Proposed scheme of the programme for Dual Degree B.Sc. (Hons.) Physics-M.Sc. Physics under Choice Based Credit System (w.e.f 2017-18) and third semester onwards for 2016-17 batch

Semester-I

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
BXL 101	Ability Enhancement Compulsory Course-I	English	2	2	70	30	100
BXL 102	Ability Enhancement Compulsory Course-II	Environmental Science	2	2	70	30	100
BPL 101	Core Course-I	Physics-I : Mechanics	4	4	70	30	100
BCL 101	Generic Elective-I	Chemistry-I	4	4	70	30	100
BML 101 BBL 101	Generic Elective-II	Elementry Mathematics-I/ Elementry Biology-1 (Fundamentals of Biology)	4	4	70	30	100
BML 102 BBL 102	Generic Elective-III	Mathematics-I (Basic Algebra)/ Biology-I (Cell & Cellular Processes)	4	4	70	30	100
BPP 101	Core Course Practical-I	Physics Lab-I	2	4	70	30	100
BCP 101	Generic Elective Practical-I	Chemistry Lab-I	2	4	70	30	100
BBP 101	Generic Elective Practical-II	Biology Lab	2	4	70	30	100
		Total	**26**	**32**			

Notes:

i) Students who have studied mathematics at 10+1 and 10+2 level shall opt Elementary Biology-I (Paper code: BBL-101) & Mathematics-I (BML-102) and those who have studied Biology shall opt Elementary Mathematics -I (BML-101) & Biology -I (BBL-102) in 1st semester.

ii) Semester-I & II will be common for all the four programs.

Semester-II

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
BXL 201	Ability Enhancement Compulsory Course-III	Hindi	2	2	70	30	100
BPL 201	Core Course-II	Physics-II: Waves and Optics	4	4	70	30	100
BCL 201	Generic Elective-IV	Chemistry-II	4	4	70	30	100
BML 201 BBL 201	Generic Elective-V	Elementry Mathematics-II/ Elementry Biology-II(Cell Biology)	4	4	70	30	100
BML202 BBL 202	Generic Elective-VI	Mathematics-II Calculus/ Biology-II (General Biochemistry)	4	4	70	30	100
BXL 202	Generic Elective-VII	Computer Science	2	2	70	30	100
BPP 201	Core Course Practical-II	Physics Lab -II	2	4	70	30	100
BCP201	Generic Elective Practical – III	Chemistry Lab-II	2	4	70	30	
BXP 201	Generic Elective Practical-IV	Computer Science Lab	2	4	70	30	100
		Total	**26**	**32**			

Notes:

i) Students who have studied mathematics at 10+1 and 10+2 level shall opt Elementary Biology-I (Paper code: BBL-201) & Mathematics-I (BML-202) and those who have studied Biology shall opt Elementary Mathematics -I (BML-201) & Biology -I (BBL-202) in 1st semester.

ii) Semester-I & II will be common for all the four programmes.

SEMESTER-III

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
BPL 301	Core Course-III	Electricity and Magnetism	4	4	70	30	100
BPL 302	Core Course-IV	Mathematical Physics-I	4	4	70	30	100
BPL 303	Core Course-V	Applied Optics	4	4	70	30	100
BPL 304	Discipline Specific Elective -I	(i) Physics of Semiconductor Devices OR (ii) Digital Signal Processing	4	4	70	30	100
BPL 305	Skill Enhancement Course-I	Basic Instrumentation Skills	2	2	70	30	100
BPP 301	Core Course Practical-III	Physics Lab-III	3	6	70	30	100
BPP 302	Core Course Practical-IV	Physics Lab-IV	3	6	70	30	100
		Total	24	30			

SEMESTER-IV

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
BPL 401	Core Course-VI	Elements of Modern Physics	4	4	70	30	100
BPL 402	Core Course-VII	Classical Mechanics	4	4	70	30	100
BPL 403	Core Course-VIII	Heat and Thermodynamics	4	4	70	30	100
BPL 404	Discipline Specific Elective -II	(i) Astronomy and Astrophysics OR (ii) Methods of Experimental Physics	4	4	70	30	100
BPL 405	Skill Enhancement Course-II	Computational Physics	2	2	70	30	100
BPP 401	Core Course Practical-V	Physics Lab-V	3	6	70	30	100
BPP 402	Core Course Practical-VI	Physics Lab-VI	3	6	70	30	100
		Total	24	30			

SEMESTER-V

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
BPL 501	Core Course-IX	Quantum Mechanics	4	4	70	30	100
BPL 502	Core Course-X	Statistical Mechanics	4	4	70	30	100
BPL 503	Core Course-XI	Mathematical Physics-II	4	4	70	30	100
BPL 504	Discipline Specific Elective -III	(i) Nano Materials and Applications OR (ii) Optical Communication Systems	4	4	70	30	100
BPP 501	Core Course Practical-VII	Physics Lab-VII	3	6	70	30	100
BPP 502	Core Course Practical-VIII	Physics Lab-VIII	3	6	70	30	100
BPP 503	Discipline Specific Elective Practical -I	(i) Material Science Lab. OR (ii) Optical Communication System Lab.	2	4	70	30	100
		Total	24	32			

SEMESTER-VI

Paper Code	Course opted	Nomenclature	Credits	Hr/ week	Marks		
					Ext.	Int.	Total
BPL 601	Core Course-XII	Basic Electronics	4	4	70	30	100
BPL 602	Core Course-XIII	Atomic and Molecular Physics	4	4	70	30	100
BPL 603	Core Course-XIV	Solid State Physics	4	4	70	30	100
BPL 604	Discipline Specific Elective -IV	(i) Nuclear and Particle Physics OR (ii) Medical Physics	4	4	70	30	100
BPP 601	Core Course Practical-IX	Physics Lab-IX	3	6	70	30	100
BPP 602	Core Course Practical-X	Physics Lab-X	3	6	70	30	100
BPP 603	Discipline Specific Elective Practical -II	(i) Nuclear Physics Lab. OR (ii) Medical Physics Lab	2	4	70	30	100
		Total	24	32			

BXL-101: ENGLISH

Marks (Theory) : 70 **Credits : 2 (30 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Syntax

Sentence structures, Verb patterns and their usage

UNIT-II

Phonetics

Basic Concepts – Vowels, Consonants, Phonemes, Syllables, Articulation of Speech Sounds – Place and Manner of Articulation; Transcription of words and simple sentences, using International Phonetic Alphabet.

UNIT-III

Comprehension

Listening and Reading comprehension – Note taking, Reviewing, Summarising, Interpreting, Paraphrasing and Précis Writing.

UNIT-IV

Composition

Descriptive, Explanatory, Analytical and Argumentative Writing - description of simple objects like instruments, appliances, places, persons, principles, description and explanation of processes and operations; analysis and arguments in the form of debate and group discussion.

Reference books:

1. Roy A. & Sharma P.L. English for Students of Science, Orient Longman.
2. Spoken English for India by R.K. Bansal and J.B. Harrison, Orient Longman.
3. Tickoo M.L. & Subramanian A.E. Intermediate Grammar, Usage and Composition, Orient Longman.
4. Pink M.A. & Thomas S.E. English Grammar, Composition and Correspondence, S. Chand and Sons Pvt.Ltd.,Delhi.
5. Thomson & Martinet A Practical English Grammar, OUP, Delhi.
6. Hornby A.S Guide to Patterns and Usage in English, OUP, Delhi.
7. Balasubramanian T. A Textbook of English Phonetics for Indian Students, MacMillan, Chennai.
8. O¨Connor J.D. Better English Pronunciation, Cambridge Univ. Press, London.
9. McCarthy English Vocabulary in Use, Foundation Books (Cambridge University Press), Delhi.
10. Buck,Assessing Listening, Foundation Books (Cambridge University Press), Delhi.

BXL-102: ENVIRONMENTAL SCIENCE

Marks (Theory) : 70 **Credits : 2 (30 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

The Multidisciplinary nature of environmental studies

Definition, scope and importance, Need for public awareness.

Natural resources: Renewable and non-renewable resources

Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestration

b) Water resources: Use and over-utilization of surface and ground water, floods and drought.

c) Mineral resources: Use and exploitation, environmental effects of extrading.

d) Food resources: World food problems, changes caused by agriculture, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

e) Energy Resources: Growing energy needs, renewable and non renewable energy sources use of alternative energy sources.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

Unit-II

Ecosystems

Concept of an ecosystem, Structure and function of an ecosystem, Procedures, consumers and decomposers, Energy flow in the ecosystem, Ecological succession & Food chains, food webs and ecological pyramids.

Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a megadiversity nation.

Unit-III

Environmental Pollution

Definition, Causes, effects and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution & Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Unit-IV

Social Issues and the Environment

From Unsustainable to sustainable development, urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people- its problems and concerns. Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain,

ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation, Consumerism and waste products, environment Protection Act, Air (Prevention and Control of Pollution) Act, Water(Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environment legislation & Public awareness.

Reference books:

1. De A. K. Environmental Chemistry, Wiley Eastern Ltd, 1999.
2. Bharucha E. Text book of Environmental studies, University press, Hydrabad 2005.
3. Cunningham W P., Cooper T H. Gorhani E. Hepworth M T, Environmental Enclopedia, Jaico publication House, Mumbai, 2001.
4. Miller T G. Environmental Science Wadsworth publishing corp, 2000.

BPL-101: PHYSICS - I: MECHANICS

Course Objective: The objective of this course is to teach the students fundamentals of Newtonian Mechanics, rigid body dynamic, concept of inverse square force and the special theory of relativity.

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

Unit – I

Fundamentals of Dynamics: Reference frames, Inertial and non-inertial frames of references, Conservative and non-conservative forces, Fictitious forces, Concept of potential energy, Energy diagram. Stable and unstable equilibrium, Elastic potential energy, Force as gradient of potential energy, Work & Potential energy, Impulse, Centre of Mass for a system of particles, Motion of centre of mass, Expression for kinetic energy, Linear momentum and angular momentum for a system of particles in terms of centre of mass values.

Collisions: Elastic and inelastic collisions between particles, Centre of Mass and Laboratory frames.

Unit - II

Equation of motion of a rigid body, Rotational motion of a rogid body in general and that of plane lamina, Rotaion of angular momentum vector about a fixed axis, Angular momentum and kinetic energy of a rigid body about principal axis, Torque, Principle of conservation of angular momentum, Moment of Inertia, Calculation of moment of inertia for rectangular, cylindrical and spherical bodies, Kinetic energy of rotation, Motion involving both translation and rotation.

Unit – III

Inverse Square Law Force: Forces in nature (qualitative), Central forces, Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential energy and force between a point mass and spherical shell, a point mass and solid sphere, gravitational and electrostatic self energy, two body problem and concept of reduced mass, Motion of a body under central force, Equation of orbit in inverse-square force field, Kepler's laws and their derivation, Deduction of Newton's law of gravitation from Kepler's laws.

Unit – IV

Special Theory of Relativity: Michelson-Morley Experiment and its outcome, Galilean transformation (velocity, acceleration) and its inadequacy, Postulates of Special Theory of Relativity, Lorentz Transformations, Lorentz contraction, Time dilation, Relativistic transformation of velocity, frequency and wave number, Relativistic addition of velocities, Variation of mass with velocity, Massless Particles, Mass-energy Equivalence, Relativistic Doppler effect, Relativistic Kinematics, Transformation of Energy and Momentum.

Reference Books:

1. An introduction to Mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
2. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000.
3. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.

BCL-101: CHEMISTRY-I

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – 1

Chemical Thermodynamics Objectives and limitations of Chemical Thermodynamics, state functions, thermodynamic equilibrium, work, heat, internal energy, enthalpy. First Law of Thermodynamics: First law of thermodynamics for open, closed and isolated systems. Reversible isothermal and adiabatic expansion/compression of an ideal gas.Irreversible isothermal and adiabatic expansion.Enthalpy change and its measurement, standard heats of formation and absolute enthalpies.Kirchoff's equation.

Second and Third Law: Various statements of the second law of thermodynamics. Efficiency of a cyclic process (Carnot's cycle). Entropy: Entropy changes of an ideal gas with changes in P,V, and T. Free energy and work functions. Gibbs-Helmholtz Equation, Criteria of spontaneity in terms of changes in free energy.Introduction to Third law of thermodynamics.

UNIT-II

Conductance and Electrochemistry

Arrhenius theory of electrolytic dissociation.Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes.Molar conductivity at infinite dilution.Kohlrausch law of independent migration of ions.

Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods.Applications of conductance to measure degree of dissociation of weak electrolytes.

Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half cell potentials, application of electrolysis in metallurgy and industry. Chemical cells with examples, Standard electrode (reduction) potential.

UNIT-III

Fundamentals of Organic Chemistry Electronic Displacements: Inductive Effect, Electromeric Effect, ResonanceandHyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affectingpK values.

UNIT-IV

Stereochemistry Conformations with respect to ethane, butane and cyclohexane.Interconversion of WedgeFormula, Newmann, Sawhorse and Fischer representations.Concept of chirality (uptotwocarbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism,Diastereomerism and Meso compounds). Threo and erythro; D and L; *cis–trans*nomenclature; CIP Rules: R/ S (for upto 2 chiral

carbon atoms) and E / Z Nomenclature (forupto two C=C systems).

Chemistry of Biomolecules

Occurrence, classification of Carbohydrates.Amino acids, peptides and their classification.α-Amino Acids.Zwitterions, pK_avalues, isoelectric point, components of nucleic acids, nucleosides and nucleotides.

Refrence Books::

1. Atkins, P.W. & Paula, J. *Physical Chemistry,* 10th Ed., Oxford University Press, 2014.
2. Castellan, G.W.,Physical Chemistry, Narosa Publishers
3. Morrison, R. N. & Boyd, R. N. *Organic Chemistry,* Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Finar, I. L. *Organic Chemistry (Volume 1),* Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products),* Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6. Eliel, E. L. &Wilen, S. H. *Stereochemistry of Organic Compounds,* Wiley: London,1994.
7. Kalsi, P. S. *Stereochemistry Conformation and Mechanism,* New Age International, 2005.
8. McMurry, J.E. *Fundamentals of Organic Chemistry,* 7th Ed. Cengage Learning India Edition, 2013.

BML-101: ELEMENTARY MATHEMATICS-I

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Sets, Relations and Functions : Sets and their Representations, The Empty Set, Finite and Infinite Sets, Equal Sets, Subsets, Universal Set, Venn Diagrams, Operations on Sets, Complement of a Set, Practical Problems on Union and Intersection of Two Sets, Cartesian Product of Sets, Relations, Functions.
Sequences and Series : Sequences, Series, Arithmetic Progression (A.P.), Geometric Progression (G.P.), Relationship Between A.M. and G.M.

UNIT – II

Straight Lines : Introduction, Slope of a Line, Various Forms of the Equation of a Line, General Equation of a Line, Distance of a Point From a Line.
Trigonometric Functions : Angles, Trigonometric Functions, Trigonometric Functions of Sum and Difference if Two Angles, Trigonometric Equations.

UNIT –III

Permutations and Combinations : Fundamental Principle of Counting, Permutations, Combinations.
Binomial Theorem : Introduction, Binomial Theorem for Positive Integral Indices, General and Middle Terms.

UNIT – IV

Linear Inequalities : Inequalities, Algebraic Solutions of Linear Inequalities in One Variable and their Graphical Representation, Graphical Solution of Linear Inequalities in Two Variables, Solution of System of Linear Inequalities in Two Variables.

Probability : Introduction, Random Experiments, Event, Axiomatic Approach to Probability, Addition Theorems on Probability, Conditional Probability Multiplicative Law of Probability

Books Recommended:

Mathematics Text Book for Class XI, National Council of Educational Research and Training.
R.S. Verma and K.S. Sukla, Text Book on Trigonometry, Pothishala Pvt. Ltd, Allahabad.
S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, S. Chand & Sons.
Ivo Duntsch and Gunther Gediga, Set, Relations, Functions, Methodos Publishers.

BBL-101: ELEMENTARY BIOLOGY-I

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Introduction to concepts of biology
Themes in the study of biology; A closer look at ecosystem; A closer look at cell; The process of Science; Biology and everyday life
Evolutionary history of biological diversity
Early earth and the origin of life; Major events in the history of life; Mechanism of Macroevolution; Phylogeny and the tree of life

UNIT – II

Classifying the diversity of life
Kingdoms of Life –Prokaryotes, Eukaryotes, Archaea
Darwinian view of life and origin of species
Darwin's theory of evolution; The evolution of populations; Concepts of species; Mechanism of speciation
Genetic approach to Biology
Patterns of inheritance and question of biology; Variation on Mendel's Law; The molecular basis of genetic information; The flow of genetic information from DNA to RNA to protein; Genetic Variation; Methodologies used to study genes and gene activities; Developmental noise; Detecting macromolecules of genetics; Model organisms for the genetic analysis; Distinction between Phenotype and Genotype

UNIT – III

Chemistry of life
The constituents of matter; Structure of an atom; The energy level of electron; The formation and function of molecules depend on chemical bonding between atoms; Chemical reaction make or break chemical bonds
Water and life
The water molecule is polar; Properties of water; Ionization of water
Carbon and life
Organic chemistry-the study of carbon compounds; what makes carbon special? Properties of organic compounds

UNIT – IV

Structure and function of biomolecules
Most macromolecules are Polymers; Carbohydrates act as fuel and building materials; Lipids are group of hydrophobic molecules; Protein have diverse structures and functions; Nucleic acids store and transmit hereditary information

References:

1. Campbell, N.A. and Reece, J. B. (2008) Biology 8th edition, Pearson Benjamin Cummings, San Francisco.
2. Raven, P.H et al (2006) Biology 7th edition Tata McGrawHill Publications, New Delhi
3. Griffiths, A.J.F et al (2008) Introduction to Genetic Analysis, 9th edition, W.H. Freeman & Co. NY

BML-102: MATHEMATICS-I (BASIC ALGEBRA)

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT - I

Symmetric, Skew-symmetric, Hermitian and skew Hermitian matrices. Elementary operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

UNIT - II

Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, Bilinear and Quadratic forms.

UNIT - III

Relations between the roots and coefficients of general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Transformation of equations.

UNIT - IV

Nature of the roots of an equation, Descarte's rule of signs. Solutions of cubic equations (Cardon's method). Biquadratic equations and their solutions.

Reference Books :

1. H.S. Hall and S.R. Knight, Higher Algebra, H.M. Publications 1994.
2. Shanti Narayan, A Text Books of Matrices.
3. Chandrika Prasad, Text Book on Algebra and Theory of Equations. Pothishala Private Ltd., Allahabad.

BBL-102: BIOLOGY-I (CELL & CELLULAR PROCESSES)

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT - I

Techniques in Biology
Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Sample Preparation for light microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); Sample Preparation for electron microscopy; X-ray diffraction analysis

UNIT - II
Cell as a unit of Life
The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components

UNIT - III
Cell Organelles
• Mitochondria: Structure, marker enzymes, composition; mitochondrial biogenesis; Semiautonomous nature; Symbiont hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA
• Chloroplast Structure, marker enzymes, composition; semiautonomous nature, chloroplast DNA
• ER, Golgi body & Lysosomes Structures and roles. Signal peptide hypothesis, N-linked glycosylation, Role of golgi in O-linked glycosylation. Cell secretion, Lysosome formation.
• Peroxisomes and Glyoxisomes: Structures, composition, functions in animals and plants and biogenesis
• Nucleus: Nuclear Envelope- structure of nuclear pore complex; chromatin; molecular organization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and ribosome structure (brief).

UNIT – IV

Cell Wall & Membrane
The functions of membranes; Models of membrane structure; The fluidity of membranes; Membrane proteins and their functions; Carbohydrates in the membrane; Faces of the membranes; Selective permeability of the membranes; Cell wall
Cell Division.
Role of Cell division; Overview of Cell cycle; Molecular controls; Meiosis

References:
1. Campbell, N.A. and Reece, J. B. (2008) Biology 8th edition, Pearson Benjamin Cummings, San Francisco.
2. Raven, P.H et al (2006) Biology 7th edition Tata McGrawHill Publications, New Delhi
3. Sheeler, P and Bianchi, D.E. (2006) Cell and Molecular Biology, 3rd edition, John Wiley & sons NY

BPP-101: PHYSICS LAB – I

Marks (External) : 70 **Credits : 2**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

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

Reference Books

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

BCP-101: CHEMISTRY LAB-I

Marks (External) : 70 **Credits : 2**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. Preparation of reference solutions.
2. Redox titrations: Determination of Fe^{2+}, $C_2O_4^{2-}$(using $KMnO_4$, $K_2Cr_2O_7$)
3. Iodometic titrations: Determination of Cu^{2+} (using standard hypo solution).
4. To determine the surface tension of at least two liquids using stalagmometer by drop no. and drop weight methods (Use of organic solvents excluded).
5. To study the effect of surfactant on surface tension of water.
6. To determine the viscosity of at least two liquids by using Ostwald's viscometer (use of organic solvents excluded).
7. To study the process of (i) sublimation (ii) Crystallization of camphor and phthalic acid
8. Preparation and purification through crystallization or distillation and ascertaining their purity through melting point or boiling point
9. Iodoform from ethanol (or acetone)
10. p-Bromoacetanilide from acetanilide

Reference :

1. Vogel A. I., Tatchell A.R., Furnis B.S., Hannaford A.J., Smith P.W.G.,Vogel's Text Book of Practical Organic Chemistry,5th Edn.,Pubs: ELBS, 1989.
2. Pavia D.L., Lampanana G.M., Kriz G.S. Jr., Introduction to Organic Laboratory Techniques, 3rd Edn., Pubs: Thomson Brooks/Cole,2005.
3. Mann F.G., Saunders. P.C.,Practical Organic Chemistry,Pubs:Green& Co. Ltd., London, 1978.
4. Svehla, G., Vogel's Qualitative Inorganic Analysis (revised); 7th edition, Pubs: Orient Longman, 1996.
5. Bassett, J., Denney, R.C., Jeffery, G.H., Mendham, J., Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th edition, Pubs: Orient Longman,1978.
6. Yadav J. B., Advanced Practical physical Chemistry

BBP-101: BIOLOGY LAB

Marks (External) : 70 **Credits : 2**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. To learn a) use of microscope b) principles of fixation and staining.
2. Preparation of Normal, molar and standard solutions, phosphate buffers, serial dilutions
3. Use of micropipettes
4. Measurement of cell size by cytometry
5. To perform gram staining of bacteria.
6. To study the cytochemical distribution of nucleic acids and mucopolysaccharides with in cells/tissues from permanent slides.
7. To perform quantitative estimation of protein using the Lowry's method. Determine the concentration of the unknown sample using the standard curve plotted.
8. To study of plasmolysis & deplamolysis of *Rhoeo* leaf.
9. To study prokaryotic cells, Bacteria/fungi and eukaryotic cells.
10. To prepare squash from root tip of Alium cepa & study various stages of mitosis.

बी.एक्स.एल–201: हिन्दी

कुल अंक: 70 क्रैडिट –2

आंतरिक मूल्यांकन–30 समय–3 घण्टे

खण्ड (क)

निर्धारित कवि

1 कबीरदास 2 सूरदास

3 मीराबाई 4 रसखान

खण्ड (ख)

हिन्दी साहित्य का इतिहास भक्तिकाल: पाठ्यक्रम में निर्धारित आलोचनात्मक प्रश्न–

1 सन्तकाव्य की प्रवृतियाँ 2 सूफी काव्य की प्रवृतियाँ

3 कृष्ण काव्य की प्रवृतियाँ 4 राम काव्य की प्रवृतियाँ

5 भक्तिकाल का: स्वर्णयुग

खण्ड (ग)

अलंकार–अनुप्रास, श्लेष, यमक, उपमा, रूपक, अतिश्योक्ति, मानवीकरण, अन्योक्ति, समासोक्ति आदि।

खण्ड (घ)

मुहावरे एवं लोकोक्तियाँ।

खण्ड(क) के लिए निर्धारित पाठ्यपुस्तक–मध्यकालीन काव्य–कुंज : सं. डॉ रामसजन पाण्डेय प्रकाशन:खाटूश्याम प्रकाशन, 1276/5 पीर जी मोहल्ला, प्रताप टाकीज, रोहतक।

निर्देश:– सभी प्रश्न अनिवार्य हैं।

1. खण्ड (क) में निर्धारित पाठ्यपुस्तक में से व्याख्या के लिए चार अवतरण पूछे जाएँगे, जिनमें से परीक्षार्थी को किन्हीं दो की सप्रसंग व्याख्या करनी होगी। प्रत्येक व्याख्या 6 अंक की होगी। पूरा प्रश्न 12 अंक का होगा।
2. खण्ड (क) में निर्धारित कवियों में से किन्ही दो कवियों के साहित्यिक परिचय पूछे जाएँगे, जिनमें से किसी एक कवि का साहित्यिक परिचय लिखना होगा। यह प्रश्न 8 अंक का होगा।

BPL-201: PHYSICS-II : WAVES AND OPTICS

Course objective: The objective of this course is to introduce the basics of oscillatory motion, wave motion, and phenomena of light interference and diffraction.

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Oscillations: SHM: Simple Harmonic Oscillations, Differential equation of SHM and its solution. Simple pendulum and compound pendulum, Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle, Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats), Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences.

Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods, Lissajous Figures with equal and unequal frequency and their uses.

UNIT - II

Wave Motion: Wave Equation, Solution of wave equation, Particle and Wave Velocities, Intensity of Wave.

Transverse Waves: The string as a force oscillator**,** Velocity of Transverse Vibrations of Stretched Strings, Reflections and transmission of waves on a string at a boundary, Reflections and transmission of Energy.

Longitudinal Waves: Velocity of Longitudinal Waves in a Fluid in a Pipe, Newton's Formula for Velocity of Sound, Laplace's Correction, Reflections and transmission of sound waves at a boundary, Reflections and transmission of sound intensity, Energy distribution in sound waves, Phase and Group Velocities

UNIT – III

Wave Optics: Definition and properties of wave front, Huygens Principle, Concept of Temporal and Spatial Coherence and its experimental measurements.

Intereference: Intereference, Division of amplitude and wave front, Newton's rings, Youngs's double slit experiment, Fresnel's biprism, Interference in thin film, Michelson's interferometer and its appilication in measuring the wavelength of unknown sources and wavelength difference.

UNIT -IV

Fraunhofer diffraction: Single slit, Double slit multiple slits and Circular aperture, Various kind of diffraction grating, Resolving power of grating, Rayleigh Criteria of the limit of resolution and Resolving Power of an optical instruments.

Fresnel Diffraction: Fresnel's Assumptions, Fresnel's Half-Period Zones for Plane Wave, Rectilinear Propagation of Light, Theory of a Zone Plate and its application, Multiple Foci of a Zone Plate, Qualitative description for Fresnel diffraction pattern of a straight edge, a slit and a wire.

Reference Books

1. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
2. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
3. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

BCL-201: CHEMISTRY-II

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT - I

Chemical Bonding and Molecular Structure

Introduction to Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, polarizing power and polarizability

Introduction to Covalent bonding: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonalbipyramidal and octahedral arrangements.

Ionic Solids: Factors affecting the formation of ionic solids, concept of close packing, radius ratio rule and coordination number. Calculation of limiting radius ratio for tetrahedral and octahedral sites.Structures of some common ionic solids NaCl, ZnS (zinc blende and wurtzite).

UNIT-II

Acids and Bases

Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.

Basic Coordination Chemistry

Coordinate Bond. Werner's coordination theory, ligands, chelates. Nomenclature of coordination compounds. Stereochemistry of different coordination numbers, isomerism. Valence-bond and crystalfield theories of bonding in complexes. Explanation of properties such as geometry colour and magnetism.

UNIT-III

Chemical Kinetics And Catalysis

Rates of reactions, rate constant, order and molecularity of reactions. Differential rate law and integrated rate expressions for zero, first, second and third order reactions. Half-life time of a reaction. Methods for determining order of reaction. Effect of temperature on reaction rate and the concept of activation energy.

Catalysis: Homogeneous catalysis, Acid-base catalysis and enzyme catalysis. Heterogeneous catalysis.

UNIT-IV

Basics of spectroscopy

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.Electromagnetic radiations, Introduction to ultraviolet, visible and infrared spectroscopy, electronic transitions, λ_{max}&ε_{max}, chromophore, auxochrome, bathochromic, hypsochromic shifts.Infrared radiation and types of molecular vibrations, functional group and fingerprint region.

BOOKS SUGGESTED:

1.Cotton F.A. and Wilkinson G., Murillo C.A., Bochmann M., Advanced Inorg. Chemistry, 6th Edition, Pubs: John Wiley & Sons. Inc., 1999.

2. Lee J.D., Concise Inorganic Chemistry, 4th edition, Pubs: ELBS,1991.

3. Huheey J.E., Keiter E.A., Keiter R.L., Inorganic Chemistry : Principles of Structures and Reactivity; 4th Edition, Pubs: Harper Collins, 1993.

4. Greenwood N.N. and Earnshaw A., Chemistry of the Elements, 2nd edition., Pubs: Butterworth/Heinemann, 1997.

5. Douglas B., Daniel D. Mc and Alexander J., Concepts of Models of Inorganic Chemistry, Pubs: John Wiley,1987.

6. Puri B.R., Sharma L. R. and Pathania M. S., Principles of Physical Chemistry, Pubs: Vishal Publishing Company, 2003.

7. Laidler K. J Chemical Kinetics, McGraw Hill.

8. Castellan G.W. Physical Chemistry, Narosa Publishers

9. Kemp W. Organic Spectroscopy

BML-201: ELEMENTARY MATHEMATICS-II

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Matrix Algebra : Introduction, types of matrices, addition and multiplication of matrix, transpose of matrix, concept of elementary row and column operations. Determinant and its properties, minors, cofactors. Application of determinants in finding area of triangle. Adjoint and inverse of square matrix. Solution of homogeneous and non-homogeneous linear equations and condition for solution.

UNIT – II

Differential Calculus : Differentiation of standard functions including function of a function (Chain rule). Differentiation of implicit functions, Logarithmic differentiation, parametric differentiation, elements of successive differentiation.
Integral Calculus : Integration as inverse of differentiation, indefinite integrals of standard forms, integration by parts, partial fractions and substitution. Formal evaluation of definite integrals.

UNIT – III

Ordinary Differential Equations : Definition and formation of ordinary differential equations, equations of first order and first degree, variable separable, homogeneous equations, linear equations (Leibnitz form) and differential equations reducible to these types, Linear differential equation of order greater than one with constant coefficients, complementary function and particular integrals.

UNIT – IV

Partial Differential Equations: Introduction and formation of P.D.E., solution of P.D.E., linear equation of first order (Lagrange's Equation), Non-Linear Equation of first order.
Vector Calculus: Differentiation of vectors, scalar and vector point functions, gradient of scalar field and directional derivative, divergence and curl of vector field and their physical interpretation.

Books Recommended:

1. Shanti Narayan : Differential and Integral Calculus, S. Chand.
2. S.L. Ross, : Differential Equations, John Wiley and sons inc., Ny,1984.
3. Shanti Narayan : A Textbook of Matrices, S. Chand.
4. Ian N. Snnedon : Elements of Partial Differential Equations, McGraw Hill.
5. Murray R. Spiegal : Vector Analysis Schaum Publishing Company, New York

BBL-201: ELEMENTARY BIOLOGY-II (CELL BIOLOGY)

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Cell: Introduction and classification of organisms by cell structure, cytosol, compartmentalization of eukaryotic cells, cell fractionation.
Cell Membrane and Permeability: Chemical components of biological membranes, organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport.

UNIT II

Membrane Vacuolar system, cytoskeleton and cell motility: Structure and function of microtubules, Microfilaments, Intermediate filaments.
Endoplasmic reticulum: Structure, function including role in protein segregation. Golgi complex: Structure, biogenesis and functions including role in protein secretion.

UNIT III

Lysosomes: Vacuoles and micro bodies: Structure and functions
Ribosomes: Structures and function including role in protein synthesis.
Mitochondria: Structure and function, Genomes, biogenesis.
Chloroplasts: Structure and function, genomes, biogenesis
Nucleus: Structure and function, chromosomes and their structure.

UNIT IV

Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function. Signal transduction.
Cancer: Carcinogenesis, agents promoting carcinogenesis, characteristics and molecular basis of cancer.

References:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition.Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASMPress & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

BML-202: MATHEMATICS-II (CALCULUS)

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

UNIT -II

Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Newton's method. Radius of curvature for pedal curves. Tangential polar equations. Centre of curvature. Circle of curvature. Chord of curvature, evolutes. Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps.

UNIT – III

Tracing of curves in Cartesian, parametric and polar co-ordinates. Reduction formulae. Rectification, intrinsic equations of curve.

UNIT -IV

Quadrature (area) Sectorial area. Area bounded by closed curves. Volumes and surfaces of solids of revolution. Theorems of Pappu's and Guilden.

Books Recommended :

1. Differential and Integral Calculus, Shanti Narayan.
2. Murray R. Spiegel, Theory and Problems of Advanced Calculus. Schaun's Outline series. Schaum Publishing Co., New York.
3. N. Piskunov, Differential and Integral Calculus. Peace Publishers, Moscow.
4. Gorakh Prasad, Differential Calculus. Pothishasla Pvt. Ltd., Allahabad.
5. Gorakh Prasad, Integral Calculus. Pothishala Pvt. Ltd., Allahabad.

BBL-202: BIOLOGY-II (GENERAL BIOCHEMISTRY)

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT I

Introduction to Biochemistry:
A historical prospective. Amino acids & Proteins: Structure & Function. Structure and properties of Amino acids, Types of proteins and their classification, Forces stabilizing protein structure and shape. Different Level of structural organization of proteins, Protein Purification. Denaturation and renaturation of proteins. Fibrous and globular proteins.
Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides. Homo & Hetero Polysaccharides, Mucopolysaccharides, Bacterial cell wall polysaccharides, Glycoprotein's and their biological functions

UNIT II

Lipids: Structure and functions –Classification, nomenclature and properties of fatty acids, essential fatty acids. Phospholipids, sphingolipids, glycolipids, cerebrosides, gangliosides, Prostaglandins, Cholesterol.
Nucleic acids: Structure and functions: Physical & chemical properties of Nucleic acids, Nucleosides & Nucleotides, purines & pyrimidines,. Biologically important nucleotides, Double helical model of DNA structure and forces responsible for A, B & Z – DNA, denaturation and renaturation of DNA

UNIT III

Enzymes: Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, metalloenzymes, monomeric & oligomeric enzymes, activation energy and transition state, enzyme activity, specific activity, common features of active sites, enzyme specificity: types & theories, Biocatalysts from extreme thermophilic and hyperthermophilic archaea and bacteria. Role of: NAD+ , NADP+, FMN/FAD, coenzymes A, Thiamine pyrophosphate, Pyridoxal phosphate,lipoic-acid, Biotin vitamin B12, Tetrahydrofolate and metallic ions

UNIT IV

Carbohydrates Metabolism: Reactions, energetics and regulation. Glycolysis: Fate of pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway and its significance, Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle, Electron Transport Chain, Oxidative phosphorylation. ß-oxidation of fatty acids.

References:

1. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
2. Buchanan, B., Gruissem, W. and Jones, R. (2000) Biochemistry and Molecular Biology of Plants.American Society of Plant Biologists.
3. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA.
4. Hopkins, W.G. and Huner, P.A. (2008) Introduction to Plant Physiology. John Wiley and Sons.
5. Salisbury, F.B. and Ross, C.W. (1991) Plant Physiology, Wadsworth Publishing Co. Ltd.

BXL-202: COMPUTER SCIENCE

Marks (Theory) : 70 **Credits :2 (30 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

An Overview of Computer System

Anatomy of a digital Computer, Memory Units, Main and Auxiliary Storage Devices, Input Devices, Output Devices, Classification of Computers. Radix number system: Decimal, Binary, Octal, Hexadecimal numbers and their inter-conversions; Representation of information inside the computers.

UNIT-II

Operating System Basics

The user Interface, Running Programmes, Managing files, Introduction to PC operating Systems: Unix/Linux, DOS, Windows 2000.

UNIT-III

Internet basics

Introduction to the basic concepts of Networks and Data Communications, How Internet works, Major features of internet, Emails, FTP, Using the internet.

UNIT-IV

Programming Languages

Machine-, Assembly-, High Level- Language, Assembler, Compiler, Interpreter, debuggers, Programming fundamentals: problem definition, algorithms, flow charts and their symbols, introduction to compiler, interpreter, assembler, linker and loader and their inter relationship.

Reference books:

1. Goel A., Computer Fundamentals, Pearson Education, 2010.
2. Aksoy P. & DeNardis L., Introduction to Information Technology, Cengage Learning, 2006
3. Sinha P. K. & Sinha P. Fundamentals of Computers, BPB Publishers, 2007

BPP-201: PHYSICS LAB - II

Marks (External) : 70 **Credits : 2**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. To determine the frequency of an electric tuning fork by Melde's experiment.
2. To study Lissajous Figures.
3. To determine refractive index of the Material of a prism using sodium source.
4. To determine the dispersive power of the material of a prism using mercury source.
5. To determine the wavelength of sodium source using Michelson's interferometer.
6. To determine wavelength of sodium light using Fresnel Biprism.
7. To determine wavelength of sodium light using Newton's Rings.
8. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
9. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
10. To determine dispersive power and resolving power of a plane diffraction grating.

Reference Books

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

BCP-201: CHEMISTRY LAB-II

Marks (External) : 70 **Credits : 2**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Complexometrictitrations: Determination of Mg^{2+}, Zn^{2+} by EDTA.

Paper Chromatography: Qualitative Analysis of any one of the following Inorganic cations and anions by paper chromatography (Pb^{2+}, Cu^{2+}, Ca^{2+}, Ni^{2+}, Cl^- , Br^- , I^- and PO_4^{3-} and NO_3^-).

To determine the specific refractivity of at least two liquids.

Determine rate constant of acid catalyzed hydrolysis of methyl acetate.

Determination of conductance of electrolytes

The preliminary examination of physical and chemical characteristics (physical state, colour, odour and ignition test), extra element detection (N,S,Cl, Br and I).

Reference Books:

1. Vogel A. I., Tatchell A.R., Furnis B.S., Hannaford A.J., Smith P.W.G.,Vogel's Text Book of Practical Organic Chemistry,5th Edn.,Pubs: ELBS, 1989.
2. Pavia D.L., Lampanana G.M., Kriz G.S. Jr., Introduction to Organic Laboratory Techniques, 3rd Edn., Pubs: Thomson Brooks/Cole,2005.
3. Mann F.G., Saunders. P.C.,Practical Organic Chemistry,Pubs:Green& Co. Ltd., London, 1978.
4. Svehla, G., Vogel's Qualitative Inorganic Analysis (revised); 7th edition, Pubs: Orient Longman, 1996.
5. Bassett, J., Denney, R.C., Jeffery, G.H., Mendham, J., Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th edition, Pubs: Orient Longman,1978.
6. Das R.C. &Behra B. Experimental Physical Chemistry, , McGraw Hill.
7. Shoemaker &GailandExperiments in Physical Chemistry, McGraw Hill.
8. YadavJ. B. Advanced Practical physical Chemistry

BXP-201: COMPUTER SCIENCE LAB

Marks (External) : 70 **Credits : 2**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Programming language: C fundamentals, formatted input/ output, expressions, selection statements, loops and their applications; Basic types, arrays, functions, including recursive functions, program organization: local and external variables and scope; pointers & arrays

Representative programming in C

1. Write a program to find the largest of three numbers. (if-then-else)
2. Write a program to find the largest number out of ten numbers (for-statement)
3. Write a program to find the average mail height & average female heights in the class (input is in form of sex code, height).
4. Write a program to find roots of quadratic equation using functions and switch statements.
5. Write a program to multiply two matrices

BOOKS SUGGESTED:

Kanetkar Y. Let Us C, BPB publication

BPL -301: ELECTRICITY AND MAGNETISM

Course Objective: The objective of the course is to teach the students all the standard introductory topics including electrostatics, magnetism, circuits, electromagnetic waves, and electric and magnetic fields in matter.

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT - I

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

UNIT - II

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

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UNIT – III

Magnetic Properties of Matter: Magnetization vector (**M),** Magnetic Intensity (**H),** Magnetic Susceptibility and permeability, Relation between **B, H, M**, Para-, Dia- and Ferromagnetism, B-H curve and hysteresis

Dielectric Properties of Matter: Dielectrics, Induced Dipoles, Polarization, Bound Charges, Field inside a dielectric, Gauss's law in dielectrics, Electrical Susceptibility, Permittivity and Dielectric Constant, Energy in dielectric system, Forces on Dielectrics, Displacement vector **D**, Relations between **E**, **P** and **D**.

UNIT – IV

Electromagnetic Induction: Faraday's Law, Lenz's Law, Self Inductance and Mutual Inductance, Reciprocity Theorem, Energy stored in a Magnetic Field, Introduction to Maxwell's Equations, Charge and Energy Conservation and Displacement current, The Continuity Equation, Poynting theorem, Electromagnetic waves and their properties

Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits, Complex Reactance and Impedance, Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width, Parallel LCR Circuit.

Reference Books:

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
2. Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
3. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.

BPL -302: MATHEMATICAL PHYSICS – I

Course Objective: The course covers basics of differential equation, vector calculus, vector algebra, vector differentiation, vector integration, probability and errors. These topics are useful for the mathematical basis of electromagnetism and quantum mechanics courses.

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT - I

Calculus: Recapitulation: Limits, continuity, average and instantaneous quantities, differentiation, Plotting functions, Intuitive ideas of continuous, differentiable, etc, functions and plotting of curves, Approximation: Taylor and binomial series (statements only).

First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor, Homogeneous Equations with constant coefficients, Wronskian and general solution, Statement of existence and Uniqueness Theorem for Initial Value Problems, Particular Integral.

UNIT - II

Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials, Constrained Maximization using Lagrange Multipliers.

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

UNIT -III

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

Vector Integration: Ordinary Integrals of Vectors, Multiple integrals, Jacobian, Notion of infinitesimal line, Surface and volume elements, Line, surface and volume integrals of Vector fields, Flux of a vector field, Gauss's divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs).

UNIT - IV

Orthogonal Curvilinear Coordinates: Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.

Introduction to probability: Independent random variables, Probability distribution functions; Binomial, Gaussian, and Poisson distributions (with examples), Mean and variance, Dependent events: Conditional Probability, Bayes' Theorem and the idea of hypothesis testing.

Theory of Errors: Systematic and Random Errors, Propagation of Errors, Normal Law of Errors, Standard and Probable Error, Least-squares fit, Error on the slope and intercept of a fitted line.

Reference Books:

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013,7th Edn., Elsevier.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
3. Mathematical Physics, H K Das, S Chand

BPL-303: APPLIED OPTICS

Course Objective: The course covers basics of several optical phenomena including interference, diffraction and polarization of light. Further, the course provides an insight of practical applications of Lasers and Optical fibers.

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT I

Basic Geometrical Optics: The laws of reflection and refractions - Reflection of light from optical surfaces (Plane and Curved), Critical angle and total internal reflection (TIR), Refraction in prisms, Image formation with mirrors and lenses, Lens formulas for thin lenses Magnification and Numerical Aperture, Cardinal points, Imaging with camera, Microscope and Telescope .Ray Tracing and its application in Image Evaluation, Aberrations in optical systems.

UNIT II

Basic physical optics: Huygens' Principle and its application. Superposition of waves, , Interference-Constructive and destructive interference, two beam and multiple beam interference, Thin film interference and its applications-Anti-reflection and reflection coatings, Interference filters, Diffraction revisited, Diffraction . Grating and its application, Concept of Diffraction limited optics, Polarization-Law of Malus, Polarization by reflection and Brewster's angle, Polarization by crystals-Quarter and half wave plates.

UNIT III

Coherent Optics: Lasers-Basic concept of stimulated emission and amplification, Requirements of gain medium, pumping and cavity, Laser beam properties like coherence, Monochromaticity, Directionality and Intensity, He-Ne and Laser Diode, Typical Laser Interferometers (Fizeau and Michelson) and its application in non destructive testing, Febry Perot Interferometer and its spectroscopic applications.
Holography: Basic concept of holography, Consideration of source and recording media for holograms, Reflection, transmission and color holograms,

UNIT – IV

Detectors and Fiber Optics: Photo detectors - Eye as a detector-structure, Eye response curve and resolution**,** Basics of photo detection mechanism, Concept of responsively and detectivity, Photo diode and PIN diodes.
Basics of Optical Fibers: Structure and Index profiles of optical fibers, Ray model for propagation through a fiber, The numerical aperture and acceptance angle of optical fiber, Attenuation and dispersion in optical fiber, Qualitative descriptions of modes of fibers, Fiber optic applications in illumination, communication and sensors.

Reference Books:

1. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
2. Fundamentals of Photonics, SPIE, Opens Source

BPL-304: (i) PHYSICS OF SEMICONDUCTOR DEVICES

Course Objective: The course enables students to develop an in-depth understanding about the physics of semiconductors through an exposure of various types of semiconductor diodes, transistors, and fabrication of integrated circuits.

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Physics of Semiconductors: The Energy-Band theory of Crystals, Classification of materials, Intrinsic and extrinsic semiconductors, Donor and Acceptor impurities, Charge densities in semiconductors, Electrical properties of Ge and Si, Generation and recombination of charges, Carrier diffusion, Continuity equation, Injected minority-carrier charge, The Potential variation within a graded semiconductor.

UNIT – II

Semiconductor Diodes: Open circuit p-n junction, V-I characteristics and their dependence, Idea Diode, The Diffusion capacitance, Breakdown Diodes, Tunnel Diode, Semiconductor Photodiode, LED, Diode as circuit element, Load line, Piecewise linear diode model, p-n junction as rectifier (half, full and bridge rectifier), Ripples, Filters (capacitor, inductor and π filters), Clipping and clamping circuits.

UNIT – III

Bipolar Junction Transistors (BJT): The junction transistor and its current components, I-V characteristics, Transistor as an amplifier, Type of transistors, Common-Base (CB), Common-Emitter (CE), Common-Collector (CC) configuration, characteristics of CE, CB and CC configurations, Ebers-Moll BJT Model, Phototransistor, Switching Transistor, Biasing for transistor, load line and Q point. Types of biasing, Fixed Bias circuits, Collector to base bias circuits, Bias circuit with emitter resistance, Voltage divider bias circuits.

UNIT – IV

Integrated Circuits (IC): Fabrication and Characteristics: Integrated circuit Technology, Basic monolithic IC, Epitaxial Growth, Masking and Etching, Diffusion of impurities, Transistors for Monolithic circuits, Monolithic diodes, Integrated resistors, Integrated capacitors and inductors, Large scale and medium scale integration (LSI and MSI), Metal Semiconductor contacts

Reference Books:

1. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
2. Basic Electronics and Linear Circuits, N. N. Bhargava et. al., 2nd Edition, McGraw Hill, India
3. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
4. Solid State Electronic Devices, B. G. Streetman & S. K. Banerjee, 6th Edn.,2009, PHI Learning

BPL-304: (ii) DIGITAL SIGNAL PROCESSING

Course Objective: The objective of this course is to provide a comprehensive discussion on digital systems, concept of Fourier transformation for digital signals, various filters and fast Fourier transformation for these signals.

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Discrete-Time Signals and Systems: Classification of Signals, Transformations of the Independent Variable, Periodic and Aperiodic Signals, Energy and Power Signals, Even and Odd Signals, Discrete-Time Systems, System Properties, Impulse Response, Convolution Sum; Graphical Method; Analytical Method, Properties of Convolution, Commutative, Associative, Distributive, Shift, Sum Property System Response to Periodic Inputs.

UNIT – II

Discrete-Time Fourier Transform: Fourier Transform Representation of Aperiodic Discrete-Time Signals, Periodicity of DTFT, Properties; Linearity; Time Shifting; Frequency Shifting; Differencing in Time Domain; Differentiation in Frequency Domain; Convolution Property. The z-Transform: Bilateral (Two-Sided) z-Transform, Inverse z-Transform, Relationship Between z-Transform and Discrete-Time Fourier Transform, z-plane, Region-of-Convergence; Properties of ROC.

UNIT - III

Filter Concepts: Phase Delay and Group delay, Zero-Phase Filter, Linear-Phase Filter, Simple FIR Digital Filters, Simple IIR Digital Filters, All pass Filters, Averaging Filters, Notch Filters, Discrete Fourier Transform: Frequency Domain Sampling (Sampling of DTFT),

The Discrete Fourier Transform (DFT): DFT and its Inverse, DFT as a Linear transformation, Properties; Periodicity; Linearity; Circular Time Shifting; Circular Frequency Shifting; Circular Time Reversal; Multiplication Property.

UNIT - IV

Fast Fourier Transform: Direct Computation of the DFT, Symmetry and Periodicity Properties of the Twiddle factor (WN), Radix-2 FFT Algorithms; Decimation-In-Time (DIT) FFT Algorithm; Decimation-In-Frequency (DIF) FFT Algorithm, Inverse DFT Using FFT Algorithms.

Realization of Digital Filters: Non Recursive and Recursive Structures, Canonic and Non Canonic Structures, Equivalent Structures (Transposed Structure), FIR Filter structures; Direct-Form; Cascade-Form; Basic structures for IIR systems; Direct-Form I. Finite Impulse Response Digital Filter: Advantages and Disadvantages of Digital Filters, Types of Digital Filters.

Reference Books:

1. Digital Signal Processing, Tarun Kumar Rawat, 2015, Oxford University Press, India
2. Digital Signal Processing, S. K. Mitra, McGraw Hill, India.
3. Principles of Signal Processing and Linear Systems, B.P. Lathi, 2009, 1st Edn.
4. Oxford University Press. Fundamentals of Digital Signal processing using MATLAB, R.J. Schilling and S.L. Harris, 2005, Cengage Learning.
5. Fundamentals of signals and systems, P.D. Cha and J.I. Molinder, 2007, Cambridge University Press.

BPL - 305: BASIC INSTRUMENTATION SKILLS

Course Objective: The course is based on imparting practical knowledge about commonly used electronic instruments including digital multimeter and cathode ray oscilloscope to the undergraduate students of physics.

Marks (Theory) : 70 **Credits : 2(30 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the two units with four questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

Unit - I

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc., Errors in measurements and loading effects.
Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance, Specifications of multimeters and their significance.

Unit - II

Digital Multimeter: Block diagram and working of a digital multimeter, Working principle of time interval, frequency and period measurements using universal counter/ frequency counter, Time - base stability, Accuracy and resolution.
Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity, Principles of voltage measurement (block diagram only), Specifications of an electronic Voltmeter/ Multimeter and their significance.

Unit - III

Cathode Ray Oscilloscope: Block diagram of basic CRO, Construction of CRT, Electron gun, electrostatic focusing and acceleration (qualitative treatment only), Brief discussion on screen phosphor, visual persistence & chemical composition, Time base operation, synchronization, Front panel controls, Specifications of a CRO and their significance,

Unit - IV

Use of CRO for the measurement of voltage (dc and ac), frequency and time period. Special features of dual trace, Introduction to digital oscilloscope and probes, Digital storage Oscilloscope: Block diagram and principle of working.

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Digital Circuits and system
3. s, Venugopal, 2011, Tata McGraw Hill.
4. Electronic Devices and circuits, S. Salivahanan& N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill

BPP-301: PHYSICS LAB - III

Marks (External) : 70 **Credits : 3(60Hrs)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. Study Ammeter and Voltmeter
2. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
3. Study functioning of CRO
4. To study the characteristics of a series RC Circuit.
5. To determine an unknown Low Resistance using Potentiometer.
6. To determine an unknown Low Resistance using Carey Foster's Bridge.
7. To determine the value of e/m by Bar magnet
8. Study of I-V characteristics of PN Junction diode.
9. Study input and output characteristics of Transistor.
10. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
11. To study the response curve of a parallel LCR circuit and determine its (a) Anti resonant frequency and (b) Quality factor Q.
12. Measurement of charge and current sensitivity and CDR of Ballistic Galvanometer
13. Determine a high resistance by leakage method using Ballistic Galvanometer.

Reference Books

1) Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2) A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
3) A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub

BPP-302: PHYSICS LAB- IV

Marks (External) : 70 **Credits : 3(60Hrs)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. Measurement of Planck's constant using black body radiation and photo-detector
2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
3. To determine the Planck's constant using LEDs of at least 4 different colours.
4. To determine the thickness of a thin wire using a laser Source.
5. To determine the wavelength of laser source using diffraction of single slit.
6. To determine the wavelength of laser source using diffraction of double slits.
7. To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating
8. Study of Thermal Conductivity of a bad conductors
9. To verify inverse square law using various light sources
10. To find the specific rotation coefficient for cane sugar using polarimeter.

Reference Books

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

BPL-401: ELEMENTS OF MODERN PHYSICS

Course Objective: The aim of the course is to give the students a flavor of developments in the understanding of physics in the last century by introducing the concepts of dual nature of matter, basic quantum mechanics, and radioactivity along with predictions of The Standard Model.

Marks (Theory): 70 **Credits: 4 (60 lectures)**
Marks (Internal Assessment): 30 **Time: 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Particle properties of waves: Electromagnetic waves, Blackbody radiation, Photoelectric effect, Light, X-ray, X-ray diffraction, Compton scattering, Pair Production.
Wave properties of matter: deBroglie waves, Phase and group velocity, Particle diffraction, Electron microscope, Uncertainty principle.
Atomic structure: Rutherford scattering, Rutherford model, Nuclear size, Electron orbits, Atomic spectra, Bohr model, Energy levels and spectra, Correspondence principle, Atomic excitation, Franck Hertz experiment.

UNIT – II

Schrodinger equation: Momentum and Energy operators, Stationary states, Physical interpretation of a wave function, probabilities and normalization, Probability and probability current densities in one dimension, Particle in a box.
Quantum theory of Hydrogen atom: Schrodinger equation for H-atom, Separation of variables, Quantum numbers, Electron probability density, Radiative transition, Selection rules, Zeeman effect.

UNIT – III

Many electron atoms: Electron spin, Exclusion principles, Stern-Gerlach experiment, Symmetric and anti-symmetric wave functions, Periodic tables, Atomic structures, Spin-orbit coupling, Total angular momentum, X-ray spectra.
Nuclear structure: Size and structure of atomic nucleus and its relation with atomic weight, Impossibility of an electron being in the nucleus, Nature of the nuclear force, NZ graph, Binding energy curve and mass defect.

UNIT – IV

Radioactivity: Stability of the nucleus, Law of radioactive decay, Mean life and half-life, Alpha decay, Beta decay, Beta particle energy spectrum and Pauli's prediction of neutrino, Gamma ray emission, Energy-momentum conservation, Electron-positron pair creation by gamma photons in the vicinity of a nucleus, Fission and fusion reactions, Fission - nature of fragments and emission of neutrons, Nuclear reactor, Fusion and thermonuclear reactions in stars.
Elementary particles: Interaction and particles, Leptons, Hadrons, Quarks, Field bosons, Standard Model of particles, History of the Universe (Qualitative).

Reference Books:

1. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
2. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
3. Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson

BPL-402: CLASSICAL MECHANICS

Course Objective: The objective of the course is to provide a basic knowledge of constraints, planetary motion, Langrange's formulation along with the significance of Hamiltonian of classical system of particles.

Marks (Theory): 70 **Credits: 4 (60 lectures)**
Marks (Internal Assessment): 30 **Time: 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Constraints & their classification, Generalized coordinates, D'Alembert's principle and Lagrange's equations, Simple applications of the Lagrangian formulation, Hamilton's principle, Derivation of Lagrange's equations from Hamilton's principle, Conservation theorems and symmetry properties. Two – body central force problem: Reduction to the equivalent one-body problem, Equations of motion and first integrals, Equivalent 1-D problem and classification of orbits.

UNIT -II

Virial theorem, Differential equation for the orbit and integrable power-law potentials, The Kepler problem, Scattering in a central force field, Legendre transformations and the Hamilton equations of motion, Cyclic coordinates and Routh's procedure, The physical significance of the Hamiltonian, Derivation of Hamilton's equations from a variational principle, The principle of Least Action.

UNIT –III

The equations of canonical transformation, Examples of canonical transformations, Poisson brackets, Special cases of Poisson brackets, Poisson theorem, Poisson bracket and Canonical transformation, Jacobi's identity and its derivation, Lagrange brackets and its properties, Relationship between Poisson and Lagrange brackets and its derivation, Angular momenta and Poisson bracket.

UNIT –IV

Hamilton-Jacobi equation for Hamilton's principal function, Harmonic Oscillator problem, stable and unstable equilibria, elementary idea of small oscillations, normal modes and coordinates , free vibrations of a linear triatomic molecule.

Reference Books:

1. Classical Mechanics, 3rd ed.,2002 by H.Goldstein, C. Poole and J. Safko, Pearson Edition
2. Classical Mechanics of particles and rigid bodies by K. C. Gupta New Age International 2008
3. Classical Mechanics A Contemporary Approach: J.V. Jose and E.J.Saletan (2006) Cambridge University Press

BPL-403: HEAT AND THERMODYNAMICS

Course Objective: This course aims to provide the understanding on the relationship between Heat Flow and work done by teaching the definitions of various thermo-dynamical quantities, laws of thermodynamics, Maxwell's relations, and kinetic theory of gases.

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Zeroth and First Law of Thermodynamics: Extensive and intensive thermodynamic variables, Thermodynamic equilibrium, Zeroth law, Work and heat, State functions, First law of thermodynamics, Internal energy, Applications of first law, General relation between C_P and C_V, Work done during isothermal and adiabatic Processes .

Second Law of Thermodynamics: Reversible and Irreversible process with examples, Conversion of Work into Heat and Heat into Work, Heat Engines, Carnot's Cycle, Carnot engine & efficiency, Refrigerator & coefficient of performance, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence, Carnot's Theorem.

UNIT – II

Entropy: Concept of entropy, Clausius theorem, Clausius Inequality, Second law of thermodynamics in terms of entropy, Entropy of a perfect gas, Principle of increase of entropy, Entropy changes in reversible and irreversible processes, Entropy of the universe, Temperature–Entropy diagrams for Carnot's cycle, Third Law of thermodynamics, Unattainability of absolute zero.

Thermodynamic Potentials: Thermodynamic potentials: Internal energy, Enthalpy, Helmholtz free energy, Gibb's free energy, First and second order phase transitions with examples, Clausius-Clapeyron equation.

UNIT – 3

Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's relations, Using Maxwell's relations: (1) Clausius-Clapeyron equation, (2) Values of Cp-Cv (3) TdS equations, (4) Joule-Kelvin coefficient for ideal and Van der Waal gases, (5) Change of temperature during adiabatic process.

Kinetic Theory of Gases: Distribution of velocities: Maxwell-Boltzmann law of distribution of Velocities in an ideal Gas and its experimental verification, RMS and most probable speeds, Degrees of freedom, Law of equipartition of energy (No proof required), Specific heats of gases.

UNIT – 4

Molecular Collisions: Mean free path, Collision probability, Estimates of mean free path, Transport phenomenon in ideal gases: (1) Viscosity, (2) Thermal conductivity and (3) Diffusion, Brownian motion

Real Gases: Deviations from the ideal gas equation, Boyle Temperature, Van der Waal's Equation of state for real gases, Values of critical constants, P-V Diagrams, Joule's experiment, Free adiabatic expansion of a perfect gas, Joule-Thomson porous plug experiment, Joule-Thomson effect for real and Van der Waal gases, Temperature of inversion, Joule-Thomson cooling.

Reference Books:

1. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press
3. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
4. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
5. Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University

BPL -404: (i) ASTRONOMY AND ASTROPHYSICS

Course Objective: The objective of the course is to provide the understanding of basic concepts in observational astronomy and required astronomical techniques. A detailed introduction is given on Solar system, galaxy, and interstellar space.

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT - I

Astronomical Scales: Astronomical Distance, Mass and Time, Scales, Brightness, Radiant Flux and Luminosity, Measurement of Astronomical Quantities Astronomical Distances, Stellar Radii, Masses of Stars, Stellar Temperature.

Basic concepts of positional astronomy: Celestial Sphere, Geometry of a Sphere, Spherical Triangle, Astronomical Coordinate Systems, Geographical Coordinate Systems, Horizon System, Equatorial System, Diurnal Motion of the Stars, Conversion of Coordinates. Measurement of Time, Sidereal Time, Apparent Solar Time, Mean Solar Time, Equation of Time, Calendar. Basic Parameters of Stars: Determination of Distance by Parallax Method; Brightness, Radiant Flux and Luminosity, Apparent and Absolute magnitude scale.

UNIT - II

Astronomical techniques: Basic Optical Definitions for Astronomy (Magnification Light Gathering Power, Resolving Power and Diffraction Limit, Atmospheric Windows), Optical Telescopes (Types of Reflecting Telescopes, Telescope Mountings, Space Telescopes, Detectors and Their Use with Telescopes (Types of Detectors, detection Limits with Telescopes).

Sun and Solar System: Solar Parameters, Solar Photosphere, Solar Atmosphere, Chromosphere. Corona, Solar Activity, Basics of Solar Magneto-hydrodynamics,

UNIT - III

The milky way: Basic Structure and Properties of the Milky Way, Nature of Rotation of the Milky Way Stars and Star Clusters of the Milky Way, Properties of and around the Galactic Nucleus.

Galaxies: Galaxy Morphology, Hubble's Classification of Galaxies, Elliptical Galaxies (The Intrinsic Shapes of Elliptical, de Vaucouleurs Law, Stars and Gas). Spiral and Lenticular Galaxies (Bulges, Disks, Galactic Halo) The Milky Way Galaxy, Gas and Dust in the Galaxy, Spiral Arms.

UNIT - IV

Large scale structure & expanding universe: Cosmic Distance Ladder (An Example from Terrestrial Physics, Distance Measurement using Cepheid Variables), Hubble's Law (Distance- Velocity Relation), Clusters of Galaxies (Virial theorem and Dark Matter).

Reference Books:

1. Modern Astrophysics, B.W. Carroll & D.A. Ostlie, Addison-Wesley Publishing Co.
2. Introductory Astronomy and Astrophysics, M. Zeilik and S.A. Gregory, 4th Edition, Saunders College Publishing.
3. Fundamental of Astronomy (Fourth Edition), H. Karttunen et al. Springer Baidyanath Basu,
4. Textbook of An introduction to Astrophysics, Second printing, Prentice Hall of India Private limited, New Delhi,2001.

BPL -404: (ii) METHODS OF EXPERIMENTAL PHYSICS

Course Objective: This course aims to cover the fundamental principles involved in the methods of measurement in the experimental physics. The focus is on the teaching undergraduate students about direct and indirect methods of accurate measurements of fundamental physical quantities.

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Measurements: Accuracy and precision, Sources of uncertainty and experimental errors, Concepts of standards, Traceability and calibration, Basic of statistical analysis of data and curve fitting, Measurement of length: Calipers, Micrometer, Dial indicator, Triangulation technique, Theodolite, Range Finder.

Measurement of Angles and Arc: Inclinometers and laser levelers, Auto collimator, Angular Encoders Measurement of Time: Oscillator and Clocks, Atomic Clock.

UNIT – II

Transducers and its characteristics: Selection of instrumentation transducers, Modeling a transducers with typical example of electrical parameter measurements like current, voltage, resistance and capacitance, DC and AC Bridge Measurements Strain gauge and Whitestone Bridge, Gas and liquid thermometer, Thermoelectric Sensors: RTD, Thermistor, Thermocouples, Linear variable differential transformer (LVDT),Capacitance change transducers.

UNIT – III

Spectroscopic Instruments: Prism Spectrometers and Grating spectrometer, Measurement of refractive index and dispersion, Applications of Lasers Measurement of displacement, Fiber endoscopy, Measurements with Fresnel Bi Prism, Measurements and Newton's ring, Measurement of surface profile by autocollimator and interferometer, Traigulation techniques using laser and its applications.

UNIT – IV

Measurement of flow of liquid and gases, Measurement of Pressure, Vacuum gauges, Piezo-elecric oscillator and its application in thin film thickness monitor, Optical thickness monitors, Radiation Sensors: Principle of gas filled detectors, Ionization chamber, Scintillation detector

Reference Books

1) Measurement, Instrumentation and Experiment Design in Physics and Engineering, M. Sayer and A, Mansingh, PHI Learning Pvt. Ltd.
2) Experimental Methods for Engineers, J.P. Holman, McGraw Hill
3) The Physics of Metrology, Alexius J. Hebra, Springer 2010

BPL-405: COMPUTATIONAL PHYSICS

Course Objective: The present course is focused on efficient use of computer languages for solving physics problems/ Formulae using a scientific language like FORTRAN

Marks (Theory) : 70 **Credits : 2 (30 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with four questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and two question from each unit.

Unit - I

Introduction to Fortran: Computer architecture and organization, memory and input/output devices, Binary and decimal arithmetic, Fortran character set, Data types and integer constant, variables, Arithmetic expression, Assignment statement, Format statement, Read/write statement, Unformatted input/output statements, Algorithm, Flowcharts

Unit - II

Fortran statement & subprograms: GOTO, Computed GOTO, Arithmetic If, logical If, If Then Else, Nested If Then Else, DO loops, Continue statement, Nested do loop. Data statement, Double precision, Logical data, Complex data, While structure, Arrays and subscripted variables, Subprograms, Errors.

Unit - III

Numerical Methods: Solution of algebraic and transcendental equations by Bisection, Newton Raphson and Iteration methods. Interpolation by Newton Forward and Backward difference formula

Unit - IV

Interpolation and random processes: Error estimation of linear interpolation, Numerical differentiation (Forward and backward difference formula) and Integration (Trapezoidal and Simpson rules), Random Number generation, Monte Carlo method.

REFERENCE

1. Fortran 77 and Numerical Methods C. Xavier New Age International 1994.
2. Schaum's Outline of Programming with FORTRAN 77.

BPP-401: PHYSICS LAB- V

Marks (External) : 70 **Credits : 3(60Hrs)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Leeand Charlton's disc method.
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
7. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature.

Reference Books

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

BPP- 402 PHYSICS LAB-VI

Marks (External) : 70 **Credits : 3(60Hrs)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Topics	Description with Applications
Programs: using FORTRAN language	Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search
Random number generation	Area of circle, area of square, volume of sphere, value of π
Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods	Solution of linear and quadratic equation
Interpolation by Newton Gregory, Forward and Backward difference formula, Error estimation of linear interpolation	Evaluation of trigonometric functions
Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method	Given Position with equidistant time data calculate velocity and acceleration and vice versa. Find the area of B-H Hysteresis loop

Referred Books:

1. Fortran 77 and Numerical Methods C. Xavier New Age International 1994
2. Schaum's Outline of Programming with FORTRAN 77.

BPL-501: QUANTUM MECHANICS

Course Objective: The objective of the course is to provide a thorough understanding of basics of quantum mechanics, Schrodinger equation and its solutions for different problems. Moreover, different approximation methods have been included.

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

Unit – I

Origins of Quantum Physics : Particle Aspect of Radiation, Blackbody Radiation, Photoelectric Effect, Compton Effect, Pair Production, Wave Aspect of Particles, de Broglie's Hypothesis: Matter Waves, Matter Waves for Macroscopic Objects, Quantum View of Particles and Waves, Wave–Particle Duality: Principle of Linear Superposition, Heisenberg's Uncertainty Principle, Probabilistic Interpretation, Bohr Model of the Hydrogen Atom, Quantization Rules, Wave Packets, Localized Wave Packets, Wave Packets and the Uncertainty Relations, Motion of Wave Packets.

Unit – II

Postulates of Quantum Mechanics: The Basic Postulates of Quantum Mechanics, Probability Density, The Superposition Principle, Observables and Operators, Measurement in Quantum Mechanics, Expectation Values, Measurement and the Uncertainty Relations, Time Evolution of the System's State, Time Evolution Operator, Stationary States.

Schrödinger Equation - Wave Packets, The Conservation of Probability , Time Evolution of Expectation Values, Symmetries and Conservation Laws, Infinitesimal Unitary Transformations, Finite Unitary Transformations, Symmetries and Conservation Laws, Ehrenfest Theorem

Unit – III

Properties of One-Dimensional Motion, Discrete Spectrum (Bound States), Continuous Spectrum (Unbound States), Mixed Spectrum, Symmetric Potentials and Parity, Free Particle: Continuous States, The Potential Step, The Potential Barrier and Well, The Tunneling Effect, Infinite Square Well Potential, Asymmetric Square Well, Symmetric Potential Well, Finite Square Well Potential, The Harmonic Oscillator, Energy Eigenvalues, Energy Eigenstates.

Unit – IV

Approximation Methods for Stationary States: Perturbation Theory (time dependent and time-independent), Non-degenerate Perturbation Theory, Degenerate Perturbation Theory, Fine Structure and Anomalous Zeeman Effect, Variational Method, Wentzel–Kramers–Brillouin Method.

Reference Books:

1. Quantum Mechanics Concepts and Applications Second Edition Nouredine Zettili, Wiley
2. Quantum Physics, VK Jain, Ane Books Pvt. Ltd., 2017.
3. Basic Quantum Mechanics, Ajoy Ghatak, Trinity, 2014.
4. Introduction to Quantum Mechanics, D.J. Griffith, 2nd Ed. 2005, Pearson Education

BPL-502: STATISTICAL MECHANICS

Course Objective: The aim of the course is to familiarize the students with the concepts of Phase space, Ensembles, and their applications to Partition functions with an overlook to different distribution functions for classical and quantum systems.

Marks (Theory) : 70 **Credits : 4 (60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Foundations of statistical mechanics, Specification of states of a system, Concept of phase space and ensemble contact between statistics and thermodynamics, Equipartition theorem, Classical ideal gas, Entropy of mixing and Gibb's paradox.

UNIT-II

Microcanonical ensemble, Phase space, Trajectories and density of states, Liouville's theorem, Boltzmann H Theorem, Canonical and grand canonical ensembles, Partition functions, Calculation of statistical quantities, Energy and density fluctuations.

UNIT-III

Density matrix, Statistics of ensembles, Statistics of undistinguishable particles, Maxwell – Boltzmann, Fermi-Dirac and Bose – Einstein statistics, properties of ideal Bose – Einstein and Fermi-Dirac gases, Bose Einstein condensation, Laser cooling of atom as an example of Bose Condensate, Planck's radiation formula (Black body Radiation).

UNIT-IV

Virial equation of state, Ising model, mean – field theories of the Ising model in one dimension and exact solution in one dimension, Landau theory of phase transition.

Text and Reference Books:

1. Statistical Mechanics, R.K.Patharia
2. Statistical Mechanics, Gupta & Kumar
3. Statistical Mechanics, ESR Gopal

BPL-503: MATHEMATICAL PHYSICS-II

Course Objective: The present course provides an introduction to the Fourier series for periodic functions and their applications. It also develops an understanding of Special mathematical functions required for advanced physics problems.

Marks (Theory) : 70 **Credits : 4(60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Fourier Series: Periodic functions, Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients, Complex representation of Fourier series, Expansion of functions with arbitrary period, Expansion of non-periodic functions over an interval, Even and odd functions and their Fourier expansions Application, Summing of Infinite Series, Term-by-Term differentiation and integration of Fourier Series, Parseval Identity.

UNIT – II

Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance, Frobenius method and its applications to differential equations, Legendre, Bessel, Hermite and Laguerre Differential Equations, Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality, Simple recurrence relations, Expansion of function in a series of Legendre Polynomials.

UNIT – III

Bessel Functions of the First Kind: Generating Function, simple recurrence relations, Zeros of Bessel Functions (Jo(x) and J1(x)) and Orthogonality.

Some Special Integrals: Beta and Gamma Functions and its Relation, Expression of Integrals in terms of Gamma Functions, Error Function (Probability Integral).

Dirac Delta function and its properties: Definition of Dirac delta function, Representation as limit of a Gaussian function and rectangular function, Properties of Dirac delta function.

UNIT – IV

Partial Differential Equations: Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes, Diffusion Equation.

Reference Books:

1. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
2. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
3. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.

BPL -504: (i) NANO MATERIALS AND APPLICATIONS

Course Objective: The objective of the course is to introduce the basic concepts related to nanoscale systems and their synthesis approaches, characterization tools, properties and their applications in the day to day life.

Marks (Theory) : 70 **Credits : 4(60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

Unit - I

Nano scale Systems: Length scales in physics, Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods), Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation- Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1Dnanostructures and its consequences.

Unit - II

Synthesis of nanostructure materials: Top down and Bottom up approach, Photolithography. Ball milling, Gas phase condensation, Vacuum deposition, Physical vapor deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition, Chemical vapor deposition (CVD), Sol-Gel, Electro deposition, Spray pyrolysis, Hydrothermal synthesis, Preparation through colloidal methods, MBE growth of quantum dots.

Unit - III

Characterization and interaction: X-Ray Diffraction, Optical Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy, Scanning Tunneling Microscopy, Coulomb interaction in nanostructures, Concept of dielectric constant for nanostructures and charging of nanostructure, Quasi-particles and excitons, Excitons in direct and indirect band gap semiconductor nanocrystals, Quantitative treatment of quasi-particles and excitons, charging effects

Unit – IV

Application of nano materials: Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron transfer devices (no derivation), CNT based transistors, Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage, Magnetic quantum well, magnetic dots - magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS).

Reference books:

1. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
2. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company)
3. K.K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience and Technology (PHI Learning Private Limited).
4. Introduction to Nanoelectronics, V.V. Mitin, V.A. Kochelap and M.A. Stroscio,2011, Cambridge University Press.

BPL -504: (ii) OPTICAL COMMUNICATION SYSTEMS

Course Objective: The present course is designed to provide the basic information on various communication systems based on light sources and transmitters. In addition, the students will be exposed to related optical instrumentation and design.

Marks (Theory) : 70 **Credits : 4(60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

Unit – I

Basic Concepts of Communication Systems: Analog and Digital Signals, Digitization, Transmission channels, Signal Multiplexing, Optical Communication Systems Overview-Evolution of optical communication, Elements of a typical optical link, Applications of a optical fiber in Optical link. The Behavior of Light,

Optical Fibers-Propagation of light in fiber, Numerical aperture and acceptance angle, Modes in optical fiber, Modal Field Diameter, Attenuation in optical fiber, Dispersion in optical fiber- intramodal and intermodal dispersion, Fiber manufacturing process, Optical Fiber Cables

Unit – II

Light Sources and Transmitters: Characteristics of sources, LED –surface emitter and edge emitter, Laser Diode-Febry-Perot, Distributed feedback and vertical cavity surface emitting lasers, LED and LD transmitters, External modulators, Photodiodes and Receivers: Photodiodes- PIN and Avalanche, photodiode structure and performance particularly in communication.

Connectors and Splices- Source to fiber to fibre and Fibre to detector coupling, Passive Optical Components- coupler, isolator and circulator, Active Optical Components for optical communication.

Unit – III

Optical Amplifiers: Semiconductor optical amplifier, Er-doped fibre amplifier ad its application, Wavelength Division Multiplexing- operational principal of WDM, Multiplexure for WDM (Thin Film filter & Grating, Constructing the WDM Network Puzzle- Network requirements, Components performance in WDM link, WDM network applications, Performance Measures-Digital link Performance, Optical Signal to Noise Ratio, Analog link performance, Measuring Performance Parameters.

Unit – IV

Optical Link Design: System Consideration, Link Power Budget, Rise-Time Budget, Line Coding, Modeling and Simulation Tools, Optical Networks- General Network Concepts, SONET/SDH, Optical Ethernet, Network Management- Management Architect, Management functions and Protocols, Element Management Test and Measurement- Power Meter, Power Attenuator, OTDR , Optical Spectrum Analyzer, Manufacturing Issues- fibre Fabrication, Component Design, Automation and Packaging

Reference Books

1) Optical Communication Essentials, Gerd Kieser, McGraW Hill
2) Fiber Optics Communications Gerd Kieser, McGraW Hill

BPP - 501: PHYSICS LAB – VII

Marks (External) : 70 **Credits : 3(60Hrs)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. Measurement of susceptibility of paramagnetic solution (Quinck`s Tube Method)
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of a dielectric Materials with frequency.
5. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.
6. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150 oC) and to determine its band gap.
7. To determine the Hall coefficient of a semiconductor sample.

Reference Books

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
4. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India.

BPP-502: PHYSICS LAB-VIII

Marks (External) : 70 **Credits : 3(60Hrs)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. To find the polarization angle of laser light using polarizer and analyzer
2. To verify Malus law of polarization
3. Measurement of focal length of Mirrors and Lenses
4. Construction of an optical 4f imaging system and concept inverse Fourier Optics
5. Comparing intensity of light sources and inverse square law
6. Study the characteristics of Photodiodes
7. To study AM/FM Transmitter and Receiver

.

Reference Books:

1. Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.
2. LASERS: Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010, Tata McGraw Hill
3. Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4th Edn., 1996, Cambridge Univ. Press

BPP-503(i): MATERIALS SCIERNCE LAB (DSE-I)

Marks (External) : 70 **Credits : 2(40Hrs)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. Band Gap of a given semiconductor material using Four-Probe method.
2. Study of Hall effect.
3. Lattice parameter and Miller Indices using XRD.
4. Determination of particle size and lattice strain using XRD.
5. Magnetic susceptibility of hydrated copper sulfate.
6. Dielectric constant of a given material.
7. Solar cell characteristics.
8. Transition temperature of a ferroelectric material.
9. Study of the phenomenon of magneto-resistance.

BPP-503(ii): OPTICAL COMMUNICATION SYSTEM LAB (DSE-I)

Marks (External) : 70 **Credits : 2(40Hrs)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. Fiber end preparation and launching of light in fiber
2. To measure the numerical aperture of an optical fibre
3. To study the variation of the bending loss in a multimode fibre
4. To determine the mode field diameter (MFD) of fundamental mode in a
5. To measure the near field intensity profile of a fibre and study its refractive index profile
6. To determine the power loss at coupling between two multimode fibre and source and fiber
7. Set up for a simple fiber optics communication link

.

Reference Books:

1. Electronic Communication systems, G. Kennedy, 1999, Tata McGraw Hill.
2. Fibre optics through experiments, M.R.Shenoy, S.K.Khijwania, et.al. 2009, Viva Books

BPL-601: BASIC ELECTRONICS

Course Objectives: To introduce students to fundamentals of circuit designs, and to provide in-depth theoretical base of Digital Electronics

Marks (Theory): 70 **Credits : 4(60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT-I

Ideal constant-voltage and constant-current Sources, Kirchhoff's Current Law & Kirchhoff's Voltage Law, Mesh & Node Analysis, Thevenin theorem, Norton theorem, Star Delta Transformation, Superposition theorem, Reciprocity Theorem, Maximum Power Transfer theorem, Applications to dc circuits.

UNIT-II

Concept of feedback in amplifier, Type of feedback, Small signal amplifiers, Analysis of stage amplifier by Graphical and Equivalent Circuit methods, Requirement of multistage amplifiers, Gain of multistage amplifier, Coupling of two stages, Frequency response of RC-coupled amplifiers, Distortion in amplifier, Classification of amplifiers, Power amplifier, Push-pull amplifier, Voltage gain in feedback amplifier, Negative feedback and its advantages, Classification of oscillators, LC and RC oscillators.

UNIT-III

Graphical Analysis of the CE Configuration, Two-port Devices and the Hybrid Model, Transistor Hybrid Model, The h Parameters, Conversion Formulas for the Parameters of the Three Transistor Configurations, Analysis of a Transistor Amplifier Circuit Using h Parameters, The Emitter Follower, Comparison of Transistor Amplifier Configurations, Linear Analysis of a Transistor Circuit, Cascading Transistor Amplifiers, Simplified Common-emitter Hybrid Model, The Common-emitter Amplifier with an Emitter Resistance.

UNIT-IV

The Junction Field Effect Transistor: Basic structure & Operation, pinch off voltage, single ended geometry of JFET, volt – ampere characteristic, Transfer Characteristics, FET parameters, Biasing of the FET and setting of Q point using load line. MOSFET: Enhancement MOSFET, Threshold Voltage, Depletion MOSFET, Biasing of MOSFET, comparison of p & n channel FETs, FET small signal model, JFET low frequency common source and common drain amplifiers, FET application as Voltage Variable Resistor (VVR)

Reference Books:

1. Basic Electronics and Linear Circuits, N. N. Bhargava et. al., 2nd Edition, McGraw Hill Education, India
2. A text book in Electrical Technology, B. L. Theraja, S. Chand & Co.
3. Circuit and Networks, 2nd Edition, A Sudhakar and Shyammohan S Palli, Tata McGraw-Hill
4. Intergrated electronics by by Jacob Millman, Christos Halkias, Chetan Parikh, McGraw Hill Education, India

BPL-602: ATOMIC AND MOLECULAR PHYSICS

Course Objective: The present course is designed to provide the basic information on introduction to atomic spectra for one electron and multi electron systems. In addition, vibration, rotational and electronic spectra of molecules will be taught.

Marks (Theory): 70 **Credits : 4(60 lectures)**
Marks (Internal Assessment): 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Introduction to atomic spectra, one electron atoms: Bohr and model of hydrogen atom, Somerfield modification of Bohr model for hydrogen atom, Quantum theory of hydrogen atoms, Quantum numbers of hydrogen atom wave function, Atomic orbitals, Vector representation of momenta and vector coupling approximations, Electron Spin, Spin orbit interaction, Vector model for atoms, Pauli Exclusion Principle, Angular momentum and magnetic moments of atoms, Coupling of angular momenta, Term symbol and derivation from electronic configuration.

UNIT –II

Two electrons systems: L-S and J-J coupling, Interaction energy in L-S and J-J coupling (sp, pd configuration), Lande interval rule, Pauli principal, selection rules, Normal and Anomalous Zeeman effects, Paschen back effect, Stark effect.

UNIT-III

Diatomic molecules and their rotational spectra: Types of molecules, Diatomic linear symmetric top, Asymmetric top and spherical top molecules, Rotational spectra of diatomic molecules as rigid rotator, energy levels, Rotational spectra of diatomic molecules as non-rigid rotator, Intensity of rotational lines.

UNIT –IV

Vibrational, Vibrational-Rotational, Raman and electronic spectra of molecules: Vibrational energy of diatomic molecules, Molecules as Harmonic Oscillator, The molecules as Anharmonic Oscillator, Molecules as Vibrating Rotator, Diatomic molecules as symmetry top, Raman Effect, Classical and quantum theory of Raman spectra, Electronic spectra.

Recommended Reading:

1. Introduction to atomic spectra by H.E. White, McGRAW Hill Book.
2. Atomic & Molecular spectra by Raj Kumar, Kedar Nath Ram Nath, Meerut

BPL -603: SOLID STATE PHYSICS

Course Objective: The aim of the course is to familiarize the students with the concepts of Crystal structure and related techniques, lattice vibrations and free electron theory, Band theory, various physical properties of solids, and Superconductivity.

Marks (Theory) : 70 **Credits : 4(60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Crystal Structure: Crystal lattice and Translation Vectors, Unit cell and basis, Primitive lattice and Bravais lattice, Symmetry concepts, Point groups and space groups, Types of Lattices, Lattice planes, simple crystal structures, Miller Indices, Interplanner spacing, Concepts of Direct and reciprocal lattice, Brillioun zones and Weigner Seitz cell concepts, X-ray diffraction: Bragg's treatment and Von Laue treatment, X-ray diffraction method: Laue and Rotating and powder crystal methods, Atomic scattering factors, Geometrical structure factor, Bonding in solids, Types of bonding.

UNIT – II

Lattice vibrations: Phonon concept, Vibration of monoatomic and diatomic lattice, Acoustical and optical modes, Dispersion relation for phonons, Density of states concepts, Dispersion relations, Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, Debye T^3 law.
Free electron theory of metals: Free electron gas models: energy levels and density of orbitals, Fermi Dirac distribution, Applications of free electron gas model.

UNIT – III

Band theory: Nearly free electron model, Bloch function, Kronig Penny model, Velocity and Effective mass of electron, Distinction between metals, semiconductors and insulators, Hall Effect, Measurement of conductivity (Four probe method) & Hall coefficient.
Dielectric Properties of solids: Polarization and susceptibility, Local Field, dielectric constant and Polarizability, Sources of Polarizability (electronic, ionic and dipolar), Piezoelectric effect, Pyroelectric effect, Ferroelectric effect.

UNIT –IV

Magnetic Properties of Matter: Types of magnetism, Dia-, Para-, Ferri-, Ferro and antiferromagnetic materials, Langevin's Classical and quantum Theory of Dia– and Paramagnetic, Curie's law, Weiss's Theory of Ferromagnetism, Exchange interactions, Concept of domains and Hysteresis.
Superconductivity: Experimental Results, Critical Temperature, Critical magnetic field, Meissner effect, Type I and type II Superconductors, London's Equation and Penetration Depth, Thermodynamically and optical properties: energy gap, heat capacity and entropy, Isotope effect, Idea of BCS theory (No derivation), Flux quantization, Josephson effect, Idea of high TC superconductors.

Reference Books:

1) Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd.
2) Elements of Solid State Physics, J.P. Srivastava, 4th Edition, 2015, Prentice-Hall of India

BPL-604: (i) NUCLEAR AND PARTICLE PHYSICS

Course Objective: The course enables the students to develop an in-depth understanding about the basic properties of nuclei, nuclear models and reactions, Radioactivity, and elementary particles.

Marks (Theory) : 70 **Credits : 4(60 lectures)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

Unit - I

Structure of nuclei: Basic Properties of Nuclei: (1) Mass, (2) Radii, (3) Charge, (4) Angular Momentum, (5) Spin, (5) Magnetic Moment (μ), (6) Stability and (7) Binding Energy,
Radioactivity: Law of Radioactive Decay, Half-life, Theory of Successive Radioactive Transformations. Radioactive Series, Binding Energy, Mass Formula.
α-decay: Range of α-particles, Geiger-Nuttal law and α-particle Spectra. Gamow Theory of Alpha Decay, β-decay :- Energy Spectra and Neutrino Hypothesis, γ-decay : Origin of γ-rays, Nuclear Isomerism and Internal Conversion.

Unit - II

Nuclear Reactions: Types of nuclear reactions and conservation laws, Concept of reaction cross-section, Concept of Compound and Direct Reaction, Compound Nucleus, Scattering of nucleon (np, pp and nn scattering)

Unit - III

Nuclear Models and nuclear forces: Liquid Drop Model, Mass formula, Limitations of liquid drop model, Magic number, Shell Model and its application, Meson Theory of Nuclear Forces and Discovery of Pion.

Unit - IV

Particle Physics: Cosmic Rays: Nature and their Properties, Elementary Particles (Qualitative Discussion Only), Fundamental Interactions, Classification of Elementary Particles, Particles and Antiparticles, Baryons, Hyperons, Leptons, and Mesons, Elementary Particle Quantum Numbers : Baryon Number, Lepton Number, Strangeness, Electric Charge, Hypercharge and Isospin, Conservation Laws and Symmetry, Different Types of Quarks and Quark Contents of Spin ½ Baryons, Idea of Standard Model, Higgs Boson.

Referred Books:

1. Concepts of Modern Physics by Arthur Beiser (McGraw-Hill Book Company, 1987)
2. Concepts of nuclear physics by Bernard L.Cohen.(New Delhi: Tata Mcgraw Hill, 1998).
3. Introduction to the physics of nuclei and particles by R.A. Dunlap.(Singapore: Thomson Asia, 2004).
4. Nuclear physics by Irving Kaplan. (Oxford & IBH, 1962).
5. Introductory nuclear physics by Kenneth S. Krane.(John Wiley & Sons, 1988).

BPL-604: (ii) MEDICAL PHYSICS

Course Objective: This course aims to cover the fundamental principles involved in the Biomechanics, Physics of senses, effect of radiation on biological systems and various types of medical imaging techniques.

Marks (Theory): 70 **Credits : 4(60 lectures)**
Marks (Internal Assessment): 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – I

Biomechanics: Properties of materials-Stress/strain relationships, The principles of equilibrium, and its applications in biomechanics, Stress analysis, Structural instability, Kinematics and kinetics, Kinematics of the knee Walking and running, Pressures in the body Pressure in the cardiovascular system, Fundamentals of fluid dynamics, Flow through an orifice, Steady flow, Biomechanical Measurements.

UNIT –II

Physics of the sense: Cutaneous sensation, The chemical senses- Gustation (taste), Olfaction (smell), Audition and audiology - Physics of sound and concept of hearing, hearing defects and hearing aids Vision-Anatomy and physiology of the eye, limit of vision and color vision, Defect in vision and its correction, Biomaterials and biocompatibility, Material response to the biological environment, Tissue response to the biomaterial and its implications.

UNIT – III

Ionizing Radiation - Dose and exposure measurements, standard and protection: Origin of medical applications of X-rays and Gamma rays, Absorption, scattering and attenuation of gamma-rays, Biological effects and protection from radiations, Dose and exposure measurement of radiations, Practical experimental dose measurement during radiography, Ionization chambers, G-M counters, Scintillation counters, Film dosimeters, Alternative non ionizing radiation for these ionizing radiations

UNIT – IV

Medical Imaging: Basic concept and applications of radionuclide imaging, Ultrasonic imaging, Magnetic resonance imaging, CT imaging, Radionuclide imaging, Bone imaging. Basic image processing

Radioisotopes and nuclear medicine: Diagnosis and treatments with radioisotopes, Atomic structure physics of Isotopes, Production of isotopes, Naturally occurring radioactive isotopes and man-made radioisotopes, Principles of measurement, , Non-imaging investigation and Non-imaging examples Haematological measurements, Glomerular filtration.

Reference Books:

1. Medical Physics, J.R. Cameron and J.G.Skofronick, Wiley (1978)
2. Medical Physics and Biomedical Engineering, B H Brown, R H Smallwood, D C Barber, P V Lawford and D R Hose , Institute of Physics Publishing (1999)

BPP -601: PHYSICS LAB-IX

Marks (External) : 70 **Credits : 3(60Hrs)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. Verify Thevenin and Norton Network Theorem
2. To verify the Superposition, and Maximum power transfer theorems.
3. Study frequency response of R-C Coupled Amplifier
4. Study characteristics of a Push-Pull Amplifier
5. Study characteristics of JFET
6. Study a LC/RC Oscillator using transistors
7. Study functioning of Multivibrators
8. Study of Crystal Oscillator

Reference Books:

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994,Mc-Graw Hill.
2. Modern Digital Electronics, R.P. Jain, 4th Edition, 2010, Tata McGraw Hill.

BPP-602: PHYSICS LAB -X

Marks (External) : 70 **Credits : 3(60Hrs)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Computations of

1. Solution of First order Differential equation using Runge-Kutta Method
2. Solution of First order Differential equation for Newton's law
3. Solution of First order Differential equation for Classical equations of motion
4. Solution of Radioactive decay equations
5. Solution of First order Differential equation using modified Euler Method
6. Curve fitting, Least square fit, Goodness of fit, standard deviation
7. Solution of Second order Differential equation of Damped and Forced Harmonic oscillator
8. Simulation of Current in RC, LC circuits with DC source

Reference

1. Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
2. Mathematics for Physicists, P. Dennery and A. Krzywicki, 1967, Dover Publications

BPP-603(i): NUCLEAR PHYSICS LAB(DSE-II)

Marks (External) : 70 **Credits : 2(40Hrs)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. $\chi 2$- Statistics using G. M. Counter
2. Range of alpha particles in air using Spark Counter.
3. Resolving Time of G. M. Counter set-up.
4. Resolving Time of a Fast Coincidence Circuit.
5. (a) Thickness of Al Sheet using G. M. Counter. (b) Gamma Ray Absorption Experiment.
6. Study of Energy Resolution of Gamma Ray Detector as a function of E_{γ}.
7. Finding the wavelength for the characteristic K_{α} and K_{β} x-ray radiation of molybdenum using XRD.

BPP-603(ii): MEDICAL PHYSICS LAB(DSE-II)

Marks (External) : 70 **Credits : 2(40Hrs)**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

1. Understanding the working of a manual Hg Blood Pressure monitor and measure the Blood Pressure.
2. ECG/EEG Simulation lab
3. Ultrasound Experiment/ Ultrasound Cleaning/Ultrasound Therapy
4. X- ray Experiment/XRD/Dental X-ray
5. Study of Human Eye
6. Correction of Myopia/Hyperopia using a combination of lenses on an optical bench/breadboard
7. Familiarization with Geiger-Muller (GM) Counter and to measure background radiation
8. Familiarization with Radiation meter and to measure background radiation

Reference Books:

1. Basic Radiological Physics, Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
2. Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry Lippincot Williams and Wilkins (1990)
3. Physics of Radiation Therapy : F M Khan - Williams and Wilkins, 3rd edition (2003)