel, Vector Analysis, Schaum publishing Company, New York.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. B.V. Ramana, 'Higher Engineering Mathematics', 11th Reprint, Tata McGraw Hill, New Delhi, 2010.
6. Peter Baxandall , Hans Liebeck , 'Vector Calculus', Dover Publications; 2008 edition.

BASIC MATHEMATICS-I

Subject Code: BMATH5-102 **L T P C** **Duration: 60 Hrs.**
3 1 0 4

Course Objective: To introduce concept of limits and continuity, differentiation, integration, tracing of curves and application of definite integrals.

UNIT-I (15 Hrs.)

Basic concept of limit and continuity, Properties of limit and classification of discontinuities, Properties of continuous functions, Differentiability and differentials, Successive differentiation and Leibnitz theorem, Derivatives of higher order, nth derivative of well-known functions.

UNIT-II (13 Hrs.)

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of sin x, cos x, e^x , log(l+x), $(l+x)^m$, Maxima and Minima, Indeterminate forms, Curvature, Asymptotes, Singular points, Tracing of curves, tracing of curves in polar and Parametric forms.

UNIT-III (16 Hrs.)

Integration: Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, properties of definite integral.

UNIT-IV (16 Hrs.)

Applications of Definite Integrals, Plane Area, Arc Length, Areas between Curves, Centroids, Moments of Inertia, Volumes, Reduction formulae for integrals of rational, trigonometric, exponential and logarithmic function and of their combinations.

Course Outcome: The student will be able to solve the problems related to concept of limits and continuity, differentiation, integration, tracing of curves and application of definite integrals.

Reference Books

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, PrenticeHall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

ELECTRICITY AND MAGNETISM

Subject Code: BPHYS1-101 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objective: To provide a detailed knowledge of basic concept of electricity and magnetism.

UNIT-I

Electric Field and Electric Potentials (15 Hrs.)

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. Potential and Electric Field of a dipole. Force and Torque on a dipole. Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor.

UNIT-II

Magnetic Field and Electric Potentials (15 Hrs.)

Magnetic force between current elements and definition of Magnetic Field B. Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of B: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements.

UNIT-III

Dielectric and Magnetic Properties of Matter (15 Hrs.)

Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D. Relations between E, P and D. Gauss' Law in dielectrics. Magnetization vector (M). Magnetic Intensity(H). Magnetic Susceptibility and permeability. Relation between B, H, M. Ferromagnetism. B-H curve and hysteresis.

UNIT-IV

Electromagnetic induction and Electric circuits (15 Hrs.)

Electromagnetic Induction: Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current. Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and Band Width. Parallel LCR Circuit. Network theorems: Ideal Constant-voltage and Constant-current Sources. Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem.

Course Outcomes: After completion of the course, student will be able to understand and handle the problems related with electricity and magnetism.

Reference Books:

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw.
2. Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education.
3. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
4. Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson Education.
5. Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
6. Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press.

MECHANICS

Subject Code: BPHYS1-102 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Objective: To understand the concept of Dynamics, Motion under Central Forces, Oscillations and special theory of relativity.

UNIT-I

Fundamentals of Dynamics (16 Hrs.)

Review of Newton's Laws of Motion. Momentum of variable mass system: motion of rocket. Motion of a projectile in uniform gravitational field. Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse. Work and Energy: Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy. Collisions: Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames.

UNIT-II

Gravitation and Central Force Motion (14 Hrs.)

Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere. Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness.

UNIT-III

Oscillations (15 Hrs.)

SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor. Non-Inertial Systems: Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems.

UNIT-IV

Special Theory of Relativity (15 Hrs.)

Reference frames. Inertial frames, Galilean transformations; Galilean invariance, Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics. Transformation of Energy and Momentum.

Course Outcomes: The student will be able to analyze and solve a multi level problem in mechanics.

Reference Books:

1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
2. Mechanics, Berkeley Physics, Vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
3. Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.
4. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
5. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
6. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.

INORGANIC CHEMISTRY-I

Subject Code: BCHMS1-101 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives

1. To familiarize with atomic structure, quantum numbers and shapes of orbitals
2. To understand periodic table and periodicity of elements
3. To understand the concept of various bonding theories
4. To understand importance of redox reactions

UNIT-I

Atomic Structure (14 Hrs.)

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f*orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

UNIT-II

Periodicity of Elements (16 Hrs.)

s, *p*, *d*, *f* block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to *s* & *p*-block.

(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.

(b) Atomic radii (van der Waals)

(c) Ionic and crystal radii.

(d) Covalent radii (octahedral and tetrahedral)

(e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.

(f) Electron gain enthalpy, trends of electron gain enthalpy.

(g) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.

UNIT-III

Chemical Bonding I (12 Hrs.)

(i) *Weak Chemical Forces:* van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points.

(ii) *Ionic bond:* General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

UNIT-IV

Chemical Bonding II (18Hrs.)

(i) *Covalent bond:* Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCl, BeF_2, CO_2, (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.

(ii) *Metallic Bond:* Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.
Oxidation-Reduction: Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class.

Course Outcomes: The completion of this course will make student to acquire the knowledge of:
1. wave mechanics, atomic theories and shapes of orbitals
2. periodic table and various periodic properties
3. ionic bond, covalent bond, metallic bond and various weak chemical forces
4. redox reactions and applications of redox reactions

Reference Books:
• Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
• Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970
• Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2006.
• Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 1962.

ELECTRICITY AND MAGNETISM LAB

Subject Code: BPHYS1-104 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objective: To learn practically the various concepts of electricity and magnetism. The course will provide hand on training to the students for handling various electrical instruments.

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series RC Circuit.
3. To determine an unknown Low Resistance using Potentiometer.
4. To determine an unknown Low Resistance using Carey Foster's Bridge.
5. To compare capacitances using De'Sauty's bridge.
6. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
7. To verify the Thevenin and Norton theorems.
8. To verify the Superposition, and Maximum power transfer theorems.
9. To determine self inductance of a coil by Anderson's bridge.
10. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
11. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
12. Determine a high resistance by leakage method using Ballistic Galvanometer.
13. To determine self-inductance of a coil by Rayleigh's method.
14. To determine the mutual inductance of two coils by Absolute method.

Course Outcome: The completion of this course will make student confident to handle practically the various concepts of electricity and magnetism.

Reference Books

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. Engineering Practical Physics, S.Panigrahi and B.Mallick, 2015, Cengage Learning.
5. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

MECHANICS LAB

Subject Code: BPHYS1-106 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objective: To learn practically the various concepts of mechanics. The course will provide hand on training to the students for handling various mechanical instruments.

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To study the random error in observations.
3. To determine the height of a building using a Sextant.
4. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
5. To determine the Moment of Inertia of a Flywheel.
6. To determine g and velocity for a freely falling body using Digital Timing Technique.
7. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
8. To determine the Young's Modulus of a Wire by Optical Lever Method.
9. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
10. To determine the elastic Constants of a wire by Searle's method.
11. To determine the value of g using Bar Pendulum.
12. To determine the value of g using Kater's Pendulum.

Course Outcome: The completion of this course will make student confident to handle practically the various concepts of mechanics.

Reference Books

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal.
4. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
5. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.

INORGANIC CHEMISTRY-I LAB

Subject Code: BCHMS1-103 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objectives
1. To develop basic understanding of various lab practices including safety measures.

2. To familiarize with solution preparation.
3. To understand acid-base and oxidation reduction titrimetry.

EXPERIMENTS

(A) Titrimetric Analysis
(i) Calibration and use of apparatus
(ii) Preparation of solutions of different Molarity/Normality of titrants
(B) Acid-Base Titrations
(i) Estimation of carbonate and hydroxide present together in mixture.
(ii) Estimation of carbonate and bicarbonate present together in a mixture.
(iii) Estimation of free alkali present in different soaps/detergents
(C) Oxidation-Reduction Titrimetry
(i) Estimation of Fe(II) and oxalic acid using standardized $KMnO_4$ solution.
(ii) Estimation of oxalic acid and sodium oxalate in a given mixture.
(iii) Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

Course Outcomes: The students will acquire knowledge of:
1. Preparation of solutions
2. Estimation of carbonates, bicarbonates and free alkalis in solution with acid base titrations
3. Estimation of Fe(II) and oxalic acid with oxidation reduction titrimetry

Reference Book
Vogel, A.I. A Textbook of Quantitative Inorganic Analysis, ELBS.

COMPUTATIONAL PHYSICS SKILLS

Subject Code: BPHYS1-108 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objective: To learn the basics to computation physics and FORTRAN programming language.

UNIT-I

Introduction
Importance of computers in Physics, paradigm for solving physics problems for solution. Algorithms and Flowcharts: Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates, Roots of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of sin (x) as a series, algorithm for plotting (1) lissajous figures and (2) trajectory of a projectile thrown at an angle with the horizontal.

UNIT-II

Scientific Programming
Some fundamental Linux Commands (Internal and External commands). Development of FORTRAN, Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Fortran

Statements: I/O Statements (unformatted/formatted), Executable and Non-Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic.

UNIT-III

Control Statements

Types of Logic (Sequential, Selection, Repetition), Branching Statements (Logical IF, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DOWHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines.

UNIT-IV

Visualization

Introduction to graphical analysis and its limitations. Introduction to Gnuplot. importance of visualization of computational and computational data.

Programming:

1. To print out all natural even/ odd numbers between given limits.
2. To find maximum, minimum and range of a given set of numbers.
3. Calculating Euler number using exp(x) series evaluated at x=1.
4. To compile a frequency distribution and evaluate mean, standard deviation etc.
5. To evaluate sum of finite series and the area under a curve.
6. To find the product of two matrices
7. To find a set of prime numbers and Fibonacci series.
8. To write program to open a file and generate data for plotting using Gnuplot.
9. Plotting trajectory of a projectile projected horizontally.
10. Plotting trajectory of a projectile projected making an angle with the horizontally.
11. To find the roots of a quadratic equation.
12. Motion of a projectile using simulation and plot the output for visualization.
13. Numerical solution of equation of motion of simple harmonic oscillator and plot the outputs for visualization.
14. Motion of particle in a central force field and plot the output for visualization

Course Outcomes: After the completion of the course the students will be able to handle the problems related with the physics using Fortran Programming.

Reference Books

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.
2. Computer Programming in Fortran 77". V. Rajaraman (Publisher:PHI).
3. Gnuplot in action: understanding data with graphs, Philip K Janert, (Manning 2010)

4. Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co.
5. Computational Physics: An Introduction, R. C. Verma, et al. New Age International Publishers, New Delhi (1999)
6. A first course in Numerical Methods, U.M. Ascher and C. Greif, 2012, PHI Learning

ENVIRONMENTAL SCIENCES

Subject Code: BMNCC0-002 **L T P C** **Duration: 30 Hrs.**
2 0 0 2

Course Objective: To create awareness among students about environment protection.

UNIT-I

Natural Resources

Renewable and Non-renewable Resources: Natural resources and associated problems. (a) Forest resources: Use and over-exploitation, deforestation. Timber extraction and their effects on forests and tribal people. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

UNIT-II

Ecosystems

(a) Concept of an ecosystem. (b) Structure and function of an ecosystem. (c) Producers, consumers and decomposers. (d) Energy flow in the ecosystem. (e) Ecological succession. (f) Food chains, food webs and ecological pyramids.

UNIT-III

Environmental Pollution

Definition (a) Causes, effects and control measures of: i) Air pollution ii) Water pollution iii) Soil pollution iv) Marine pollution v) Noise pollution vi) Thermal pollution vii) Nuclear pollution (b) Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

UNIT-IV

Social Issues and the Environment

(a) From unsustainable to sustainable development (b) Urban problems and related to energy (c) Water conservation, rain water harvesting, Watershed Management (d) Resettlement and rehabilitation of people; its problems and concerns. (e) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Course Outcomes: Based on this course, the students will understand / evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development.

Recommended Books:

1. J.G. Henry and G.W. Heinke, 'Environmental Sc. & Engineering', Pearson Education, **2004**.
2. G.B. Masters, 'Introduction to Environmental Engg. & Science', Pearson Education, **2004**.

3. ErachBharucha, 'Textbook for Environmental Studies', UGC, New Delhi.

MATHEMATICS-II

Subject Code: BMATH5-201 **L T P C** **Duration:60 Hrs.**
3 1 0 4

Course Objective: To introduce concept of probability, basic statistics, sequence and series and Partial differentiation.

UNIT-I (14 Hrs.)

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables;

UNIT-II (15 Hrs.)

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

UNIT-III (15 Hrs.)

Sequence and Series: Convergence of sequence and series, tests for convergence (Comparison test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test, Cauchy's Integral test, series of positive and negative terms); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

UNIT-IV (16 Hrs.)

Partial differentiation –Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative, Differentiation of implicit functions and composite functions, Jacobians and its properties.

Course Outcome: After the completion of the course, the students will be able to solve the problems related to probability, basic statistics, sequence and series and Partial differentiation.

Reference Books:

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9th Edn., Pearson, Reprint, 2002.
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn, John Wiley & Sons,2006.
3. B.V. Ramana, 'Higher Engineering Mathematics', 11th Reprint, Tata McGraw Hill, New Delhi, 2010.
4. B.S. Grewal, 'Higher Engineering Mathematics', 36th Edn., Khanna Publishers, 2010.
5. S.C. Gupta and V.K. Kapoor ,Fundamentals of Applied Statistics,4th Edition, Sultan Chand & Sons, 2014.

BASIC MATHEMATICS-II

Subject Code: BMATH5-202 **L T P C** **Duration: 60 Hrs.**
3 1 0 4

Course Objective: To introduce concept of matrices and determinants, sequence and series and Partial differentiation.

UNIT-I (14 Hrs.)

Matrices and Determinants: Algebra of matrices, Inverse and rank of a matrix, System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

UNIT-II (15 Hrs.)

Sequence and Series: Convergence of sequence and series, tests for convergence (Comparison test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test, Cauchy's Integral test, series of positive and negative terms); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

UNIT-III (16 Hrs.)

Partial differentiation –Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative, Differentiation of implicit functions and composite functions, Jacobians and its properties.

UNIT-IV (15 Hrs.)

Partial derivatives, directional derivatives, total derivative, Tangent plane and normal line, Maxima, minima and saddle points, Method of Lagrange multipliers.

Course Outcome: After the completion of the course, the students will be able to solve the problems related to matrices and determinants, sequence and series and Partial differentiation.

Reference Books:

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9th Edn., Pearson, Reprint, 2002.
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn, John Wiley & Sons,2006.
3. T. Veerarajan, 'Engineering Mathematics for First Year', Tata McGraw Hill, New Delhi, 2008.
4. B.V. Ramana, 'Higher Engineering Mathematics', 11th Reprint, Tata McGraw Hill, New Delhi, 2010.
5. B.S. Grewal, 'Higher Engineering Mathematics', 36th Edn., Khanna Publishers, 2010.

THERMAL PHYSICS

Subject Code: BPHYS1-201 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objective: To provide a detailed knowledge of laws of thermodynamics, applications of laws of thermodynamics, and Maxwell's thermodynamic relations.

UNIT-I

Laws of Thermodynamics (15 Hrs.)

Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem.

UNIT-II

Applications of laws of thermodynamics (15 Hrs.)

Applications of First Law: General Relation between C_P and C_V, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient. Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale.

Entropy (15Hrs.)

Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes. Principle of Increase of Entropy. Temperature–Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero.

UNIT-IV

Thermodynamic Potentials (15Hrs.)

Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Surface Films and Variation of Surface Tension with Temperature. Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of Cp-Cv, (3) TdS Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process.

Course Outcomes: After completion of the course, student will be able to solve the problems related with the laws of thermodynamics, entropy, and Maxwell's thermodynamic relations.

Reference Books:

1. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
2. Statistical Physics and Thermodynamics, V.S. Bhatia, 1990, Shoban Lal Nagin Chand.
3. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
4. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
5. Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University.
6. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications

WAVES AND OPTICS

Subject Code: BPHYS1-202 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objective: To understand the fundamentals of harmonic oscillations, wave motion, wave optics: diffraction, interferometer and holography.

UNIT-I

Harmonic oscillations and Superpositions (15Hrs.)

Introduction to Harmonic oscillations, Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences. Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses.

UNIT-II

Wave Motion (15 Hrs.):

Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves. Velocity of Waves: Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction. Superposition of Two Harmonic Waves: Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N Harmonic Waves.

UNIT-III

Wave Optics and Interference (15 hrs.)

Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence. Interference: Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index. Interferometer: Michelson Interferometer-(1) Idea of form of fringes (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer.

UNIT-IV

Diffraction (15 hrs.)

Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula. (Qualitative discussion only) Fraunhofer diffraction: Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating. Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire.

Course Outcomes: After completion of the course, student will be able to – understand and utilize the idea of harmonic oscillations, wave motion, wave optics. The course will provide basic and advanced concept of interference and diffraction.

Reference Books

1 Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
2 Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
3 Optics, Ajoy Ghatak, 2008, Tata McGraw Hill.
4 The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
5 The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
6 Fundamental of Optics, A. Kumar, H.R. Gulati and D.R. Khanna, 2011, R. Chand Publications.

ORGANIC CHEMISTRY-I

Subject Code: BCHMS1-201 **L T P C** **Duration: 60 Hrs.**
4 0 0 4

Course Objectives
1. To understand the concepts behind basics of organic chemistry
2. To understand the concept of stereochemistry
3. To familiarize with the chemistry of aliphatic compounds
4. To understand concepts behind aromaticity

UNIT-I

Basics of Organic Chemistry (6 Hrs.)

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, influence of hybridization on bond properties.

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

UNIT-II

Stereochemistry (18Hrs.)

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules.

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.

UNIT-III

Chemistry of Aliphatic Hydrocarbons (16 Hrs.)

Carbon-Carbon sigma bonds

Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

Carbon-Carbon pi bonds:

Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroborationoxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition

reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl
benzene.
Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

UNIT-IV

Cycloalkanes and Conformational Analysis (20 Hrs.)
Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.
Aromatic Hydrocarbons
Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.

Course Outcomes:
Students will acquire the knowledge of:
1. Stereochemistry concepts
2. Reaction intermediates, electronic effects and types of reactions
3. Formation of carbon-carbon sigma and pi bonds
4. Conformational analysis of cycloalkanes
5. Aromaticity concepts

Reference Books:
• Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
• Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd.
• Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
• Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
• Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

THERMAL PHYSICS LAB

Subject Code: BPHYS1-204 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objective: To learn practically the various concepts of thermodynamics. The course will provide hand on training to the students for handling various related instruments.

1. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
2. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method
3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).

6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two
Junctions.
7. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature.

Course Outcome: The completion of this course will make student confident to handle practically the various concepts of thermodynamics.

Reference Books

1 Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2 A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
3 Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4 A Laboratory Manual of Physics for undergraduate classes,D.P.Khandelwal,1985, Vani Pub.

WAVES AND OPTICS LAB

Subject Code: BPHYS1-205 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

Course Objective: To learn practically the various concepts of waves and optics. The course will provide hand on training to the students for handling various related instruments.

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify λ^2 –T law.
2. To investigate the motion of coupled oscillators.
3. To study Lissajous Figures.
4. Familiarization with: Schuster`s focusing; determination of angle of prism.
5. To determine refractive index of the Material of a prism using sodium source.
6. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source
7. To determine the wavelength of sodium source using Michelson's interferometer.
8. To determine wavelength of sodium light using Fresnel Biprism.
9. To determine wavelength of sodium light using Newton's Rings.
10. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
11. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
12. To determine dispersive power and resolving power of a plane diffraction grating.

Course Outcome: The completion of this course will make student confident to handle practically the various concepts of waves and optics.

Reference Books

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.

2. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985,
Heinemann Educational Publishers.
4. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

Subject Code: BMNCC0-004 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

Course Objective: To familiarize the students about consequences of drug abuse and preventive measures.

UNIT-I

Meaning of Drug Abuse
Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

UNIT-II

Consequences of Drug Abuse
Individual: Education, Employment, Income. Family: Violence. Nation: Law and Order problem.

UNIT-III

Prevention of Drug Abuse
Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny.
School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

UNIT-IV

Treatment and Control of Drug Abuse
Medical Management: Medication for treatment and to reduce withdrawal effects. Psychological Management: Counselling, Behavioural and Cognitive therapy. Social Management: Family, Group therapy and Environme-ntal intervention. Treatment: Medical, Psychological and Social Management. Control: Role of Media and Legislation.

Course Outcome: It will develop the general consciousness among students about impacts of drug abuse.

Recommended Books:

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, 2003.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, 2004.
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills, 1981.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi, 1985.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books, 1982.
6. Ishwar Modi and Shalini Modi, 'Addiction and Prevention', Rawat Publications, Jaipur, 1997.
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, 2003 & 2004.

8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi, 2013.
9. Bhim Sain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi, 1991.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar, 2009.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra, Delhi, 2000.
12. S. Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention andCessation', Cambridge University Press, 2008.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Eco -nomic and Political Weekly, 2017.
14. 'World Drug Report', United Nations Office of Drug and Crime, 2016.
15. 'World Drug Report', United Nations Office of Drug and Crime, 2017.