Scheme of Instruction & Syllabi

Of

Bachelor of Science
(Honors)

(Physics)

(Effective from Session 2017-2018)

Department of Applied Sciences&
Humanities

INVERTIS UNIVERSITY

Bareilly-243123 U.P.

B.Sc. Honours (Physics)

This program provides a specialized ability to identify and solve significant problems across a broad range of application areas concerned chiefly with knowledge of Physics as well as of cross-discipline nature, to develop the aptitude to apply the principles of Physics and related sciences to articulate an in depth understanding of core knowledge on various areas of Physical Sciences. It is designed to help students to understand the importance of role of this knowledge to contribute in improving the quality of human life. It also helps students recognize and appreciate the contribution of great scientists in the field of Physics and related fields.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

This program acts as a specialized degree and helps to develop critical, analytical and problem solving skills at first level. This specialized degree makes the graduates employable in scientific organizations and also to assume expert administrative positions in various types of organizations. Further acquisition of higher level degrees will help the graduates to pursue a career in academics or scientific organizations as a researcher.

The Program Educational Objectives are to prepare the students to:

PEO-1. Work independently or in team with engineering, medical, ICT professionals and scientists in scientific problem solving.

PEO-2. Act as expert administrators in public, private and government organizations or business administrator with further training and education.

PEO-3. Pursue masters and doctoral research degrees to work in colleges, universities as professors or as scientists in research establishments.

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PROGRAM OUTCOMES (POs)

After undergoing this programme, a student will be able to execute the following successfully:

PO-1. **Scientific knowledge**: Apply the knowledge of Physics, Scientific fundamentals, and scientific specialization to the solution of complex scientific problems.

PO-2. **Problem analysis**: Identify, formulate, research literature, and analyze scientific problems to arrive at substantiated conclusions using first principles of Physical sciences and nature.

PO-3. **Design/development of solutions**: Design solutions for complex scientific problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4. **Conduct investigations of complex problems**: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern scientific tools including prediction and modeling to complex activities with an understanding of the limitations.

PO-6. **Scientific temper and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the practice.

PO-7. **Environment and sustainability**: Understand the impact of the professional scientific solutions in societal and environmental

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contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the work practice.

PO-9. **Individual and team work**: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO-10. **Communication**: Communicate effectively with their community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

PO-11. **Project management and finance**: Demonstrate knowledge and understanding of scientific and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO-12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning and research in the broadest context of scientific & technological change.

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B.Sc. (Honors) (Physics)

Scheme of Instruction

(Effective from session 2017-2018)

I Year									
I Semester			**Teaching Scheme**			**Marks Distribution**			**Credits**
PAPER	**CODE**	**SUBJECT**	**L**	**T**	**P**	**ESM**	**MSM**	**Total**	
Paper 1	BHM101	Matrix & Calculus	3	1	0	70	30	100	4
Paper 2	BHM102	Numerical & Statistical Techniques	3	1	0	70	30	100	4
Paper 3	BHP101	Mechanics	3	1	0	70	30	100	4
Paper 4	BHP102	Optics	3	1	0	70	30	100	4
Paper 5	**BHC-101**	Inorganic Chemistry-I	3	1	0	70	30	100	4
Paper 6	**BHC-102**	Organic Chemistry-I	3	1	0	70	30	100	4
Lab 1	BHM151	Lab Work-I	0	0	2	35	15	50	2
Lab 2	BHP151	Physics Lab I	0	0	2	35	15	50	2
Lab 3	**BHC-151**	Chemistry Lab-I	0	0	2	35	15	50	2
		Total	**18**	**6**	**6**	**525**	**225**	**750**	**30**
II Semester									
PAPER	**CODE**	**SUBJECT**	**L**	**T**	**P**	**ESM**	**MSM**	**Total**	**Credits**
Paper 1	BHM201	Vector Calculus	3	1	0	70	30	100	4
Paper 2	BHM202	Analytical Geometry	3	1	0	70	30	100	4
Paper 3	BHP201	Properties of matter	3	1	0	70	30	100	4
Paper 4	BHP202	Waves and Oscillations	3	1	0	70	30	100	4
Paper 5	**BHC-201**	Physical Chemistry-I	3	1	0	70	30	100	4
Paper 6	**BHC-202**	Inorganic Chemistry-II	3	1	0	70	30	100	4
Lab 1	BHM251	Lab Work-II	0	0	2	35	15	50	2
Lab 2	BHP251	Physics Lab II	0	0	2	35	15	50	2
Lab 3	**BHC-251**	Chemistry Lab-II	0	0	2	35	15	50	2
		Total	**18**	**6**	**6**	**525**	**225**	**750**	**30**

L – Lecture
T – Tutorial
P – Practical
ESM – End Semester Marks

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II Year									
III Semester			**Teaching Scheme**			**Marks Distribution**			**Credits**
PAPER	**CODE**	**SUBJECT**	**L**	**T**	**P**	**ESM**	**MSM**	**Total**	
Paper 1	BHM301	Differential equations	3	1	0	70	30	100	4
Paper 2	BHM302	Statics & Dynamics	3	1	0	70	30	100	4
Paper 3	BHP301	Electricity and Magnetism	3	1	0	70	30	100	4
Paper 4	BHP302	Semiconductor Physics	3	1	0	70	30	100	4
Paper 5	BHC-301	Organic Chemistry-II	3	1	0	70	30	100	4
Paper 6	BHC-302	Physical Chemistry-II	3	1	0	70	30	100	4
Lab 1	BHM351	Lab Work-III	0	0	2	35	15	50	2
Lab 2	BHP351	Physics Lab III	0	0	2	35	15	50	2
Lab 3	BHC-351	Chemistry Lab-III	0	0	2	35	15	50	2
Total			**18**	**6**	**6**	**525**	**225**	**750**	**30**
IV Semester									
PAPER	**CODE**	**SUBJECT**	**L**	**T**	**P**	**ESM**	**MSM**	**Total**	**Credits**
Paper 1	BHM401	Elementary Algebra & Analysis	3	1	0	70	30	100	4
Paper 2	BHM402	Integral Transform	3	1	0	70	30	100	4
Paper 3	BHP401	Thermal Physics	3	1	0	70	30	100	4
Paper 4	BHP402	Electronic devices & circuits	3	1	0	70	30	100	4
Paper 5	BHC-401	Inorganic Chemistry-III	3	1	0	70	30	100	4
Paper 6	BHC-402	Organic Chemistry-III	3	1	0	70	30	100	4
Lab 1	BHM451	Lab Work-IV	0	0	2	35	15	50	2
Lab 2	BHP451	Physics Lab IV	0	0	2	35	15	50	2
Lab 3	BHC-451	Chemistry Lab-IV	0	0	2	35	15	50	2
Total			**18**	**6**	**6**	**525**	**225**	**750**	**30**

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III Year									
V Semester			**Teaching Scheme**			**Marks Distribution**			**Credits**
PAPER	**CODE**	**SUBJECT**	**L**	**T**	**P**	**ESM**	**MSM**	**Total**	
Paper 1	BHP501	Digital Electronics	3	1	0	70	30	100	4
Paper 2	BHP502	Atomic and Molecular Physics	3	1	0	70	30	100	4
Paper 3	BHP503	Quantum Mechanics	3	1	0	70	30	100	4
Paper 4	BHP504	Modern Physics	3	1	0	70	30	100	4
Paper 5	BHP505	Fundamentals & Programming in C	3	1	0	70	30	100	4
Lab 1	BHP551	Physics Lab V	0	0	2	35	15	50	2
Lab 2	BHP552	C Programming Lab	0	0	2	35	15	50	2
Total			**15**	**5**	**4**	**420**	**180**	**600**	**24**
VI Semester									
PAPER	**CODE**	**SUBJECT**	**L**	**T**	**P**	**ESM**	**MSM**	**Total**	**Credits**
Paper 1	BHP601	Solid State Physics	3	1	0	70	30	100	4
Paper 2	BHP602	Nuclear & Particle Physics	3	1	0	70	30	100	4
Paper 3	BHP603	Statistical Mechanics	3	1	0	70	30	100	4
Paper 4	BHP604	Mathematical Physics	3	1	0	70	30	100	4
Paper 5	BHP605	Electromagnetic Theory	3	1	0	70	30	100	4
Paper 6	BHP606	Environmental Science	2	1	0	35	15	50	2
Lab 1	BHP651	Physics Lab VI	0	0	2	35	15	50	2
Total			**17**	**5**	**2**	**420**	**180**	**600**	**24**

L – Lecture
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ESM – End Semester Marks

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SEMESTER I

BHM101: Matrix & Calculus	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To work with matrices and determine if a given square matrix is invertible.
2. To solve systems of linear equations and application problems requiring them.
3. To compute determinants and know their properties.
4. To find and use eigen values and eigenvectors of a matrix.
5. To introduce the basic tools of calculus and geometric properties of different conic sections which are helpful in understanding their applications in planetary motion, design of telescope and to the real-world problems.

Detailed Syllabus

Unit-1

Matrices: Elementary row and column transformation, Rank of matrix, Linear dependence, Consistency of linear system of equations and their solution, Characteristic equation, Caley-Hamition theorem, Eigen values and eigen vectors, Diagonalisation, Complex and unitary matrices, Application of matrices to engineering problems.

Unit-2

Differential Calculus-I: Leibnitz theorem, Partial differentiation, Eulers theorem, Curve tracing, Change of variables, Expansion of function of several variables.

Unit-3

Differential Calculus-II: Jacobian, approximation of errors, Extrema of functions of several variables, Lagranges method of multipliers (Simple applications).

Text Books:-

1. H.K.Dass, Higher Engineering Mathmatics, S.Chand Publications.
2. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004.

Reference Books:-

1. R.K.Jain&S.R.K.Iyenger, Advance Engineering Mathematics, Narosa Publishing House, 2002.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
3. E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
4. C.Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd. 2003
5. Peter V. O"Neil, Advanced Engineering Mathematics, Thomson (Cengage) Learning, 2007. 5. Peter V. O"Neil, "Advanced Engineering Mathematics", Thomson (Cengage) Learning, 2007.

Course Outcomes:

After completing the course, students will be able to:

1. Find the inverse of a square matrix.
2. Solve the matrix equation Ax = b using row operations and matrix operations.
3. Find the determinant of a product of square matrices, of the transpose of a square matrix, and of the inverse of an invertible matrix
4. Find the characteristic equation, eigen values and corresponding eigenvectors of a given matrix.
5. Determine if a given matrix is diagonalizable.
6. Sketch curves in a plane using its mathematical properties in the different ordinate systems of reference.
7. Apply derivatives in Optimization, Social sciences, Physics and Life sciences etc.

BHM102: Numerical & Statistical Techniques	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To comprehend various computational techniques to find approximate value for possible root(s) of non-algebraic equations, to find the approximate solutions of system of linear equations and ordinary differential equations.
2. To make the students familiar with the basic statistical concepts and tools which are needed to study situations involving uncertainty or randomness.
3. To render the students to several examples and exercises that blend their everyday experiences with their scientific interests.

Detailed Syllabus

Unit-1

Numerical Techniques – I Zeroes of transcendental and polynomial equation using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods. Interpolation: Finite differences, difference tables, Newton‟s forward and backward interpolation , Lagrange‟s and Newton‟s divided difference formula for unequal intervals.

Unit-2

Numerical Techniques –II Solution of system of linear equations, Gauss- Seidal method, Crout method. Numerical differentiation, Numerical integration , Trapezoidal , Simpson‟s one third and three-eight rules, Solution of ordinary differential (first order, second order and simultaneous) equations by Euler‟s, Picard‟s and forth-order Runge-Kuttamehthods.

Unit-3

Statistical Techniques - I Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves etc., Correlation, Linear, non –linear and multiple regression analysis, Probability theory.

Unit-4

Statistical Techniques - II Binomial, Poisson and Normal distributions, Sampling theory (small and large), Tests of significations, Chi-square test, t-test.

Text Books:-

1. H.K.Dass, Higher Engineering Mathmatics, S.Chand Publications.
2. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004.

Reference Books:-

1. R.K.Jain&S.R.K.Iyenger, Advance Engineering Mathematics, Narosa Publishing House, 2002.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
3. E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.

4. C.Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd. 2003
5. Peter V. O'Neil, Advanced Engineering Mathematics, Thomson (Cengage) Learning,2007.
5. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson (Cengage) Learning, 2007.

Course Outcomes:

After completing the course, students will be able to:

1. Apply some numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.
2. Interpolation techniques to compute the values for a tabulated function at points not in the table.
3. Understand the applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions.
4. study the joint behavior of two random variables.
5. establish a formulation helping to predict one variable in terms of the other, i.e., correlation and linear regression.
6. Solve an algebraic or transcendental equation using an appropriate numerical method.
7. Solve a linear system of equations using an appropriate numerical method.
8. Perform an error analysis for a given numerical method.

BHP101: Mechanics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To understand the fundamentals of physics like Linear Momentum, Rotational Dynamics, Motion under Central Forces, Properties of Matter etc.
2. It gives an in-depth understanding of specialist bodies of knowledge within the engineering discipline

Detailed Syllabus

Unit-1

Fundamentals of dynamics

Dynamics of a system of particles, Centre of mass, conservation of momentum, idea of conservation of momentum from Newton‟s third law, impulse, and momentum of variable mass system: motion of rocket

Unit-2

Work and Energy

Work and kinetic energy theorem, conservative and nonconservative forces, potential energy, energy diagram, stable and unstable equilibrium, gravitational potential energy, force as gradient of potential energy, work and potential energy, work done by nonconservative forces, law of conservation of energy

Unit-3

Rotational dynamics

Angular momentum of a particle and system of particles, torque, conservation of angular momentum, rotation about a fixed axis, moment of inertia, theorems of moment of inertia, calculation of moment of inertia for one dimensional bar, rectangular lamina, disc, cylindrical rod, spherical shell & solid sphere, kinetic energy of rotation, motion along an inclined plane involving both translation and rotation

Unit-4

Gravitation

Law of gravitation, inertial and gravitational mass, potential and field due to spherical shell and solid sphere, orbital velocity and escape velocity

Text Book:

1.Daniel Kleppner, Robert J. Kolenkow, *An introduction to mechanics*, McGraw-Hill, 1973
2.F W Sears, M W Zemansky and H D Young, *University Physics*, Narosa Publishing House, 1982
3.David Halliday, Robert ResnickJearlWalkerPrinciples of Physics, 10ed, ISV Paperback – 2015

Reference Books:

1.Charles Kittel, Walter Knight, MalvinRuderman, Carl Helmholz, Burton Moyer,

Mechanics Berkeley physics course, Vol.1: Tata McGraw-Hill, 2007
2.Keith R. Symon, *Mechanics*, Addison Wesley; 3 edition, 1971
3.D. S. Mathur, *Mechanics*, (S. Chand & Company Limited, 2000)

Course Outcomes:

After completing the course, students will be able to:

1. Define conservative, non-conservative forces, work, potential energy, impulse, torque, moment of inertia, angular momentum, law of gravitation.
2. Understand dynamics of system of particles, idea of conservation of momentum from Newton‟s third law, orbital and escape velocity.
3.Calculate moment of inertia for one dimensional bar, rectangular lamina, cylindrical rod, spherical shell and solid sphere, potential and field due to spherical shell and solid sphere
4.Analyse the motion along an inclined plane involving both translation and rotation, and rotation about a fixed axis.
5. Evaluate work done by non-conservative forces, momentum of variable mass system.
6. Create potential energy diagram with stable and unstable equilibrium.

BHP102: Optics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To understand the fundamental of ray optics and geometrical optics.
2. To understand the fundamentals of physics like interference of light, diffraction, Polarization.

Detailed Syllabus

Unit-1 Geometrical optics Introduction of ray optics, Sign conventions, General theory of image formation, Cardinal points, Newton‟s formula, Equivalent focal length of combination of two thin lenses
Unit-2 Interference Theory of interference, Conditions for sustained interference, Division of amplitude and division of wavefront, Young‟s double slit experiment, Fresnel‟s biprism, Phase change on reflection: Stoke‟s treatment, Interference in thin films: parallel and wedge-shaped films, Newton‟s rings: measurement of wavelength and refractive index Michelson‟s interferometer.
Unit-3 Fraunhofer diffraction Introduction of diffraction, Types of diffraction, Difference between interference and diffraction, Diffraction due to (i) a single slit, (ii) a double slit and (iii) N-slit or a plane transmission grating
Unit-4 Resolving power Introduction, Resolving power, Rayleigh‟s criterion, Limit of resolution of Eye, Limit of resolution of a convex lens, Resolving power of optical instruments, Lord Rayleigh Criterion for resolution, Resolving power of a grating
UNIT 5 Polarization Introduction of polarized light, Polarization by reflection & refraction, Brewster‟s law, Malus‟s law, Phenomena of double refraction, Uniaxial & biaxial crystals, Ordinary & extraordinary ray, Quarter wave plate & Half wave plate, Analysis of plane, Circular and Elliptical polarized light, Optical activity, Fresnel‟s theory of optical activity, Specific rotation, Polarimeter.

Text Books:

1. Francis Arthur Jenkins and Harvey Elliott White, Fundamentals of Optics McGraw-Hill, 1976
2. Eugene Hecht and A. R. Ganesan, Optics, Pearson Education, 2002
3. Brijlal&Subhramanyam, Optics, S. Chand Publications, 2011

Reference Books:

1. Abdul Al-Azzawi , Light and Optics: Principles and Practices, CRC Press, 2007
2. A. K. Ghatak& K. Thyagarajan , Contemporary Optics, Plenum Press,1978

Course Outcomes:

After completing the course, students will be able to:

1. Recognize and classify different characteristics of light; such as reflection, refraction transmission and dispersion etc.

2. Understand the techniques for the demonstration of dual nature; particle and wave nature of light.

3. Apply the different experimental methods of light interference, diffraction and polarization phenomenon for the determination of light wavelength, film thickness, refractive index etc.

4. Analyse the behaviour of positive and negative crystals in view of ordinary and extraordinary rays.Toanalyse the behaviour of plane polarized, elliptically polarized and circularly polarized light.

5. Evaluate the specific rotation of optically active sugar solutions using saccharimeter.

6. Design and fabricate simple optical set-ups for obtaining coherent extended sources, for interference.

BHC101: Inorganic Chemistry-I	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks I Semester Exam – 70 marks

Course Objectives:

1. To give an overview of complete knowledge of atomic structure.
2. To describe the solid state and theories of bonding.
3. To explain periodic table and general properties.
4. To explain the atomic radii.
5. To explain about hydrogen and water treatment.

Detailed Syllabus

Unit-1

Atomic Structure

Wave mechanics: de Broglie equation, Heisenberg‟s uncertainty principle and its significance, Schrodinger‟s wave equation, significance of ψ and ψ_2. Quantum numbers, Shapes of *s*, *p*, *d* and *f* orbitals. Pauli‟s exclusion principle, Hund‟s rule of maximum multiplicity, Aufbau‟s principle.

Unit-2

Solids State

Solids and their classification, unit cells, Close packing, Radius ratio rule and crystal coordination number. Chemical bonding, hydrogen bonding, Theories of bonding in metals (Free electron, VB & Band theory).

Unit-3

Periodicity of Elements

Position of elements (*s*, *p*, *d*&*f* block) in the periodic table and general properties related to their electronic structures.

Detailed discussion of the following properties of the elements, with reference to *s* &*p* block.

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

(b) Atomic radii (Vander Waals, Ionic & Covalent radii)

(c) Ionization enthalpy and factors affecting ionization energy.

(e) Electronegativity, Pauling‟s/ Mullikan‟s/ Electronegativity scales

Unit-4

Hydrogen and water treatment

Chemistry of Hydrogen, Hydrogen peroxide including manufacturing and structure, Heavy Hydrogen, Heavy water, ortho and Para Hydrogen. Hardness of water, removal & estimation of hardness. Zeolite method and ion exchange method for removing hardness of water.

Text and Reference Books

1. *Basic Inorganic Chemistry*,F.A Cotton, G.Wilkinson, and Paul L.Gauss, 3rd Edition (1995), John Wiley & Sons, New York.
2. *Concise Inorganic Chemistry*,J.D.Lee, 5th Edition (1996), Chapman & Hall, London.

Course Outcomes:

After completing the course, students will be able to:

1	Describe the Hund multiplicity, Pauli exclusion principles and Aufbau principle.
2	Summarize the Band theory, Valance bond theory, Effective Nuclear Charge, atomic radii, ionisation enthalpy, and electro negativity.
3	Solve the problems based on quantum numbers, hardness of water.
4	Differentiate among the localized and delocalized chemical bond, radical and angular wave functions, ideal and non-ideal gases.

BHC102: Organic Chemistry-I	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks I Semester Exam – 70 marks

Course Objectives:

1. To give an overview of complete knowledge of classification and nomenclature of Organic compounds.
2. To describe the electronic Displacements.
3. To explain different types of reactions.
4. To explain the stereochemistry of compounds.
5. To explain about hydrocarbans and named reaction.

Detailed Syllabus

Unit-1 General Organic Chemistry Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules. Electronic Displacements: Inductive, Electromeric, Resonance effects and Hyperconjugation. Homolytic and Heterolytic fission. Electrophiles and Nucleophiles. Introduction of organic reactions : Addition, Elimination and Substitution reactions.
Unit-2 Stereochemistry Fischer Projection, Newmann and Sawhorse Projection formulae, Element of symmetry, Atropisomerism, Chirality-optical activity, Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations. Relative and absolute configurations: D/L and R/S nomenclatures. An introduction to Spectroscopy.
Unit-3 Hydrocarbons and name reactions Chemistry of alkanes: Formation of alkanes, Aldol condensation, canizzaro reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation.
Unit-4 Unsaturated Hydrocarbons Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, reactions. Saytzeff eliminations. Reactions of alkenes: Electrophilic additions, their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical).

Unit-5

Aromatic Hydrocarbons

Aromaticity: Huckel‟s rule, aromatic character of arenes, cyclic carbocations / carbanions and heterocyclic compounds. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft‟s alkylation/acylation. Directing effects of the groups.

Text and Reference Books

1. *Organic Chemistry*, I. L. Finar , Vol. I, 6th Edition (1973), ELBS and Longman Ltd., New Delhi.
2. *Organic Chemistry*, R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
3. *Organic Chemistry*, Paula Y. Bruice , 2nd Edition, Prentice-Hall, International Edition (1998).

* Latest editions of all the suggested books are recommended.

Course Outcomes:

After completing the course, students will be able to :

1. Define inductive, mesomeric,electromeric and resonance effects. Homolytic and Heterolytic Bond fission. Electrophiles and nucleophiles.
2. Summarize types of hybridisation, halogenations, nitration, sulphonation and Friedel-Craft‟s alkylation/acylation.
3. Determine the formation of alkenes and alkynes by elimination reactions .
4. Compare different types of reaction intermediates and their stability.
5. Judge the stereochemistry of compounds using Fischer‟s, Newmann and Sawhorse Projections.
6. Hypothesize geometrical isomerism on the basis of cis-trans and syn-anti isomerism.

BHM151:Lab Work I	
Teaching Scheme Lectures: 2 hrs/Week Credits: 2	**Examination Scheme** External marks- 35 Internal marks- 15

Course Objectives:

1. To create and control simple plot and user-interface graphics objects in MATLAB.
2. Tofamiliar with memory and file management in MATLAB.
3. To design simple algorithms to solve problems
4. To understand the MATLAB environment
5. To get basic knowledge about simple numerical computations and analyses using MATLAB.

Detailed Syllabus

Modeling of the following problems using*Matlab/ Mathematica/ Maple* etc.

(i) Plotting of graphs of function e^{ax+b}, $\log(ax+b)$, $1/(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $|ax+b|$ and be able to find the effect of a and b on thegraph.

(ii) Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparingthem.

(iii) Any one of thefollowing

(a) Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids,hypocycloid)

(b) Obtaining surface of revolution ofcurves

(c) Tracing of conics in Cartesian coordinates/ polarcoordinates

(d) Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic

Course Outcomes:

After completing the course, students will be able to:

1. Perform computations on scalars and multidimensional arrays from MATLAB command window.
2. Use commands to retrieve data from the user or from input files into the workspace.
3. Create MATLAB functions that perform required tasks based on specified data inputs and outputs.
4. Write MATLAB programs that perform required repetition involving un-nested and nested while and for loops.
5. Generate plots and export this for use in reports and presentations.

BHP151-Physics Lab I	
Teaching Scheme Practical : 2 hr/week Credits: 2	**Examination Scheme** Attendance - 5 Marks Teachers Assessment – 10 Marks End Semester Exam – 35 marks

Prerequisite: - Handling of scales, weights and measures, idea of Least count and vernier scales, average or means of data, error analysis, practice in making simple measurements with vernier devices, idea of types of errors in measurement and methods to minimize them.

Course Objectives:

1. To give an overview of the experiment equipment and underlying principles.
2. To give complete knowledge of handling of instrument and making correct measurements
3. To describe the method of making calculations and plotting graphs & interpret them.
4 To explain the various possible causes of error and their removal.
5. To organize the result and make further use in understanding and problem solving.
6. To create new experimental setups for related extended and advanced measurements.

Detailed Syllabus

Student has to perform any eight experiments;

1. To determine the height of a tower with a sextant.
2. To determine the wavelength of monochromatic light by Newton‟s ring.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the Moment of Inertia of a Flywheel.
5. To determine the coefficient of viscosity of water by capillary flow method (Poiseuille‟s method).
6. To determine the surface tension of a liquid by Jager‟s method.
7. To determine the modulus of rigidity by horizontal apparatus.
8. To determine the modulus of rigidity by vertical apparatus.
9. To determine g by Bar Pendulum.
10. To determine g by Katter‟s Pendulum.

Reference Books:

1. GeetaSanon, B. Sc. Practical Physics, 1st Edn. (2007), R. Chand & Co
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi
3. InduPrakash and Ramakrishna, A Text Book of Practical Physics Vol 1 &Vol 2, KitabMahal, New Delhi
4. D. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes,Vani Publication House, New Delhi

Course Outcomes:

After completing the course, students will be able to:

1. Make correct measurements using laboratory instruments
2. Align and setup the instrument for performing the experiment.
3. Diagnose any errors in arrangement
4. Analyze the observations by calculating the related physical quantities.
5. Evaluate the percentage and maximum probable error.
6. Minimize the sources of error and designing additional related experiments

BHC151: Chemistry Lab -I	
Teaching Scheme Practicals: 2 hrs/Week Credits: 2	**Examination Scheme** External marks- 35 Internal marks- 15

Course Objectives:

1. To give an overview of Acid- Base Titrations.
2. To explain Oxidation- Reduction Titrimetry.

Detailed Syllabus

Unit-1

(A) Acid- Base Titrations

(i) Estimation of carbonate and hydroxide present together in mixture.

(ii) Estimation of carbonate and bicarbonate present together in a mixture.

(ii) Estimation of free alkali present in different soaps/detergents.

Unit-2

(B) 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:

After completing the course, students will be able to:

1. Understand various types of Estimation of anions.
2. Identify Oxidation- Reduction Titrimetry.

SEMESTER II

BHM 201: Vector Calculus	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To define vector fields.
2. To calculate line integrals along piecewise smooth paths; interpret such quantities as work done by a force .
3. To use the fundamental theorem of line integrals.
4. To use Green‟s theorem to evaluate line integrals along simple closed contours on the plane.
5. To compute the curl and the divergence of vector fields.
6. To apply Stokes‟ theorem to compute line integrals along the boundary of a surface.
7. To use Stokes‟ theorem to give a physical interpretation of the curl of a vector field.
8. To use the divergence theorem to give a physical interpretation of the divergence of a vector field.

Detailed Syllabus

Unit-1 Vector Differential Calculus: Vector differentiation. Velocity, Acceleration of a particle moving on a space curve. Point function, Gradient, divergence and curl of a vector and their physical interpretations.
Unit-2 Multiple Integrals: Double and triple integral, Change of order, Change of variables, Beta and Gamma functions, Application to area, volume, Dirichlet integral and its applications.
Unit-3 Vector Integral Calculus: Line, surface and volume integrals, Statement and problems of Green‟s, Stoke‟s and Gauss divergence theorems (without proof).
Text and Reference Books 1. H.K.Dass, Higher Engineering Mathmatics, S.Chand Publications. 2. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004. 3. R.K.Jain&S.R.K.Iyenger, Advance Engineering Mathematics, Narosa Publishing House, 2002. 4. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005. 5. E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005. 6. C.Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd. 2003 7. Peter V. O‟Neil, Advanced Engineering Mathematics, Thomson (Cengage) Learning,2007. 8. Peter V. O‟Neil, “Advanced Engineering Mathematics”, Thomson (Cengage) Learning, 2007.

Course Outcomes:

After completing the course, students will be able to:

1. Memorize definition of directional derivative and gradient and illustrate geometric meanings with the aid of sketches.
2. Memorize theorem relating directional derivative to gradient and reproduce proof.
3. Calculate directional derivatives and gradients.
4. Apply gradient to solve problems involving normal vectors to level surfaces.
5. Explain the concept of a vector integration a plane and in space.
6. Establish Inter-relationship amongst the line integral, double and triple integral formulations.

7. Apply the applications of multi variable calculus tools in physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc.

BHM202-Analytical Geometry	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To get basic knowledge about Circle, Cone, Parabola, Hyperbola, Ellipse etc.
2. To understand the concepts & advance topics related to two & three dimensional geometry.
3. To study the applications of conics.
4. To study the application of Sphere, cone and cylinder.
5. To study how to trace the curve.

Detailed Syllabus

General equation of second degree, Tracing of conics, System of conics, Confocal conics, Polar equation of a conic and its properties. Three dimensional system of co-ordinates, Projection and direction cosines, Plane, Straight line. Sphere, cone and cylinder. Central conicoids, Reduction of general equation of second degree, Tangent plane and normal to a conicoid, Pole and polar,Conjugate diameters, Generating lines, Plane sections.
Text and Reference Books 1. P. N. Pandey: Polar Coordinate Geometry, Sharda Academic Publishing House, Allahabad. 2. MataAmbarTiwari and R. S. Sengar: A course in Vector Analysis and its Applications. 3. P.K.Jain A Textbook Of Analytical Geometry Of Three Dimensions New Age International 4. S.L. Loney, The Elements of Coordinate Geometry, Macmillan and Company, London 5. Gorakh Prasad and H.C.Gupta : Text Book on Coordinate Geometry, Pothishala Pvt. Ltd., Allahabad.

Course Outcomes:

After completing the course, students will be able to:

1. Understand geometrical terminology for angles, triangles, quadrilaterals and circles.
2. Measure angles using a protractor.
3. Use geometrical results to determine unknown angles.
4. Recognize line and rotational symmetries.
5. Find the areas of triangles, quadrilaterals and circles and shapes based on these.

BHP201: Properties of Matter	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To understand the general properties of matter including elasticity, bending of beams etc.
2. To develop the basic understanding by solving problems based on fluids both in rest and in motion.

Detailed Syllabus

Unit-1

Elasticity

Hooke‟s law, stress-strain diagram, elastic moduli, relation between elastic constants, poisson‟s ratio-expression for poisson‟s ratio in terms of elastic constants, work done in stretching and work done in twisting a wire, twisting couple on a cylinder, determination of rigidity modulus by static torsion, torsional pendulum, determination of rigidity modulus and moment of inertia, determination of Y, η and σ by searle‟s method

Unit-2

Bending of beams

Bending of beams, expression for bending moment, cantilever, expression for depression at the loaded end, oscillations of a cantilever, expression for time period, determination of young‟s modulusby cantilever oscillations non-uniform bending, determination of young‟s modulus by koenig‟s method, uniform bending, expression for elevation, experiment to determine young‟s modulus using pin and microscope method

Unit-3

Surface tension

Synclastic and anticlastic surface, excess of pressure, application to spherical and cylindrical drops and bubbles, variation of surface tension with temperature, Jaegar‟s method

Unit-4

Viscosity

Stream line and turbulent flow of fluids, ideal fluids, equation of continuity, rate flow of liquid in a capillary tube, Poiseuille‟s formula for flow of a liquid through a capillary tube, determination of coefficient of viscosity of a liquid in laboratory

Text Book:

1. Mechanics, Berkeley Physics, vol.1,C.Kittel,W.Knight, et.al. 2007, Tata McGraw-Hill
2. D. S. Mathur , Mechanics , (S. Chand & Company Limited, 2000)

Reference Books:

1. Properties of matter by Murugeshan R, S. Chand & Co. Pvt. Ltd., New Delhi
2. Properties of matter by BrijLal&Subramaniam, N Eurasia publishing Co., New Delhi, 1989

Course Outcomes:

After completing the course, students will be able to:

1. Understand , stress-strain diagram, elastic moduli, moment of inertia ,Y, η and σ by searle‟s method differential equation of SHM and its solution, electrical damped harmonic oscillator: LCR circuit, forced electrical oscillation
2. Calculate , mathematical formulation, differential equation of forced harmonic oscillator, sharpness of resonance, differential equation of SHM and its solution, relation between elastic constants, poisson‟s ratio-expression for poisson‟s ratio in terms of elastic constants,
3. Analyse work done in stretching and work done in twisting a wire determination of rigidity modulus,free oscillations of systems with one degree of freedom: (i) mass-spring system
4. Create simple pendulum, torsional pendulum, stress-strain diagram, twisting couple on a cylinder, torsional pendulum

BHP202: Waves and Oscillations	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

It helps to understand and describe simple harmonic motion (SHM), be able to derive the equations of motions for physical systems that undergo SHM .

Detailed Syllabus

Unit-1 Wave Motion

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

Unit-2

Velocity of waves

Velocity of longitudinal waves in a fluid in a pipe, Newton‟s formula for velocity of sound, laplace‟s correction, effect of various factors on velocity of sound, shock waves

Unit-3

Free oscillations

SHM: Simple harmonic oscillations, differential equation of SHM and its solution, amplitude, frequency, time period and phase, velocity and acceleration. kinetic, potential and total energy and their time average values**,** free oscillations of systems with one degree of freedom: (i) mass-spring system, (ii) simple pendulum,(iii) torsional pendulum (iv) electrical oscillator (LC circuit)

Unit-4

Damped oscillations

Damper harmonic oscillator, mathematical formulation, power dissipation, relaxation time, quality factor, electrical damped harmonic oscillator: LCR circuit

Unit-5

Forced oscillations

Introduction, transient and steady states, amplitude, phase, resonance, differential equation of forced harmonic oscillator, sharpness of resonance, power dissipation, band-width and quality factor, forced electrical oscillation.

Text Books:

1. K. Uno Ingard, Fundamentals of Waves & Oscillations, (Cambridge University Press, 1988)
2. Daniel Kleppner, Robert J. Kolenkow, An Introduction to Mechanics, (McGraw-Hill, 1973)

Reference Books:

1. A. P. French, Vibrations and Waves, (CBS Pub. & Dist., 1987)
2. N. K. Bajaj, The Physics of Waves and Oscillations, (Tata McGraw-Hill, 1988)
3. Franks Crawford, Waves: BERKELEY PHYSICS COURSE (SIE), (Tata McGraw Hill, 2007).
4. N. Subrahmanyam&Brijlal , Waves & Oscillation, (S. Chand Publications, 2010)

Course Outcomes:

After completing the course, students will be able to:

1. Understand physical characteristics of SHM and obtaining solution of the oscillator using differential equations
2. Solve wave equation and understand significance of transverse waves
3. Solve for the solutions and describe the behavior of a damped and driven harmonic oscillator in both time and frequency domains
4. Gain knowledge on applications of transverse and longitudinal waves.
5. Obtain boundary conditions of a longitudinal vibration in bars free at one end and also fixed at both the ends

BHC201: Physical Chemistry-I	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks II Semester Exam – 70 marks

Course Objectives:

1. To give an overview of complete knowledge of kinetic theory of gases.
2. To describe the Viscosity of liquids, experimental determination of viscosity coefficient.
3. To explain different types colloids and their characteristic properties.
4. To explain about thermodynamics and its laws.
5. To explain about gels, micelles and emulsions.

Detailed Syllabus

Unit-1 Gaseous state Kinetc theory of gases, ideal gas laws based on kinetic theory. Behaviour of real gases-the van der Waal‟s equation. Critical phenomena-critical constants of a gas and their determination.
Unit-2 Liquid State Surface tension of liquids-capillary action, experimental determination of surface tension, temperature effect on surface tension. Viscosity of liquids, experimental determination of viscosity coefficient, its variation with temperature.
Unit-3 Thermodynamics First law of thermodynamics and their applications, thermodynamic system, states and processes work, heat and internal energy, zeroth law of thermodynamics, various types of work done on a system in reversible and irreversible process, Calorimetry and thermochemistry, enthalpy changes in various physical and chemical process, second law of thermodynamics and its applications.
Unit-4 Colloidal chemistry Colloids, the colloidal state, preparation and purification of colloids and their characteristic properties, lyophilic and lyophobic colloids and coagulation, protection of colloids, gels, emulsions, micelles surfactants and their classification.

Text and Reference Books

1. *Physical Chemistry*: P. C. Rakshit, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.
2. *Physical Chemistry*: B. R. Puri, L. R. Sharma, and M. S. Pathania.37th Edition (1998), ShobanLalNagin Chand & Co., Jalandhar.
3. *Physical Chemistry*: P. Atkins and J. De Paul, 8th Edition (2006), International Student Edition, Oxford University Press.

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* Latest editions of all the suggested books are recommended

Course Outcomes:

After completing the course, students will be able to:

1. State that kinetc theory of gases.
2. Explain the Collision in a gas-mean free path.
3. Briefly describe experimental determination of viscosity coefficient.
4. Determine the enthalpy changes in various physical and chemical process.
5. Classify the nonradioactive and chemical pathways.
6. Define lyophilic and lyophobic colloids and coagulation, protection of colloids, gels, emulsions, surfactants and micelles.

BHC202: Inorganic Chemistry-II	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks II Semester Exam – 70 marks

Course Objectives:

1. To give an overview of chemical bonding.
2. To describe the electronic configuration of s,p and d blocks.
3. To explain hybridization and various theories of bonding.
4. To explain the weak Chemical forces.
5. To explain acids and bases.

Detailed Syllabus

Unit-1
Chemistry of s and p-block and d-block elements
Alkali and alkaline earth metals and their general properties, general charachterstics of p-block elements and d-block elements.

Unit-2
Chemical Bonding
Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Madelung constant, Born-Haber cycle and its application, Solvation energy.

Unit-3
Hybridization and various theories of bonding
Lewis structure, Valence Bond theory (Heitler-London approach).Energetics of hybridization. Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules (CO, NO) and homonuclear diatomic molecules, VSPER theory and its applications.

Unit-4
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

Unit-5
Acids and Bases
Bronsted- Lowry concept of acid-base reaction, solvated proton, relative strength of acids, types of acid-base reactions, leveling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids andBases (HSAB), Application of HSAB principle.

Text and Reference Books

1. *Inorganic Chemistry*, Huhey, J.E. Prentice Hall 1993
2. *Concepts & Models of Inorganic Chemistry*, Douglas, B.E. and Mc Daniel, D.H., Oxford 1970
3. *Concise Inorganic Chemistry*, Lee, J.D., ELBS (1991)
4. *Inorganic Chemistry*, Shriver &Atkins,Third Edition, Oxford Press 1994.
Inorganic Chemistry, H.W. Porterfield,Second Edition, Academic Press, 2005

Course Outcomes:

After completing the course, students will be able to:

1.	Explain the general charachterstics of s, p-block elements and d-block elements.
2.	Explain the hybridization in different molecules.
3.	Explain the molecular orbital diagrams of diatomic and simple polyatomic molecules (CO, NO).
4.	Determine the types of chemical forces.
5.	Classify the acids and bases.
6.	Define HSAB principle.

BHM251: Lab Work II	
Teaching Scheme Lectures: 2 hrs/Week Credits: 2	**Examination Scheme** External marks- 35 Internal marks- 15

Course Objectives:

1. To create and control simple plot and user-interface graphics objects in MATLAB.
2. Tofamiliar with memory and file management in MATLAB.
3. To design simple algorithms to solve problems
4. To understand the MATLAB environment
5. To get basic knowledge about simple numerical computations and analyses using MATLAB.

Detailed Syllabus

Modeling of the following problems using*Matlab/ Mathematica/ Maple* etc.

(i) Any one of thefollowing
- (a) To find numbers between two realnumbers.
- (b) Plotting subsets of R to study boundedness/unboundedness and bounds (if theyexist).
- (c) Plotting of sets on R to discuss the idea of cluster points, lim sup,liminf.

(ii) Any one of thefollowing
- (a) Plotting of recursivesequences.
- (b) Study the convergence of sequences throughplotting.
- (c) Verify BolzanoWeirstrass theorem through plotting of sequences and
- (d) Studying the convergence /divergence of infinite series by plotting their sequences of partialsum.

(iii) Any one of thefollowing
- (a) Cauchy"s root test by plotting n^{th}roots
- (b) Ratio test by plotting the ratio of $n^{th}$and n+1thterm.

(vi) Matrix operation (addition, multiplication, inverse, transpose)

Course Outcomes:

After completing the course, students will be able to:

1. Perform computations on scalars and multidimensional arrays from MATLAB command window.
2. Use commands to retrieve data from the user or from input files into the workspace.
3. Create MATLAB functions that perform required tasks based on specified data inputs and outputs.
4. Write MATLAB programs that perform required repetition involving un-nested and nested while and for loops.
5. Generate plots and export this for use in reports and presentations.

BHP251-Physics Lab II	
Teaching Scheme Practical : 2 hr/week Credits: 2	**Examination Scheme** Attendance - 5 Marks Teachers Assessment – 10 Marks End Semester Exam – 35 marks

Course Objective's

1. To introduce the proper methods for conducting controlled physics experiments, including the acquisition, analysis and physical interpretation of data.
2. Illustrate the principles of modern physics.
3. Perform experiments and interpret the results of observation, including making an assessment of experimental uncertainties.

Detailed Syllabus

Student has to perform any eight experiments;

1. To determine the Young's Modulus of material by bending of beam method.

2. To determine the Modulus of Rigidity of a Wire by Maxwell"s needle.

3. To determine the Elastic Constants of a Wire by Searle"s method.

4. To determine the coefficient of viscosity of water by capillary flow method (Poiseuille"s method).

5. To determine the surface tension of a liquid by Jager"s method.

6. To determine the modulus of rigidity by horizontal apparatus.

7. To determine the modulus of rigidity by vertical apparatus.
8. To determine g by Bar Pendulum.
9. To determine g by Katter"s Pendulum.

10. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g, and (c) Modulus of Rigidity
11. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde"s Experiment.

Reference Books:

1. GeetaSanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
3. InduPrakash and Ramakrishna, A Text Book of Practical Physics Vol. 1 & Vol. 2, KitabMahal, New Delhi.
4. D. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes,Vani Publication House, New Delhi.

Course Outcomes:

After completing the course, students will be able to:

1. Make correct measurements using laboratory instruments
2. Align and setup the instrument for performing the experiment.
3. Diagnose any errors in arrangement
4. Analyze the observations by calculating the related physical quantities.
5. Evaluate the percentage and maximum probable error.
6. Minimize the sources of error and designing additional related experiments

BHC251: Chemistry Lab -II	
Teaching Scheme Practicals: 2 hrs/Week Credits: 2	**Examination Scheme** External marks- 35 Internal marks- 15

Course Objectives:

1. To explain the viscosity.
2. To describe partition coefficient.
3. To explain the pH.
4. To explain the hardness of water.
5. To explain about conductivity.

Detailed Syllabus

1. To determine the viscosity of a given liquid at room temperature by using Ostwald‟s viscometer.
2. To study partition coefficient of iodine between carbon tetrachloride and water.
3. Determination of pH of a given solution using glass electrode.
4. Determination of conductivity of solvents.
5. Determination of hardness of water using EDTA.
6. To find out the rate constant for the inversion of cane sugar in acidic medium and to show that inversion follows the first order kinetics.

Course Outcomes:

After completing the course, students will be able to:

1. Determine viscosity of a given liquid.
2. Analyze the study of partition coefficient.
3. Identify the meaning of conductivity.
4. Understand hardness of water.
5. Find out the rate constant for the inversion of cane sugar.

SEMESTER III

BHM301: Differential Equation	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To evaluate first order differential equations including separable, homogeneous, exact, and linear.
2. To solve second order and higher order linear differential equations.
3. To solve differential equations using variation of parameters.
4. To solve linear systems of ordinary differential equations
5. To introduce students to partial differential equations.
6. To introduce students to how to solve linear Partial Differential with different methods.
7. To derive heat and wave equations in 2D and 3D.

Detailed Syllabus

Unit-1
Differential Equations
Linear differential equations of nth order with constant coefficients, Complementary functions and particular integrals, Simultaneous linear differential equations, Solutions of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications to engineering problems (without derivation).

Unit-2
Series Solutions and Special Functions: Series solutions of ODE of 2nd order with variable coefficients with special emphasis to differential equations of Legendre, and Bessel Legendre polynomials, Bessels functions and their properties.

Unit-3
Partial Differential Equations
Introduction of partial differential equations, Linear partial differential equations with constant coefficients of 2nd order and their classifications - parabolic, elliptic and hyperbolic with illustrative examples.

Unit-4
Applications of Partial Differential Equations
Method of separation of variables for solving partial differential equations, Wave and Heat equations in one dimension. Laplace equation.

Text Books:-
1. H.K.Dass, Higher Engineering Mathmatics, S.Chand Publications.
2. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004.

Reference Books:-

1. R.K.Jain&S.R.K.Iyenger, Advance Engineering Mathematics, Narosa Publishing House, 2002.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
3. E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
4. C.Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd. 2003
5. Peter V. O"Neil, Advanced Engineering Mathematics, Thomson (Cengage) Learning, 2007. 5. Peter V. O"Neil, "Advanced Engineering Mathematics", Thomson (Cengage) Learning, 2007.

Course Outcomes:

After completing the course, students will be able to:

1. Solve first order differential equations utilizing the standard techniques for separable, exact, linear, homogeneous cases.
2. Find the complete solution of a non homogeneous differential equation as a linear combination of the complementary function and a particular solution.
3. Complete solution of a non homogeneous differential equation with constant coefficients by the method of undetermined coefficients.
4. Find the complete solution of a differential equation with constant coefficients by variation of parameters.
5. Understand the working knowledge of basic application problems described by second order linear differential equations with constant coefficients.
6. Solve linear partial differential equations of both first and second order .
7. Apply partial derivative equation techniques to predict the behavior of certain phenomena.

BHM302: Statics & Dynamics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To develop an understanding of the principles of statics
2. To develop an ability to analyze problems in a systematic and logical manner, including the ability to draw free-body diagrams.
3. To analyze the statics of trusses, frames and machine.
4. To apply laws of statics.
5. To know the knowledge of equilibrium conditions of a static body.
6. To develop an understanding of the principles of dynamics.
7. To develop an ability to analyze problems in a systematic and logical manner, including the ability to draw free-body diagrams of rigid body.
8. To analyze the dynamics of rigid body.
9. To discuss the motion on smooth and rough planes.
10. To discuss general motion of rigid body, Keplers laws.

Detailed Syllabus

Unit-1 **Statics:** Analytic condition of equilibrium for coplanar forces. Equation of the resultant force. Common catenary, Centre of gravity, Virtual work. Wrenches, Null line and null plane.
Unit-2 **Dynamics:** Rotation of a vector in a plane. Radial and transverse velocity & acceleration, Tangential and Normal velocity and acceleration. Simple harmonic motion, Motion under other laws of forces, Earth attraction, Motion in resisting medium. Central orbits and Motion of a particle in the dimensions Kepler‟s laws of motion.

Text Books:-

1. R.S. Verma - A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad.

2. S.L. Loney - An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies,

Kalyani Publishers, New Delhi.

3. J.L. Synge&B.A. Griffith - Principles of Mechanics, Tata McGraw-Hill,1959.

Course Outcomes:

After completing the course, students will be able to:

1. Construct free-body diagrams and to calculate the reactions necessary to ensure static equilibrium.
2. Develop an understanding of the analysis of distributed loads.
3. Develop knowledge of internal forces and moments in members.
4. Calculate centroids and moments of inertia.
5. Construct free-body diagrams.
6. Develop an understanding of the analysis of distributed loads.
7. Understand internal forces and moments in members.
8. Apply Keplers laws to solve the problems.

BHP301: Electricity and Magnetism	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To provide a detailed and through knowledge of basic concept of electricity and magnetism.
2. Helps to know the definition of an electric field, and understand the difference between the electric field and electric force.

Detailed Syllabus

Unit-1
Electric Field

Electric field and lines, electric field due to a ring of charge, electric flux, gauss‟s law, gauss‟s law in differential form, applications of gauss‟s law: E due to (i) an infinite line of charge, (ii) a chargedcylindrical conductor, (iii) an infinite sheet of charge and two parallel charged sheets, (iv) a charged spherical shell, (v) a charged hollow sphere, (vi) a uniformly charged solid sphere, electrostatic energy.

Unit-2
Electric Potential

Line integral of electric field, electric potential difference and electric potential V (line integral), conservative nature of electrostatic field, relation between E and V, electrostatic potential energy of a system of charges, potential and electric field of (i) a charged wire and (ii) a charged disc

Unit-3
Magnetic Field

Magnetic field (B), magnetic force between current elements and definition of B, magnetic flux, Biot- savart‟s law: B due to (i) a straight current carrying conductor and (ii) current loop, Ampere‟s circuital law (integral and differential forms): B due to (i) a solenoid and (ii) a toroid

Unit-4
Magnetic Properties

Magnetism of matter: gauss‟s law of magnetism (integral and differential forms), magnetization current, relative permeability of a material, magnetic susceptibility, magnetization vector (M), magnetic intensity (H), relation between B,M and H. stored magnetic energy in matter, magnetic circuit. B-H curve and energy loss in hysteresis

Unit-5

Electromagnetic induction

Faraday‟s law (differential and integral forms), Lenz‟s law, self and mutual induction, energy stored in a magnetic field

Text Books:

1. Edward M. Purcell, Electricity and Magnetism, (McGraw-Hill Education, 1986)
2. David J. Griffiths, Introduction to Electrodynamics, 3rd Edn, (Benjamin Cummings, 1998).

Reference Books:

1. Arthur F. Kip, Fundamentals of Electricity and Magnetism , (McGraw-Hill, 1968)
2. J. H. Fewkes& John Yarwood, Electricity and Magnetism, Vol.-I (Oxford Univ. Press, 1991).
3. D. C. Tayal, Electricity and Magnetism. (Himalaya Publishing House,1988).

Course Outcomes:

After completing the course, students will be able to:

1.Define or describe electric and magnetic field and also electric potential

2.Understand the different laws in electric(gauss‟s law and applications) and magnetic field(Biotandsavart‟s laws ampere‟s laws,.Ampere‟s law)

3. Apply the different laws ofMagnetic field (Biot and Savart,s ,Ampere‟s law)for magnetic field due to current carrying coil, Solenoid Toroid .

4. Analyse the behaviour External magnetic field on the magnetic material and also the Hysteresis Loop

5. Evaluate numerical problems and theorems of electric field and magnetic field

6. Classify the possible differences among Paramagnetic materials Dia magnetic material, Ferromagnetic materials. Magnetisation.

BHP302: Semiconductor Physics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

The aim of the course is to develop physics and engineering strategies of semiconductor materials and to discuss their functionalities in modern electronic devices.

Detailed Syllabus

Unit-1
Basics of semiconductors

Energy bands in solids, valence and conduction bands, Insulators, conductors and semiconductors, Types of semiconductors: Extrinsic & intrinsic semiconductors, Fermi level, majority and minority carriers, conductivity of intrinsic and extrinsic semiconductors, p and n type semiconductors, idea about drift and diffusion

Unit-2
P-N junction

Formation of depletion layer, barrier formation in P-N junction diode, junction or barrier potential, energy band diagram of p-n junction, recombination, drift and saturation of drift velocity, biasing of P-N junction: forward and reverse

Unit-3
P-N junction diode

Junction resistance, junction breakdown, junction capacitance, equivalent circuit of P-N junction, basic idea about diode fabrication, the ideal diode, the real diode, Basic idea about different types of diode

Unit-4
Diode circuits

Diode circuits with DC and AC voltage sources, diode clipper and clamper circuits, clippers, some clipping circuits, clampers, clamping circuits

Unit-5
Rectifiers

Half wave rectifier, equivalent circuit of a half wave rectifier, full wave rectifier, equivalent circuit of a full wave rectifier, regulated and unregulated power supply, bridge rectifier.

Text Books:

1. Robert Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 8Th Edition, Pearson Education, India, 2004.
2. B.L. Thareja and R.S. Sedha, Principles of Electronic Devices and Circuits, S. Chand & Company Ltd.

Reference Books:

1. A. P. Malvino, Electronic Principles, Glencoe, 1993.
2. John Morris, Analog Electronics.
3. Allen Mottershead, Electronic Circuits and Devices, PHI, 1997.
4. V. K. Mehta, Principals of Electronics, (S Chand & Co, New Delhi) 2010
5. N. N. Bhargava, D. C. Kulshreshtha& SC Gupta , Basic Electronics & Linear Circuits, Tata McGrawHill, 2006

Course Outcomes:

After completing the course, students will be able to :

1. Describe various properties of semiconductor materials.
2. Describe band structures of semiconductor
3. Explain the properties of n-type and p-type semiconductors.
4. To understand the current flow mechanism in p-n junction diode, rectifier diodes.
5. To define or describe the semiconductor diodes (extrinsic and intrinsic semiconductors, p-n junction diode)
6. Apply the knowledge of semiconductors to illustrate the functioning of basic electronic devices such as p-n junction, rectifiers etc.

BHC301: Organic Chemistry-I	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks III Semester Exam – 70 marks

Course Objectives:

1. To give knowledge of halogenated hydrocarbons.
2. To describe the alcohols and phenols.
3. To explain about ethers and epoxides.
4. To explain about carbonyl compounds.
5. To describe about carboxylic acids and their derivatives.

Detailed Syllabus

Unit-1
Chemistry of Halogenated hydrocarbons:

Alkyl halides, Methods of preparation, nucleophilic substitution reactions – SN_1, SN_2 mechanisms. Aryl halides: Preparation, including preparation from diazonium salts. nucleophilic aromatic substitution. Organometallic compounds of Mg and Li.

Unit-2
Alcohols and Phenols

Alcohols: preparation, properties and relative reactivity of 1^0, 2^0, 3^0 alcohols, Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer – Tiemann and Kolbe‟s – Schmidt Reactions.

Unit-3
Ethers and Epoxide

Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH4.

Unit-4
Carbonyl Compounds

Structure, reactivity and preparation; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Perkin, Cannizzaro and haloform Reaction, Beckmann rearrangement.

Text and Reference Books

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Course Outcomes:

After completing the course, students will be able to:

1. Describe the basic concepts of organic functional groups.
2. Classify the alcohols, preparation, properties and relative reactivity of 1^0, 2^0, 3^0 alcohols.
3. Draw the different reaction mechanism like aldol, cannizaro and haloform etc.
4. Compare the SN2 and SN1 reactions.
5. Evaluate the reactions of epoxides with alcohols.
6. Design the synthesis of carboxylic acid and its derivatives.

BHC302: Physical Chemistry-II	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks III Semester Exam – 70 marks

Course Objectives:

1. To give an overview of chemical thermodynamics.
2. To describe the electrochemistry.
3. To explain the Le Chatelier principle.
4. To explain the solutions and colligative properties.
5. To explain about nuclear binding energy.

Detailed Syllabus

Unit-1

Chemical thermodynamics

Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics. First law: Concept of heat, q, work, w, internal energy U and statement of first law; enthalpy,H. Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; Calculation of entropy change for reversible and irreversible processes.

Unit-2

Electrochemistry

Arrhenius theory of electrolytic dissociation, Hydrolysis of salts, hydrolysis constant, buffer solutions, indicators and theory of acid-base indicators. Migration of ions: transference number and its determination by Hittorf methods.

Unit-3

Chemical equilibrium

Criteria of thermodynamic equilibrium, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Le Chatelier principle (quantitative treatment); equilibrium between ideal gases and a pure condensed phase.

Unit-4

Solutions and Colligative Properties

Dilute solutions; lowering of vapour pressure, Raoult‟s and Henry‟s Laws and their applications. Relative lowering of vapour pressure, Elevation of boiling point, Depression of freezing point, Osmotic pressure.

Unit-5 **Nuclear Chemistry** Nucleus and its classification, nuclear forces, nuclear binding energy, stability of nucleus. Radioactivity: Radioactive elements, general characteristics of radioactive decay, decay kinetics (decay constant, half life, mean life period), units of radioactivity,nuclear fusion and fission
Recommended Textbook: 1. Atkins, P. W. & Paula, J. de Atkin‟s Physical Chemistry 8th Ed., Oxford University Press (2006). 2. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004). 3. Engel, T. & Reid, P. Thermodynamics, Statistical Thermodynamics, & Kinetics Pearson Education, Inc: New Delhi (2007). 4. McQuarrie, D. A. & Simon, J. D. Molecular Thermodynamics Viva Books Pvt. Ltd.: New Delhi (2004)

Course Outcomes:

After completing the course, students will be able to:

1. Define state and path functions.
2. Interpret Concept of entropy and thermodynamic scale of temperature.
3. Estimate transference number and its determination.
4. Analyze the outline of equilibrium between ideal gases and a pure condensed phase
5. Evaluate the Elevation of boiling point, Depression of freezing point
6. Classify the problems of Radioactive elements

BHM351: Lab Work III	
Teaching Scheme Lectures: 2 hrs/Week Credits: 2	**Examination Scheme** External marks- 35 Internal marks- 15

Course Objectives:

1. To create and control simple plot and user-interface graphics objects in MATLAB.
2. Tofamiliar with memory and file management in MATLAB.
3. To design simple algorithms to solve problems
4. To understand the MATLAB environment
5. To get basic knowledge about simple numerical computations and analyses using MATLAB.

Detailed Syllabus

Use of computer aided software (CAS), for example *Matlab/ Mathematica/ Maple*/ *Maxima* etc., for developing the following Numerical programs

(i) Any two of thefollowing
   (a) BisectionMethod
   (b) Newton RaphsonMethod
   (c) SecantMethod
   (d) RegulaFalsiMethod

(ii) LU decompositionMethod

(iii) Gauss-JacobiMethod

(vi) SOR Methodor Gauss-Siedel Method

(v) Lagrange Interpolation or NewtonInterpolation

(vi) Simpson‟srule.

Course Outcomes:

After completing the course, students will be able to:

1. Perform computations on scalars and multidimensional arrays from MATLAB command window.
2. Use commands to retrieve data from the user or from input files into the workspace.
3. Create MATLAB functions that perform required tasks based on specified data inputs and outputs.
4. Write MATLAB programs that perform required repetition involving un-nested and nested while and for loops.

5. Generate plots and export this for use in reports and presentations.

BHP351-Physics Lab III	
Teaching Scheme Practical : 2 hr/week Credits: 2	**Examination Scheme** Attendance - 5 Marks Teachers Assessment – 10 Marks End Semester Exam – 35 marks

Course Objectives:

1. To give an overview of the experiment equipment and underlying principles.
2. To give complete knowledge of handling of instrument and making correct measurements
3. To describe the method of making calculations and plotting graphs & interpret them.
4. To explain the various possible causes of error and their removal.
5. To organize the result and make further use in understanding and problem solving.
6. To create new experimental setups for related extended and advanced measurements.

Detailed Syllabus

Each student has to perform any eight experiments:

1. To determine the frequency of AC mains bySonometer.
2. To study the response curve of a Series LCR circuit and determine its (a)Resonant frequency, (b) Impedance at resonance and (c) Quality factor Q, and (d)Bandwidth.
3. To study the response curve of a Parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
4. To determine the specific resistance of a given wire using Carey Foster‟s bridge.
5. To determine a Low Resistance by a Potentiometer.
6. To calibrate the given ammeter and voltmeter by potentiometer.
7. To draw hysteresis curve of a given sample of ferromagnetic material and from - this to determine magnetic susceptibility and permeability of the given specimen
8. To determine the ballistic constant of a ballistic galvanometer.
9. To study the variation of magnetic field along the axis of current carrying - circular coil and then to estimate the radius of the coil.
10. To determine Self Inductance of a Coil by Anderson‟s Bridge using AC
11. To determine high resistance by leakage method.

Reference Books:

1.GeetaSanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.
2.B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House,NewDelhi.
3.InduPrakash and Ramakrishna, A Text Book of Practical Physics Vol 1 &Vol 2, KitabMahal,NewDelhi.

4.D. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes,Vani Publication House, New Delhi

Course Outcomes:

After completing the course, students will be able to:

1. Handle laboratory instruments and make precise measurements.
2. Align and setup the instrument for performing the experiment.
3. Diagnose any errors in arrangement
4. Analyze the observations by calculating the related physical quantities and verify the underlying law of Physics.
5. Avaluate the percentage and maximum probable error and minimizing error.
6. Design improvised extensions of related experiments.

BHC351: Chemistry Lab -III	
Teaching Scheme Practicals: 2 hrs/Week Credits: 2	**Examination Scheme** External marks- 35 Internal marks- 15

Course Objectives:

1. To give an overview of heat capacity and Enthalpy.
2. To explain heat capacity and solubility.

Detailed Syllabus

LIST OF EXPERIMENTS

1. Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
2. Calculation of the enthalpy of ionization of ethanoic acid.
3. Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.
4. Determination of enthalpy of hydration of copper sulphate.
5. Study of the solubility of benzoic acid in water and determination of ΔH.

Course Outcomes:

After completing the course, students will be able to:

1. Understand heat capacity and working principle of calorimeter.
2. Analyze the reaction type and to find out the solubilities of solvents.

SEMESTER IV

BHM401: Elementary Algebra & Analysis	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To work with infinite sequences and series.
2. To work with infinite sequence is bounded.
3. To work with an infinite sequence is monotonic.
4. To work with an infinite sequence is convergent or divergent.
5. To Define the real numbers, least upper bounds, and the triangle inequality.
6. To Calculate the limit superior, limit inferior, and the limit of a sequence.
7. To discuss the present the relationships between abstract algebraic structures with familiar numbers systems such as the integers and real numbers.
8. To discuss the present concepts of and the relationships between operations satisfying various properties (e.g. commutative property).
9. To discuss the present concepts and properties of various algebraic structures.
10. To discuss the importance of algebraic properties relative to working within various number systems.
11. To develop the ability to form and evaluate conjectures.

Detailed Syllabus

Unit-1

Analysis: Real Numbers and its property, Open, closed Intervals, Boundedness, Least upper bound, Greatest Lowerbound, Sequence, Series, and its convergence (basic idea), Convergence of infinite series, Comparison test,ratio test, root test, Limits, continuity and differentiability (on Interval and Sets) of functions, Algebra of continuous and differentiable functions, Various mean value theorems.

Unit-2

Algebra: Sets, Relations, Functions and their types, Algebraic Structure, Equivalence relations and partitionsCongruence modulom relation, Algebraic Structure, Definition of a monoid, groupoid, semi group, group with examples and simple properties, Permutation groups, Subgroups, Centre and normalizer, Cyclic groups,Cosets, Lagrange‟s theorem. Homomorphism and isomorphism, Introduction to rings, subrings, integral domains, Division Ring and Field with examples.

Text and Reference Books

1. **Joseph A. Gallian**, Contemporary Abstract Algebra (4th Edition), Narosa Publishing House, New Delhi, 1999

2.**I. N. Herstein ,**Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1975**.**

3.**R. G. Bartle** and **D. R. Sherbert**, Introduction to Real Analysis(3rd Edition), John Wiley and Sons (Asia) Pte. Ltd., Singapore, 2002.

4. **S.C. Malik and Shanti Arora**, Mathematical Analysis, New Age Publication.

5. **Shanti Narayan**, Elements of Real Analysis, S. Chand & Company, New Delhi

Course Outcomes:

After completing the course, students will be able to:

1. Determine that infinite sequence is bounded.
2. Determine that infinite sequence is monotonic.
3. Determine that infinite sequence is convergent or divergent.
4.Determine that infinite series is convergent or divergent by selecting the appropriate test from the following: (a) test for divergence; (b) integral test; (c) p-series test; (d) the comparison tests; (e) ratio test; and (f) root test.
5. Describe fundamental properties of the real numbers that lead to the formal development of real analysis.
6. Demonstrate an understanding of limits and how they are used in sequences, series, differentiation and integration.
7. Understand the importance of algebraic properties with regard to working within various number systems.
8. Extend group structure to finite permutation groups.

BHM402: Integral Transform	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To analyze properties of special functions by their integral representations and symmetries.
2. To determine properties of Fourier Transform which may be solved by application of special functions.
3. To determine properties of Laplace Transform which may be solved by application of special functions.
4. To determine properties of Z- Transform which may be solved by application of special functions.

Detailed Syllabus

Unit-1 **Laplace Transform:** Laplace transform, Existence theorem, Laplace transform of derivatives and integrals, Inverse Laplace transform, Unit step function. Laplace transform of periodic functions, Convolution theorem, Application to solve simple linear and simultaneous differential equations.
Unit-2 **Fourier Series:** Periodic functions, Trignometric series, Fourier series of period 2 ð, Eulers formulae, Functions having arbitrary period, Change of interval, Even and odd functions, Half range sine and cosine series.
Unit-3 **Fourier & Z – Transform:** Introduction, Fourier integral transform, Fourier transform, properties of Fourier transform, finite Fourier transform , Fourier sine & cosine transform,Z-transform and its applications.
Text Books:- 1. H.K.Dass, Higher Engineering Mathmatics, S.Chand Publications. 2. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004. **Reference Books:-** 1. R.K.Jain&S.R.K.Iyenger, Advance Engineering Mathematics, Narosa Publishing

House, 2002.

2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.

3. E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.

4. C.Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata McGraw-

Hill Publishing Company Ltd. 2003

5. Peter V. O"Neil, Advanced Engineering Mathematics, Thomson (Cengage) Learning,

2007. 5. Peter V. O"Neil, "Advanced Engineering Mathematics", Thomson (Cengage) Learning, 2007.

Course Outcomes:

After completing the course, students will be able to:

1. Understand Integral Transform and its classification.
2. Explain the applications and the usefulness of these transform.
3. Classify and explain the different types of Transforms.
4. Understand purpose and functions of the Fourier series and Transformation.

BHP401: Thermal Physics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. It helps to apply the key concepts of thermal physics to a variety of thermodynamic systems such as engines, refrigerators, and the atmosphere.
2. To learn laws of thermodynamics, entropy, and Maxwell‟s thermodynamic relations.

Detailed Syllabus

Unit-1
Zeroth and First law of thermodynamics

Thermodynamical equilibrium, Zeroth law of thermodynamics and concept of temperature, Work and heat energy, State functions, First law of thermodynamics, Differential form of first law, Internal energy, First law and explanation of various thermodynamical processes, Applications of first law: general relation between Cp and Cv, Work done during isothermal and adiabatic processes.

Unit-2
Second law of thermodynamics

Reversible and irreversible changes, Conversion of work into heat and heat into work, Heat engines, Carnot cycle, Carnot engine and its efficiency, Refrigerator and its efficiency, Second law of thermodynamics: Kelvin-Planck and Clausius statements and their equivalence, Carnot theorem, Applications of second law of thermodynamics: thermodynamic scale of temperature.

Unit-3
Entropy

Concept of entropy, Change in entropy, Clausius theorem, Clausius inequality, Second law of thermodynamics in terms of entropy, Entropy of a perfect gas, Entropy of the universe, Entropy changes in reversible and irreversible processes, Principle of increase of entropy, Impossibility of attainability of absolute zero: third law of thermodynamics, Temperature-entropy diagrams.

Unit-4
Thermodynamic potentials and Maxwell's relations

Thermodynamic variables, Thermodynamic potentials U, H, F and G: their definitions, properties and applications, Derivations of maxwell‟s relations, Applications of maxwell‟s relations: (i) Clausius-Clapeyron equation, (ii) values of Cp-Cv, (iii) TdS equations, (iv) joule-thomson coefficient for ideal and vander-waal gases, (v) energy equations and (vi) change of temperature during an adiabatic

process.

Text Books:

1. Mark Waldo Zemansky, Richard Dittman, Heat and Thermodynamics: An Intermediate Textbook (McGraw-Hill, 1981)

2. Francis W. Sears & Gerhard L. Salinger, Thermodynamics, Kinetic Theory, and Statistical Thermodynamics(Narosa, 1986).

Reference Books:

1. Garg, Bansal and Ghosh , Thermal Physics (Tata McGra-Hill, 1993)

2. Brijlal&Subhramanyam, Thermodynamics & Statistical Physics(S.Chand Publ.)

Course Outcomes:

After completing the course, students will be able to:

1. Basic concepts of Thermodynamics and first law can be understood.
2. Understanding of various thermodynamical processes and to evaluate the work done.
3. Understand the second law of thermodynamics.
4. Apply the concepts and laws of thermodynamics to solve problems in thermodynamic systems such as gases, heat engines and refrigerators etc.
5. Apply the concept of Entropy to evaluate change of entropy in different phases of matter
6. Apply the concept of thermodynamical potentials & Maxwell‟s equations for various therodynamical problems.

BHP402: Electronic Devices & Circuits	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

It helps to give the ability to understand different types of electronic devices.

Detailed Syllabus

Unit-1 **Special Diodes & Optoelectronic Devices:** Review of P-N junction, Zener Diode & its applications, Tunnel Diode, PIN Diode, Schottky Diode, LED, Photovoltaic or Solar cell, Light activated SCR
Unit-2 **Bipolar Junction Transistor:** Bipolar junction transistor (PNP & NPN) & its biasing, transistor currents, CB, CE & CC configurations and bias conditions (cut off, active and saturation regions), relation between α&β, transistor characteristics (Common base, emitter & collector), basics of h-parameter
Unit-3 **Amplifiers:** Classification of amplifiers**,** Various gains of CB, CE & CC amplifiers, Class A, B, and C amplifiers, introduction to multistage & feedback amplifiers
Unit-4 **JFET & MOSFET:** Construction and working of JFET, output and transfer characteristics of FET, Determination of FET parameters, Application of FET as voltage variable resistor, Advantages of FET over BJT, **MOSFET:** construction and working of MOSFET, enhancement and depletion modes, output and transfer characteristics, Application of MOSFET as a switch
Unit-5 **Oscillators:** Comparison of amplifier and oscillator, Hartley &Colpitt Oscillator, RC phase shift oscillator

Text Books:

1. Robert Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 8Th Edition, Pearson Education, India, 2004.
2. A. P. Malvino, Electronic Principles, Glencoe, 1993.

Reference Books:

1. John Morris, Analog Electronics.

2. Allen Mottershead, Electronic Circuits and Devices, PHI, 1997

3. Ben G. Streetman & Sanjay Banerjee, Solid state electronic devices, Pearson Prentice Hall, 2006.

4. N. N. Bhargava, D. C. Kulshreshtha& SC Gupta, Basic Electronics & Linear Circuits, Tata McGraw Hill, 2006

5. B.L.Thareja, R.S. Sedha, Principles of Electronic Devices and Circuits, S.Chand

Course Outcomes:

After completing the course, students will be able to:

1. Define or describe the semiconductor diodes(extrinsic and intrinsic semiconductors, p-n junction diode, p-n-p and n-p-n transistor, current, resistance, transistor biasing....)
2. Analyse the characteristics of transistor and transistor biasing circuits
3. Apply the different application of integrated circuits, BJT,FET etc
4. Recognize and classify different characteristics of semiconductor, junction device,FET, MOSFET,Energy
5. Obtain knowledge on oscillators, transistors and h-parameters

BHC401: Inorganic Chemistry – III	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks IV Semester Exam – 70 marks

Course Objectives:

1. To give knowledge of s and p block elements.
2. To describe the noble gases.
3. To explain about VBT and MOT.
4. To explain about inorganic polymers.
5. To describe about silicones.

Unit-1

Chemistry of s and p block elements:

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of s and p block elements. Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate. Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses. Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes, Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and basic

properties of halogens. Theoretical principles involved in volumetric analysis, done in the lab.

Unit-2

Noble gases :

Occurrence & uses, rationalization of inertness of noble gases, Clathrates; preparation

and properties of XeF2 and XeF4, XeF6; Nature of bonding in noble gas compounds

(Valence bond treatment and MO treatment for XeF2). Molecular shapes of noble gas

compounds (VSEPR theory).

Unit-3

Inorganic Polymers:

Types of inorganic polymers, comparison with organic polymers, synthesis, structural

aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes, and polysulphates.

Text and Reference Books

1. Greenwood, N.N. and Earnshaw, Chemistry of the Elements, Butterworth-Heinemann. 1997.

2. Lee, J.D. Concise Inorganic Chemistry, ELBS (1991).

3. Canham, G.R. and Overton, T., Descriptive Inorganic Chemistry, Freeman &Co.2006

4. Cotton, F.A. and Wilkinson, G, Advanced Inorganic Chemistry, Wiley, VCH, 1999.

Course Outcomes:

After completing the course, students will be able to:

1. Explain the relative stability of different oxidation states.
2. State that hydrides and their classification ionic, covalent and interstitial.
3. Describe the oxides and oxoacids of nitrogen, Phosphorus and chlorine.
4. Preparation and properties of XeF_2 and XeF_4, XeF_6.
5. Briefly describe the types of inorganic polymers, comparison with organic polymers.
6. Explain the Borazines, silicates and phosphazenes, and polysulphates.

BHC402: Organic Chemistry –III	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks IV Semester Exam – 70 marks

Course Objectives:

1. To give knowledge of nitrogen Containing Functional Groups
2. To describe the effect of substituents and solvents on basicity.
3. To explain about polynuclear hydrocarbons.
4. To explain about classification and nomenclature of heterocyclic compounds.
5. To explain about alkaloids.

Detailed Syllabus

Unit-1

Nitrogen Containing Functional Groups

Preparation and important reactions of nitro-compounds, nitriles and isonitriles

Amines: Effect of substituents and solvents on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann‟s exhaustive methylation, Hofmann-elimination reaction; Distinction between 1^0, 2^0 and 3^0 amines with Hinsberg reagent and nitrous acid;

Diazonium Salts: Preparation and their applications.

Unit-2

Polynuclear Hydrocarbons

Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.

Unit-3

Heterocyclic Compounds

Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of:

Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine, Structure elucidation of indole, Fischer indole synthesis and Madelung synthesis), Structure elucidation of quinoline and isoquinoline, Skraup synthesis, Friedlander‟s synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction,Derivatives of furan: Furfural and furoic acid.

Unit-4

Alkaloids

Natural occurrence, General structural features, Isolation and their physiological action Hoffmann‟s exhaustive methylation, Emde‟s modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.

Course outcomes:

After completing the course, students will be able to:

1. Define or describe all concept of substituents and solvents on basicity.
2. Understand the synthesis, reactions and mechanism of substitution reactions of Furan, Pyrrole.
3. Apply the preparation and structure elucidation and important derivatives of naphthalene and anthracene.
4. Focus on natural occurrence, General structural features, Isolation and physiological action of alkaloid.
5. Judge the significance of Hoffmann‟s exhaustive methylation
6. Describe the medicinal importance of alkaloids.

BHM451: Lab Work IV	
Teaching Scheme Lectures: 2 hrs/Week Credits: 2	**Examination Scheme** External marks- 35 Internal marks- 15

Course Objectives:

1. To create and control simple plot and user-interface graphics objects in MATLAB.
2. Tofamiliar with memory and file management in MATLAB.
3. To design simple algorithms to solve problems
4. To understand the MATLAB environment
5. To get basic knowledge about simple numerical computations and analyses using MATLAB.

Detailed Syllabus

Modeling of the following problems using*Matlab/ Mathematica/ Maple* etc.

(i) Plotting second and third order solutionfamilies

(ii) Acceleration-velocitymodel

(iii) Growth and decay model cold pill and a course of coldpills

(c) Case study of alcohol in the bloodstream (initial input/ continuous input on empty stomach and with substantialmeal)

(d) Limited growth of (both exponential andlogistic)

(iv) Any two of thefollowing

(a) Lake pollution model (with constant/ seasonal flow and pollutionconcentration)

(b) Case of asingle population (with and without harvesting

(v) Any two of thefollowing

(a) Predator prey model (basic Lotkavolterra model, with density dependence, effect of DDT, two prey onepredator)

(b) Epidemic model of influenza (basic epidemic model, contagious for life, disease with carriers, disease with re-infection, density dependent contactrate)

(c) Battle model (basic battle model, jungle warfare, with desertion, long rangeweapons)

(vi) Taylor and Maclaurin series of sin x, cos$x$, log $(1+x)$, e^x, $(1+x)^n$, maxima and minima, inverse ofgraphs.

Course Outcomes:

After completing the course, students will be able to:

1. Perform computations on scalars and multidimensional arrays from MATLAB command window.
2. Use commands to retrieve data from the user or from input files into the workspace.
3. Create MATLAB functions that perform required tasks based on specified data inputs and outputs.
4. Write MATLAB programs that perform required repetition involving un-nested and nested while and for loops.
5. Generate plots and export this for use in reports and presentations.

Physics Lab-IV : BHP451	
Teaching Scheme Practical : 2 hr/week Credits: 2	**Examination Scheme** Attendance - 5 Marks Teachers Assessment – 10 Marks End Semester Exam – 35 marks

Prerequisite: - Handling of more advanced instruments, setting up delicate and sensitive arrangements and calibration of certain experimental setups, BPR251.

Course Objectives:

1. To give an overview of the experiment equipment and underlying principles.
2. To give complete knowledge of handling of instrument and making correct measurements
3. To describe the method of making calculations and plotting graphs & interpret them.
4. To explain the various possible causes of error and their removal.
5. To organize the result and make further use in understanding and problem solving.
6. To create new experimental setups for related extended and advanced measurements.

Detailed Syllabus

Student has to perform any eight experiments of the following;

1 To Study the FET characteristics
2. To Study the MOSFET characteristics
3. To Study the characteristics Of Photo diode.
4. To Determine the Refractive index Of Prism by using the White light
5. To Determine the Plank‟s constant by Photo cell
6. To study the Malus law.
7. To verify Stefan‟s law and to determine the value of Stefan‟s Constant.
8. To determine the wavelength of prominent spectral lines of mercury light by a plane transmission grating using normal incidant method

10. To determine the coefficient of Thermal conductivity of a bad conductor by Lee and charlton‟s disc method
11. To determine the coefficient of Thermal conductivity copper by Searle‟s Appartus.
12 To determine the temperature coefficient of resistance by platinum resistance thermometer (prt).
13 To determine the value of mechanical equivalent of heat with joule calorimeter
14 To determine J By callender and barne‟s

Reference books:

1. GeetaSanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.

Course Outcomes:

After completing the course, students will be able:

1. Handle laboratory instruments and make precise measurements.
2. Align and setup the instrument for performing the experiment.
3. Diagnose any errors in arrangement
4. Analyze the observations by calculating the related physical quantities and verify the underlying law of Physics.
5. Evaluate the percentage and maximum probable error and minimizing error.
6. Design improvised extensions of related experiments.

BHC451: Chemistry Lab -IV	
Teaching Scheme Practicals: 2 hrs/Week Credits: 2	**Examination Scheme** External marks- 35 Internal marks- 15

Course Objectives:

1. To describe complexometric Titrations.
2. To explain the Argentometry.
3. To give an overview of organic preparation and estimation.

Detailed Syllabus

Sec-A:

(a) Complexometric Titrations:

(i) Complexometric estimation of (i) Mg^{2+} (ii) Zn^{2+} using EDTA

(ii) Estimation of total hardnesss of water samples

(iii)Estimation of Ca^{2+} in solution by (substitution method) using Erio-chrome black-T as indicator.

(ii) Estimation of Ca/Mg in drugs and biological samples.

(b) Argentometry

Estimation of Cl^- (i) By Mohr‟s method, (ii) By Vohlard‟s method, (iii) By Fajan‟s method.

(c) Paper chromatographic separation of Ni (II) and Co(II); Cu(II) and Cd (II)C

Sec-B:

Organic Preparations

1. Diels-Alder reaction between anthracene and maleic anhydride

2. Reduction of nitrobenzene to azobenzene (TLC of the mixture) and m-dinitrobenzene to m-nitroaniline

3. Photochemical reduction of benzophenone to benzopinacol

4. Benzoin condensation of benzaldehyde (using thiamine hydrochloride)

5. Condensation of p-toluidine with benzaldehyde/salicylaldehyde/2-hydroxy-3-methoxy benzadehyde to get Schiff‟s base (solventless condensation)

Estimation of:

1. Phenol and aniline by bromination with potassium bromate-potassium bromide method

2. Glycine by formylation method

3. Saponification value of an oil/fat

Sec – C:

(I) Study the equilibrium of at least one of the following reactions by the distribution method:

(i) $I_2(aq) + I^- \rightarrow I_3^-(aq)$

(ii) $Cu_2^+(aq) + nNH_3 \rightarrow Cu(NH_3)n^{2+}$

(II) Perform the following potentiometric titrations (at least two):

(i) Strong acid with strong base (ii) weak acid with strong base and (iii) dibasic acid with strong base

(III) Potentiometric titration of Mohr's salt with potassium dichromate.

(IV) Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.

Course Outcomes:

After completing the course, students will be able to:

1. Understand various types of organic synthesis.
2. Analyze the effect of complexometric Titrations.
3. Identify argentometry and estimatation.

Semester –V

BHP501: Digital Electronics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To understand number representation and conversion between different representation in digital electronic circuits
2. The objective is to obtain a basic level of Digital Electronics knowledge and set the stage to perform the analysis and design of complex digital electronic circuits.

Detailed Syllabus

Unit-1 **Number system** Concept of number system, Decimal, Binary, Octal & Hexadecimal number systems, Conversion from one number system to other, binary addition, binary subtraction using 1‟s complement method and 2‟s compliment method
Unit-2 **Boolean algebra** De-morgan‟s theorem, boolean laws, simplification of logic circuit using boolean algebra, fundamental products, minterms and maxterms, conversion of a truth-table into an equivalent logic circuit by sum of products method and Karnaugh map (upto 4 variable)
Unit-3 **Logic gates** AND, OR and NOT Gates (Realization using Diodes and Transistor), NAND, NOR Gates, Exclusive OR and Exclusive NOR Gates
Unit-4 **Combinational circuits** Half adder and full adder and subtractor, parallel adder (upto 8 bits), multiplexer and demultiplexer
Unit-5 **Sequential Circuits** SR Latch,SR, D, T and JK Flip-Flops, Preset and Clear Operations, Race-around Conditions in JK Flip-Flops, Master-Slave JK Flip-Flop
Text Books: 1. M. Morris Mano and Michal D. Ciletti, Digital Design (4th Edition), Pearson 2. Donald P Leach & A.P. Malvino, Digital Principles and Applications, Glencoe (1995) 3. A. Anand Kumar, Fundamentals of Digital Circuits, Prentice Hall India (2004)

Reference Books:

1. 1. R.P. Jain, Modern Digital Electronics, McGraw Hill (2009)
2. HertbertTaub and Donald L Schilling, Digital Integrated Electronics, McGraw Hill

Course Outcomes:

After completing the course, students will be able to:

1. Develop a digital logic and apply it to solve real life problems.
2. Analyze, design and implement combinational logic circuits
3. Design the combinational circuits, Sequential circuits, Flip Flop, multiplexer, adder and subtractor

BHP502: Atomic and Molecular Physics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. It provides with a comprehensive background to the tools of modern atomic physics.
2. To provide a framework of understanding physics of atom and molecules, origin of X-Rays, Spectroscopic notation, rotational and vibrational spectra, Basics knowledge of Raman Spectra etc.

Detailed Syllabus

Unit-1

Atoms in electric and magnetic fields:

Electron angular momentum, Space quantization, Electron spin and spin angular momentum, Larmor‟s theorem, Spin magnetic moment, Stern-gerlach experiment, Zeeman effect, electron magnetic moment and magnetic energy, gyromagnetic ratio and Bohr magneton

Unit-2

Atoms in external magnetic fields:

Normal and anomalous Zeeman Effect, Paschen back and Stark effect (qualitative discussion only)

Unit-3

Many electron atoms:

Pauli‟s exclusion principle, Symmetric and antisymmetric wave functions, Periodic table, Fine structure, Spin orbit coupling, Spectral notations for atomic states, Total angular momentum, Vector model, L-S and j-j couplings, Hund‟s rule, Term symbols, Spectra of hydrogen and alkali atoms (Na etc.)

Unit-4

Molecular spectra:

Rotational energy levels, selection rules and pure rotational spectra of a molecule, vibrational energy levels, selection rules and vibration spectra, Rotation vibration energy levels, selection rules and rotation-vibration spectra. Determination of internuclear distance

Unit-5

Raman effect:

Quantum theory of Raman effect, characteristics of Raman lines, Stoke‟s and anti-Stoke‟s lines, Complementary character of Raman and infrared spectra.

Text Books:

1. Arthur Beiser, Concepts of Modern Physics,(McGraw-Hill Book Company, 1987)
2. J. H. Fewkes& John Yarwood, Atomic Physics Vol. II (Oxford Univ. Press, 1991)

Reference Books:

1. J. B. Rajam& foreword by Louis de-Broglie, Atomic physics, (S. Chand & Co., 2007)
2. B. H. Bransden and C.J.Joachein , Physics of Atoms and Molecules (Prentice Hall)
3. C. N. Banwell, Molecular Spectroscopy (McGraw Hill)

Course Outcomes:

After completing the course, students will be able to:

1. Describe the basics of atomic spectra(Bohr‟s atomic model, Sommerfield‟s quantization rules, angular moments and Larmor‟s precession) and Molecular spectra
2. Differentiate the L-S and j-j Coupling and Vibrational and Rotational spectra.
3. Evaluate the Numerical problems of space quantization and Vector modal L-S coupling and j-j coupling. Numerical problems of molecular spectra.
4. Classify the atomic and molecular spectra, Isotope effect
5. Determine The Sommerfield‟s extension of Bohr‟s model, Relativistic corrections for energy levels of hydrogen atom, To Determine the L-S and j-j Coupling and effect of external magnetic field (Zeeman effect) Numerical problems on the basis of space quantization and Vector modal, To estimate Rigid Rotator and harmonic Oscillator And electronic spectra
6. Develop the understanding atomic spectra (space quantization and Vector modal in terms of the angular momentum, Stern-Gerlach experiment. and Molecular spectra(Vibration and Rotational spectra. electronic spectra) Frank-Condon principle

BHP503: Quantum Mechanics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

To study origin of quantum theory through described experiments-mechanism, Uncertainty principle & Operators and its use, application of Schrödinger equation like, electron sharing in covalent bonds, fusion in the sun, cold emission, scanning tunneling microscope &indistinguishability in quantum mechanics, bosons and fermions

Detailed Syllabus

Unit-1

Particles and waves

Wave nature of matter: de-broglie hypothesis, Wave-particle duality, Davisson-Germer experiment, Wave description of particles by wave packets, Group and phase velocities and relation between them, Probability, Wave amplitude and wave functions

Heisenberg‟s uncertainty principle: Derivation from wave packets and its applications.

Unit-2

Basic Postulates and Formalism

Energy, momentum and Hamiltonian operators, time-independent schrödinger waveequation for stationary states, properties of wave function, interpretation of wave function, probability density and probability, conditions for physical acceptability of wave functions, normalization, expectation values.

Unit-3

Applications of Schrödinger wave equation

Eigen functions and eigen values for a particle in a one dimensional box, Bound state problems: general features of a bound particle system, (i) one dimensional simple harmonic oscillator: energy levels and wave functions, Zero point energy, (ii) quantum theory of hydrogen atom, Scattering problems in one dimension: (i) finite potential step: reflection and transmission, (ii) quantum phenomenon of tunneling: tunnel effect.

Text Books:

1. L. I. Schiff, Quantum Mechanics, 3rd edition, (McGraw Hill Book Co., New York 1968).
2. E. Merzbacher, Quantum Mechanics, 3rd edition, (John Wiley & Sons, Inc1997)

Reference Books:

1. J. L. Powell & B. Crasemann, Quantum Mechanics, (Addison-Wesley Pubs.Co.,1965)
2. Kamlesh K Sharma, A Text Book of Engineering Physics-II, (PragatiPrakashan, 2014)
3. AjoyGhatak& S. Lokanathan, Quantum Mechanics: Theory and Applications, 5th Edition, (Macmillan India, 2004)

Course Outcomes:

After completing the course, students will be able to:

1. Know the historical aspects of development of quantum mechanics.
2. Understand and explain the differences between classical and quantum mechanics.
3. Understand the idea of wave function.
4. Understand the uncertainty relations.
5. Solve Schrodinger equation for simple potentials.

BHP504: Modern Physics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:
To learn basics of modern Physics, Planck‟s quantum and fundamental of quantum relations.

Detailed Syllabus

Unit-1 **Relativity** Frame of reference, inertial frames & non- inertial frames, Galilean invariance and conservation laws, propagation of light, Michelson-Morley experiment; search for ether, Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition theorem, variation of mass with velocity, mass-energy equivalence, energy-momentum relation.
Unit-2 **Radiation** Properties of thermal radiation, blackbody radiation, pure temperature dependence, Kirchhoff‟s law, Stefan-Boltzmann law and Wien‟s displacement law
Unit-3 **Laser** Concept of coherence, absorption, spontaneous emission and stimulated emission processes, relation between Einstein‟s A and B coefficients, population inversion, pumping, gain, optical cavities.
Unit-4 **Laser Systems** Main components of Laser, principle of Laser action, introduction to general Lasers and their types, Ruby Laser, He-Ne Laser, CO_2 Laser, Excimer Laser
Unit-5 **Applications of Lasers** Laser applications in medicine and surgery, materials processing, optical and Satellite communication
Unit-6 **Holography** Basic Principle of Holography, Construction and reconstruction of Image on hologram and applications of holography
Unit-7 **Fiber optics** Fundamental ideas about optical fiber, Basic Principle,Acceptance angle and cone, Numerical aperture, Types of Fiber, Propagation mechanism and communication in optical fiber, Attenuation, Signal loss in optical fiber and dispersion.

Text Books:

1. AurtherBeiser, Concepts of Modern Physics, (TMH Publication, New Delhi) 2011
2. B. B. Laud; "Lasers" (New Age Publication, New Delhi)

Reference Books:

1. H. S. Mani &G.K. Mehta, Modern Physics, (East- West Press Pvt Ltd)
2. A. K. Ghatak, "Physical Optics" (Tata McGrew Hill).
3. R. Murugeshan, Modern Physics, (S Chand Publication, New Delhi) 2012

Course Outcomes:

After completing the course, students will be able to:

1. Develop the understanding of the difference between spontaneous and stimulated emission, types of laser, construction and reconstruction of hologram types of fibers, spectroscopy Annealing.
2. Recognize and classify LASER Fundamental, holography and Optical Fiber, Material Processing etc.
3. Apply the different application Medical Laser ,holography, photo chemical Spectroscopy etc.
4. Evaluate the Einstein coefficient for spontaneous emission stimulated emission, HNDT (holographic Non Destructive Testing), Time domain Spectroscopy.

BHP505: Fundamentals and Programming in C	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To define fundamental concept computer i.e. hardware and software.
2. To describe basic knowledge of operating system, algorithms and number system.
3. To introduce the principles of designing structured programs
4. To develop the programming skills of students
5. To write basic programs using conditional statements, iteration statements, functions, pointers, arrays, strings, and file handling**.**

Detailed Syllabus

Unit-1 Introduction to any Operating System [Unix, Linux, Windows], Programming Environment, Write and Execute the first program, Introduction to the Digital Computer, ComputerGenerations, Concept of an algorithm, From algorithms to programs, Algorithm specification, top-down development and stepwise refinement. Introduction to Programming, Use of high level programming language for the systematic development of programs, Introduction to the design and implementation of correct, efficient and maintainable programs, Structured Programming, Trace an algorithm to depict the logic, Number Systems and conversion methods Application software, word processors, spreadsheets, Database management systems, Power point presentations. Standard I/O in "C", Fundamental Data Types and Storage Classes: Character types, Integer, short, long, unsigned, single and double-precision floating point, storage classes, automatic, register, static and external
Unit-2 **Operators and Expressions** Using numeric and relational operators, mixed operands and type conversion, Logical operators, Bit operations, Operator precedence and associativity
Unit-3 **Conditional Program Execution:** Applying if and switch statements, nesting if and else, restrictions on switch values, use of break and default with switch.
Unit-4 **Program Loops and Iteration:** Uses of while, do and for loops, multiple loop variables, assignment operators, using break and continue.

Unit-5 **Modular Programming:** Passing arguments by value, scope rules and global variables, separate compilation, and linkage, building your own modules.
Unit-6 **Arrays** Array notation and representation, manipulating array elements, using multidimensional arrays, arrays of unknown or varying size.
Unit-7 **Structures** Purpose and usage of structures, declaring structures, assigning of Structures
Unit-8 **Pointers to Objects** Pointer and address arithmetic, pointer operations and declarations, using pointers as function arguments, Dynamic memory allocation. Sequential search Bubble and Selection Sort, String operations.
Unit-9 **The Standard C Preprocessor** Defining and calling macros, utilizing conditional compilation, passing values to the compiler.
Unit-10 **The Standard C Library** Input/Output :fopen, fread, etc, string handling functions, Math functions : log, sin, alike Other Standard C functions.
Reference Books: 1. Jeri R. Hanly, Elliot B. Koffman, "Problem Solving and Program Design in C", Pearson Addison-Wesley, 2006. 2. Behrouz A. Forouzan, Richard F. Gilberg,Computer Science- "A Structured Programming Approach Using C", Thomson, Third Edition [India Edition], 2007. 3. Victor Alvarado, Mocygo San Jose,"M. S. Office For ME Word, Excel, Power Point, CA" 4. YashwantKanetker, "Let us C", BPB Publication, 2008. 5. Balagurusamy, "Programming in ANSI „C", TMH, 3rd Edition".

Course Outcomes:

After completing the course, students will be able to:

1. Understanding the working of digital computer, operating systems like DOS, Windows, Linux, define peripheral devices, understand algorithm concept, list out features of C programming and computer
2. Classify data types and operators, explain pre processor directives and file handling concept.
3. Implement the concept of recursion, looping, file handling to solve programming problems.
4. Differentiate between while and do-while, compiler and interpreter, high level and low level, array and linked list, Exercise user defined functions to solve real time problems.
5. Inscribe C programs using Pointers to access arrays strings, functions, structures and files.

BHP551: Physics Lab V	
Teaching Scheme Practical : 2 hr/week Credits: 2	**Examination Scheme** Attendance - 5 Marks Teachers Assessment – 10 Marks End Semester Exam – 35 marks

Prerequisite: - Handling of scales, weights and measures, idea of Least count and vernier scales, average or means of data, error analysis, practice in making simple measurements with vernier devices, idea of types of errors in measurement and methods to minimize them.

Course Objective's

1. To introduce the proper methods for conducting controlled physics experiments, including the acquisition, analysis and physical interpretation of data.
2. Illustrate the principles of modern physics.
3. Perform experiments and interpret the results of observation, including making an assessment of experimental uncertainties.

Student has to perform any **eight** experiments of the following

1. To study the logic Gates
2. To study the universal logic Gates
3. To study the Half adder, Full adder
4. To study the half subtractor and full subtractor
5. To study simple flip-flop
6. To study SR flip flop
7. To study JK flip flop
8. To study the counter.
9. To study the register
10. To study the Laser as monochromatic coherent source
11. To study the wavelength of Laser using the diffraction grating
12. To study the wavelength and the Angular Spread of Laser.

Reference books:

1.GeetaSanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co
2.B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi
3.InduPrakash and Ramakrishna, A Text Book of Practical Physics, KitabMahal, New Delhi
4.D. P. Khandelwal, A Laboratory Manual of Physics for undergraduate classes, Vani Publication House, New Delhi

Course Outcomes:

After completing the course, students will be able to:

1. To make correct measurements using laboratory instruments
2. To be able to align and setup the instrument for performing the experiment.
3. To be able to diagnose any errors in arrangement
4. To analyze the observations by calculating the related physical quantities.
5. To evaluate the percentage and maximum probable error.
6. To minimize the sources of error and designing additional related experiments

BHP552: C Programming Lab

Teaching Scheme	Examination Scheme
Practical : 2 hr/week	Attendance - 5 Marks Teachers Assessment – 10 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: - Handling of scales, weights and measures, idea of Least count and vernier scales, average or means of data, error analysis, practice in making simple measurements with vernier devices, idea of types of errors in measurement and methods to minimize them.

Course Objectives:

1. To Define fundamental concept computer i.e. hardware and software.
2. To describe basic knowledge of operating system, algorithms and number system.
3. To introduce the principles of designing structured programs
4. To develop the programming skills of students
5. To write basic programs using conditional statements, iteration statements, functions, pointers, arrays, strings, and file handling.

Assignments for lab classes are as follows:

1. Introduction of Computer System: I/O devices, storage devices.
2. Getting familiar with software: OS and C compiler.
3. Write a program to print Hello.
4. Write a program to add two integers.
5. Write a program to compute factorial of a number.
6. Write a program to determine whether a number is prime or not.
7. Write a program to print Fibonacci series. .
8. Write a program in C to check whether a given number is Armstrong or not?
9. Write a program to calculate factorial of an integer using recursion.
10. Show with example (program) how arguments are passed using „Call by value‟ and „Call by reference‟ respectively.
11. Write a program to print the sum of all values of an array.
12. Write a program in C that accepts N x N matrix as input and prints transpose of this matrix.
13. Write a program to add the elements of two arrays in to third array using dynamic memory allocation.
14. Write a program in C to calculate the sum of series up to first 10 terms
1^ 4+ 2^4+ 3^4 + 4^4 + 5^4 + 6^4 + 7^4…..... 10 terms.
15. Write a program in C that takes input from a file and write it into another file.
16. Write a program to implement stack operation (Push & Pop).
17. Write a program to create a link list.

Reference books:
1. Jeri R. Hanly, Elliot B. Koffman, "Problem Solving and Program Design in C", PearsonAddison-Wesley, 2006.
2. Victor Alvarado, Mocygo San Jose,"M. S. Office For ME Word, Excel, Power Point, CA"Balagurusamy, "Programming in ANSI „C", TMH, 3rd Edition
3. Detiel&Detiel, "„C" How to program, ISBN: 0132404168, 5th Edition, 2007".

Course Outcomes:

After completing the course, students will be able to:

1. Develop small applications using c programming knowledge.
2.Design various application software components and also easily understand other programming concepts.
3. Design programs connecting decision structures, Write, Compile and Debug programs in C language
4. Develop simple C Programs using pointers and Functions

BHP601: Solid State Physics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

To study physical properties of crystal structure like, lattice translation vectors, lattice with a basis unit cell, Miller Indices, reciprocal lattice, elementary of lattice dynamics, magnetic, dielectric and ferroelectric properties of matter, superconductivity and elementary band theory etc.

Detailed Syllabus

Unit-1 **Crystal structure** Solids: amorphous and crystalline materials, lattice translation vectors, lattice with a basis-central and non-central elements, unit cell, reciprocal lattice, types of lattices, coordination number, miller indices, atomic packing fraction, separation between lattice planes, simple crystal structures of SC, BCC, FCC, diamond and HCP, brillouin zones, diffraction of x-rays by crystals, Bragg‟s law, Braggs spectrometer.
Unit-2 **Electrical properties of materials** Elementary band theory of solids, Bloch theorem, Kronig-penney model, Effective mass of electron, Concept of holes, Band gap, Energy band diagram and Classification of solids.
Unit-3 **Magnetic properties of matter** Dia, para, ferri, ferro and anti-ferromagnetic materials, Classical Langevin theory of diamagnetism, Curie‟s law, Weiss‟s theory of ferromagnetism and ferromagnetic domains, B-H curve, Hysteresis and Energy loss.
Unit-4 **Dielectric properties of materials** Polarization, Local electric field at an atom, Depolarization field, Dielectric constant, Electric susceptibility, Polarizability, Classical theory of electric polarizability, Clausius-Mosotti equation.
Unit-5 **Superconductivity** Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Type I and Type II superconductors, Temperature dependence of critical field, London‟s Equation and Penetration Depth, Idea of BCS theory (Qualitative), High temperature superconductors, Applications of Superconductors

Text Books:

1 Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley and Sons, Inc.

2. A. J. Dekkar, Solid State Physics, Macmillan India Limited, 2000.

Reference Books:

1. Puri and Babbar, "Solid State Physics" (S. Chand)
2. J. S. Blackmore, Solid State Physics, Cambridge University Press, Cambridge.
3. N. W. Ascroft and N. D. Mermin, Solid State Physics, (Harcourt Asia, Singapore, 2003)
4. M. Ali Omar, Elementary solid state physics: principles and applications, (Pearson Education, 1999)

Course Outcomes:

After completing the course, students will be able to:

1. To describe the basic concepts for understanding of structure of a crystalline material.
2. To describe different types of crystal structures in terms of the crystal lattice and the basis of constituent atoms and formulate the theory of X-ray diffraction.
3. To understand the Electrical properties of materials using band theory and formulating the problem of electrons in a periodic potential.
4. To understand the principal of classification and selection of magnetic materials.
5. To apply the knowledge of polarisation on behaviour of dielectric materials and creation of local field.
6. To apply the basic concepts of superconductivity for different types of superconductors and to understand theory behind it.

BHP602: Nuclear and Particle Physics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. To present an introductory account of nuclear physics and elementary particle physics with the nuclear model.
2. To study physical properties of Nuclei and Models, Two-nucleon System, Nuclear Stability, Accelerators and Detectors and Elementary Particles etc.

Detailed Syllabus

Unit-1 **Elementary Particles:** Basic classification based on rest mass, Spin and half life, particle interactions (gravitational, Electromagnetic, weakweek and strong Interactions).
Unit-2 **Structure of Nucleus:** Brief survey of general properties of the nucleus, mass defect and binding energy, charges, size, spin and magnetic moment
Unit-3 **Natural Radioactivity:** Fundamental laws of radioactivity, Soddy-FajansFajan‟s displacement law and law of radioactive disintegration, Half life, Basic ideas about alpha, beta and gamma decay.
Unit-4 **Nuclear Forces:** Saturation phenomena and Exchange forces, Deutron ground state properties.
Unit-5 **Nuclear Models:** Liquid drop model and Bethe Weiszacker mass formula, Single particle shell model (only the level scheme in the context of reproduction of magic numbers).
Unit-6 **Nuclear Reactions:** Nuclear reactions and their conservation laws, Cross section of nuclear reactions, Theory of fission (Qualitative), Nuclear reactors and Nuclear fusion.
Unit-7 **Accelerators and detectors:** Vaan-de Graff, Cyclotron and Synchrotron, Interaction of charged particles and gamma rays with matter (qualitative), GM counter, Scintillation counter and neutron detectors.

Text Books:

1. A. Beiser, “Perspectives of Modern Physics”.
2. T.A. Littlefield and N. Thoreley, “Atomic and Nuclear Physics” (Engineering Language Book Society).

Reference Books:

1. D. C. Tayal, Nuclear Physics, Himalya Publication
2. Irving Kaplan, Nuclear Physics, Oxford Publication, New Delhi
3. Ghoshal S.N. - Nuclear Physics - S. Chand & Co.

Course Outcomes:

After completing the course, students will be able to:

1. To define or describe all the introductory level of Nuclear and Particle Physics and its components.
2. To understand the basic theorems required for the Elementary Particles, Structure of Nucleus, Natural Radioactivity, Nuclear Forces, Nuclear Models and Nuclear Reactions.
3. To apply the different theories or methods to solve various questions.
4. To analyse the behaviour/different properties of nuclear aspects as well as the uses of different physical phenomena.
5. To evaluate numerical results of all concern theories of different sections ofNuclear / Particle Physics.
6. To create some new problems based on some theories of Nuclear and ParticlePhysics.

BHP603: Statistical Mechanics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. The objective is to develop an understanding of the statistical nature of the laws of thermodynamics.
2. To learn laws of Statistical Mechanics; Classical theory of radiation, Quantum theory of radiation, M-B, B-E & F-D distribution laws.

Detailed Syllabus

Unit-1 **The statistical basis of thermodynamics** Probability and thermodynamic probability, principle of equal a prior probabilities, probability distribution and its narrowing with increase in number of particles, The expressions for average properties, Constraints; accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states
Unit-2 **Some universal laws** Phase space representation, division of phase space into energy sheets and into phase cells of arbitrary size, applications to one dimensional harmonic oscillator and free particles, Equilibrium before two systems in thermal contact, bridge with macroscopic physics, Probability and entropy, Boltzmann entropy relation, Statistical interpretation of second law of thermodynamics, Boltzmann canonical distribution law and its applications; rigorous form of equi-partition of energy
Unit-3 **Maxwellian distribution of speeds in an ideal gas** Distribution of speeds and of velocities, experimental verification, distinction between mean, r.m.s. and most probable speed values
Unit-4 **Transition to quantum statistics:** Planck constant „h" as a natural constant and" its implications, cases of particle in a one-dimensional box and one-dimensional harmonic oscillator, Indistinguishability of particles and its consequences, Bose-Einstein, and Fermi-Dirac distributions, photons in black body chamber, free electrons in a metal, Fermi level and Fermi energy.
Text Books: **1.** F Reif, Statistical Physics : Berkeley Physics Course Volume 5 (Tata McGraw-Hill Company Ltd, 2008) **2.** S. Lokanathan and R. S. Gambhir, Statistical and Thermal Physics: an

introduction (P.H.I., 1991)

Reference Books:

1. R. K. Patharia, Statistical Mechanics, (Oxford: Butterworth, 1996)
2. K. Huang, Statistical Mechanics, (Wiley, 1987)
3. B. B. Laud "Introduction to Statistical Mechanics" (Macmillan 1981)

Course Outcomes:

After completing the course, students will be able to:

1. Understanding the statistical methods
2. Apply the concept of thermodynamically potentials & Maxwell‟s equations for solving therodynamical problems.
3. Interpret the concept of phase space for understanding the role of ensembles in statistical mechanics.
4. Understanding of classical and quantum statistics and use the statistical physics methods, such as Maxwell-Boltzmann distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems.
5. Apply the knowledge of Fermi-Dirac Statistics for estimation of thermal and magnetic properties of metals**.**
6. Analysis of Bose-Einstein Statistics for understanding of physical problems in particular: Debye theory of specific heat, properties of black-body radiation, Bose-Einstein condensation.

BHP604: Mathematical Physics	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

The emphasis of course is on applications in solving problems of interest to physicists. The students are to be examined entirely on the basis of problems, seen and unseen.

Detailed Syllabus

Unit-1 **Special functions** **Second order differential equations** and special functions series solution of linear second order ordinary differential equations: singular points of second order differential equations and their importance, series methods (frobenius), Legendre & Bessel differential equations
Unit-2 **Legendre equation**: Rodrigues‟ formula, generating functions, recurrence relations, orthogonality, Series expansion of a function in terms of a complete set of Legendre functions
Unit-3 **Bessel equation:** Bessel functions of first and second kind, generating function, recurrence formulas, zeros of Bessel functions and orthogonality conditions
Unit-4 **Fourier series** Fourier series. Dirichlet conditions (statement only). Kronecker‟s method for computation of fourier coefficients. Even and odd functions. Orthogonalityof sine and cosine functions. Sine and cosine series. Applications: square wave, triangular wave, output of full wave rectifier and other simple functions.
Unit-5 **Integral Transforms** **Fourier Transforms (FTs):** Fourier Integral Theorem, Sine and Cosine Transforms, Properties of FTs: (1) FTs of Derivatives of Functions, (2) Change of Scale Theorem, (3) FTs of Complex Conjugates of Functions, (4) Shifting Theorem, (5) Modulation Theorem, (6) Convolution Theorems, and (7) Parseval‟s Identity
Unit-6 **Laplace Transforms (LTs):** Existence Theorem, LTs of Elementary Functions. Properties of LTs: (1) Change of Scale Theorem, (2) Shifting Theorem, (3) LTs of Derivatives and Integrals of Functions, (4) Derivatives and Integrals of LTs, (5) LT of Unit Step function, (6) LTs of Periodic Functions, and (6) Convolution Theorem, Inverse LT (Bromwich Integral)

Text Books:

1. R.Courant&D. Hilbert, Methods of Mathematical Physics: Partial Differential Equation (New Delhi: Wiley India, 2008).
2. Murray R. Spiegel, Schaum's Outline of Theory and Problems of Fourier Analysis, (McGraw-Hill, 1974)

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics , (Wiley Eastern Limited,1985)
2. Charlie Harper, Introduction to Mathematical Physics. (P.H.I., 1995).
3. B S Grewal, Higher Engineering Mathematics, Khanna Publishers (2000).
4. SatyaPrakash, Mathematical Physics, PragatiPrakashan,

Course Outcomes:

After completing the course, students will be able to:

1. To define or describe Concept of Fourier series, Dirichlet conditions, Kronecker‟s
2. Method fourier coefficients, Even and odd functions. sine and cosine functions. Sine and cosine series. square wave, triangular wave, output of full wave rectifier and other simple functions.
3. To understand Fourier Transforms, Fourier Integral Theorem,Laplace Transforms (LTs): Existence Theorem, LTs of Elementary Functions.
4. To apply FTs of Derivatives of Functions Change of Scale Theorem, FTs of Complex Conjugates of Functions, Shifting Theorem, Modulation Theorem, (6) Convolution Theorems, and Parseval‟s Identity ,Solution of First and Second Order ODEs,
5. To analyse theProperties of LTs(Change of Scale Theorem, Shifting Theorem LTs of Derivatives and Integrals of Functions, Derivatives and Integrals of LTs,LT of Unit Step function, LTs of Periodic Functions, and Convolution Theorem, Inverse LT (Bromwich Integral, Fourier Transforms,. fourier coefficients Laplace Transforms
6. To Evaluatefourier coefficients, Fourier Transforms, Laplace Transforms of given functions on the basis of Properties and theorems.
7. To Classify the Fourier series, Fourier Transforms, Laplace Transforms.

BHP605: Electromagnetic Theory	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

Course Objectives:

1. It helps to provide the basic skills required to understand, develop, and design various engineering applications involving electromagnetic fields.
2. To learn laws of EM theory; e.g. Maxwell‟s equations, Poynting theorem, propagating of electromagnetic waves.

Detailed Syllabus

Unit-1 **Coordinate systems** Cartesian coordinates, circular cylindrical coordinates, spherical coordinates, Vectorcalculus: Differential length, area and volume, line surface and volume integrals, del operator, gradient of a scalar, divergence of a vector and divergence theorem, curl of a vectorand Stokes's theorem, Laplacian of a scalar.
Unit-2 **Electro &Magnetostatics** Electrostatic fields, Coulomb's law and field intensity, Electric field due to charge distribution, Electric flux density,Electric field in material space: Properties of materials, conduction currents, conductors, polarization in dielectrics, dielectric constants, continuity equation, Boundary conditions in electric and magnetic field, boundary value problems: Poisson's and Laplace‟s equations, general procedures for solving Poisson's or Laplace‟s equations,, method of images.
Unit-3 **Maxwell’s Equations** Maxwell‟s equations: Free space,conducting space non conducting,isotropic space , Space equation of continuity Displacement current, Poynting Theorem, Poynting vector.
Unit-4 **Electromagnetic Waves** Electromagnetic wave equation in free space and its solution, Propagation of electromagnetic waves in nonconducting media and conducting space and its solution, skin depth
Unit-5 **Radiation** Vector and scalar potentials, Field and radiation in dipole, Radiation by moving charges, Lienard-Wiechert potentials, Total power radiated by an accelerated charge, Lorentz formula.

Text Books:

1. M. N. O. Sadiku, "Elements of Electromagnetics", 4thEd, Oxford University Press.
2. W. H. Hayt and J. A. Buck, "Electromagnetic field theory", 7th Ed., TMH
3. David J. Griffiths, Introduction to Electrodynamics, 3rd edition, (Benjamin Cummings 1998)

Reference Books:

1. A.Z.Capri &P.V.Panat , Introduction to Electrodynamics .(New Delhi: NarosaPub.House, 2002).
2. Joseph A.Edminister, Electromagnetics 2nd ed.(New Delhi: Tata McGraw Hill, 2006)
3. M.A.W.Miah, Fundamentals of electromagnetic, (Tata McGraw Hill,1992)
4. Liang Chi Shen, Jin Au Kong , Applied Electromagnetism (PWS Pub. Co., 1995)
5. J. D. Jackson, Classical Electrodynamics, 3rd edition, (Wiley, New York 1998)

Course Outcomes:

After completing the course, students will be able to:

1. Define or describe Electromagnetic Theory.
2. Develop the understanding of the different laws of electricity and magnetism.
3. Apply the different laws of electricity and magnetism for Maxwell equations.
4. Analyze the behavior of Maxwell equations for electromagnetic waves.
5. Evaluate the electromagnetic waves in different media.
6. Create expression for the field produced by an accelerated charged particle.

BHM606: Environmental Science	
Teaching Scheme Lectures: 3 hrs/Week Tutorials: 1 hr/Week Credits: 4	**Examination Scheme** Class Test -6 Marks Teachers Assessment - 3Marks Attendance – 6 Marks Semester Exam – 35 marks

Course Objectives:

1. To give an overview of environment.
2. To describe the sustainable development.
3. To describe Natural Resources.
4. To explain different types of conventional and non-conventional sources.
5. To explain the environmental pollution and their effects.
6. To explain about women education.

Detailed Syllabus

Unit-1 Definition, Scope & Importance, Need For Public Awareness- Environment definition, Eco system – Balanced ecosystem, Human activities – Food, Shelter, Economic and social Security. Effects of human activities on environment-Agriculture, Housing, Industry, Mining and Transportation activities, Basics of Environmental Impact Assessment. Sustainable Development
Unit-2 Natural Resources- Water Resources- Availability and Quality aspects, Water borne diseases, Water induced diseases, Fluoride problem in drinking water, Mineral Resources, Forest Wealth, Material cycles-Carbon, Nitrogen and Sulphur Cycles, Energy – Different types of energy, Electro-magnetic radiation, Conventional and Non-Conventional sources – Hydro Electric, Fossil Fuel based, Nuclear, Solar, Biomass and Bio-gas, Hydrogen as an alternative future source of Energy
Unit-3 Environmental pollution and their effects, Water pollution, Land pollution, Noise pollution, Public health aspects, Air pollution, Solid waste management, Current environmental issues of importance, Population Growth, Climate Change and Global warming- Effects, Urbanization, Automobile pollution, Acid Rain, Ozone Layer depletion, Animal Husbandry, Environmental Protection-Role of Government, Legal aspects, Initiatives by Non-governmental Organizations (NGO), Environmental Education, Women Education
Text Books: **1.** Benny Joseph – "Environmental Studies" –Tata McgrawHill-2005 **2.** Dr. D.L. Manjunath, "Environmental Studies" –Pearson Education-2006. **3.** R. Rajagopalan –"Environmental studies" –Oxford Publication – 2005. **4.** M. Anji Reddy – "Text book of Environmental Science & Technology" –BS Publication. ReferenceBooks: **1.** P. VenugoplanRao, "Principles of Environmental Science and Engineering"–Prentice Hall of India. **2.**Meenakshi, "Environmental Science and Engineering" –Prentice Hall India

Course Outcomes:

After completing the course, students will be able to:

1.	Define Definition, Scope & Importance, Need For Public Awareness- Environment definition, Eco system – Balanced ecosystem, Human activities – Food, Shelter, Economic and social Security. Effects of human activities on environment-Agriculture, Housing, Industry, Mining and Transportation activities.
2.	Summarize types of Natural Resources.
3.	To water borne diseases, Water induced diseases, Fluoride problem in drinking water, Mineral Resources, Forest Wealth, Material cycles-Carbon, Nitrogen and Sulphur Cycles, Energy – Different types of energy .
4.	Compare different types of environmental pollution and their effects, Water pollution, Land pollution, Noise pollution, Public health aspects, Air pollution, Solid waste management,. .
5.	Judge current environmental issues of importance, Population Growth, Climate Change and Global warming- Effects.
6.	Describe Ozone Layer depletion, Animal Husbandry, Environmental Protection-Role of Government, Legal aspects, Initiatives by Non-governmental Organizations (NGO), Environmental Education, Women Education.

BHP651: Physics Lab VI

Teaching Scheme	Examination Scheme
Practical : 2 hr/week	Attendance - 5 Marks Teachers Assessment – 10 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: - Handling of scales, weights and measures, idea of Least count and vernier scales, average or means of data, error analysis, practice in making simple measurements with vernier devices, idea of types of errors in measurement and methods to minimize them.

Course Objective's

1. To introduce the proper methods for conducting controlled physics experiments, including the acquisition, analysis and physical interpretation of data.
2. Illustrate the principles of modern physics.
3. Perform experiments and interpret the results of observation, including making an assessment of experimental uncertainties.

Student has to perform any **eight** experiments of the following;

1. To determine the value of e/m of an electron by helical (long solenoid) method.
2. To study the Hall effect.
3. To verify inverse square law for light using a photocell as a photometer.
4. To determine the half life period of given radioactive source using a G. M. counter.
5. To compare the illuminating powers of two given bulbs by means of a photo cell.
6. To study the current flow during charging and discharging of a capacitor.
7. To design an AstableMultivibrator of given specifications using 555 Timer.
8 To Determine the dielectric constant of the given sample
9 To determine the value of Boltzmann Constant by studying Forward Characteristics of a Diode.
10. To measure the Magnetic susceptibility of Solids and Liquids.
11. To determine a Low Resistance by Carey Foster‟s Bridge.
12. To determine the self inductance of a given coil by Maxwell‟s inductance Bridge.

Reference books:

1.GeetaSanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co
2.B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi
3.InduPrakash and Ramakrishna, A Text Book of Practical Physics, KitabMahal, New Delhi
4.D. P. Khandelwal, A Laboratory Manual of Physics for undergraduate classes, Vani Publication House, New Delhi

Course Outcomes:

After completing the course, students will be able to:

1. To make correct measurements using laboratory instruments
2. To be able to align and setup the instrument for performing the experiment.
3. To be able to diagnose any errors in arrangement
4. To analyze the observations by calculating the related physical quantities.
5. To evaluate the percentage and maximum probable error.
6. To minimize the sources of error and designing additional related experiments