PHYSICS DEPARTMENT

Syllabus

Bachelor of Science (Honors) Physics

Program Code: BSCH-PHY

2022-23, 2023-24 and 2024-25

Sri Guru Teg Bahadur Khalsa College
Sri Anandpur Sahib-140118, Punjab

*An Autonomous College, Affiliated to Punjabi University Patiala
*NAAC Accredited 'A' Grade College
*College with Potential for Excellence Status by UGC
*STAR College Status by Department of Biotechnology, Govt. of India
*Department of Science & Technology FIST Scheme, Govt. of India

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Phone no. 01887-232037
Email: physicsdepartment321@gmail.com
Website: www.sgtbcollege.org.in

APPROVED
Board of Studies Meeting held on 1st August, 2022

PHYSICS DEPARTMENT

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Part-I
(Semester: I, II)
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(Chairman) (VC Nominee) (Academic Council Nominees) (Industry Expert) (Student Alumni) (Members)

SCHEME OF STUDIES

B.SC. HONORS PHYSICS PART-I

Program Code: BSCH-PHY

SEMESTER I

Course Opted	Course Code	Course Name	Credits	Maximum Marks	External Examination	Internal Assessment
Core Course-I	PHY-1.1.1	Mathematical Physics-I	6	150	100	50
Core Course-II	PHY-1.1.2	Mechanics	4	100	70	30
Core Course-II Practical	PHY-1.1.2P	Mechanics Practical	2	50	50	--
Generic Elective-1 (Choose any one course out of the A, B or C)	PHY-1.1.3 A	Chemistry I	4	100	70	30
	PHY-1.1.3 AP	Chemistry Practical	2	50	50	--
	PHY-1.1.3 B	Programming Using C++	4	100	70	30
	PHY-1.1.3 BP	Software-I Lab	2	50	50	--
	PHY-1.1.3 C	Basic Mathematics	6	150	100	50
Ability Enhancement Compulsory Course-I	PHY-1.1.4	English (Communication Skills)	2	50	35	15
Ability Enhancement Compulsory Course-II	PHY-1.1.5A/B*	Punjabi Compulsory/ Punjabi Mudla Gyan*	2	50	35	15
Ability Enhancement Compulsory Course-III	PHY-1.1.6	Drug Abuse: Problem, Management and Prevention	(Qualifying Paper)	50	50	--
Interdisciplinary Choice Based Course (Choose any one course carrying 2 credits. The second part carrying another 2 credits will be opted in the next semester to complete 4 credits with the same course.)	IDC-101	A. Fine Arts-I	2	50	35	15
		B. Music Vocal-I	2	50	35	15
		C. Gurmat Sangeet-I	2	50	35	15
		D. Religious Studies-I	2	50	35	15
		E. Creative Writing-I	2	50	35	15
		F. Punjabi Folk Stream and Culture-I	2	50	35	15
		G. Health and Fitness	2	50	35	15
		H. Consumerism in India-I	2	50	35	15
			24	**600**		

*A student can opt for Punjabi Mudla Gyan under the following conditions:

1. Those students who have passed their Matric Examination outside the State of Punjab and have not opted for Punjabi Subject in Matric.
2. Wards of Defense/Para-Military Personnel.

SCHEME OF STUDIES

B.SC. HONORS PHYSICS PART-I

Program Code: BSCH-PHY

SEMESTER II

Course Opted	Course Code	Course Name	Credits	Maximum Marks	External Examination	Internal Assessment
Core Course-III	PHY-1.2.1	Electricity and Magnetism	4	100	70	30
Core Course-III Practical	PHY-1.2.1P	Electricity and Magnetism Practical	2	50	50	--
Core Course-IV	PHY-1.2.2	Waves and Optics	4	100	70	30
Core Course-IV Practical	PHY-1.2.2P	Waves and Optics Practical	2	50	50	--
Generic Elective-2 (Choose any one course out of the A, B or C but same as in previous semester)	PHY-1.2.3 A	Chemistry-II	4	100	70	30
	PHY-1.2.3 AP	Chemistry Practical	2	50	50	--
	PHY-1.2.3 B	Web Development Using PHP	4	100	70	30
	PHY-1.2.3 BP	Software – II Lab	2	50	50	--
	PHY-1.2.3 C	Differential Equations	6	150	100	50
Ability Enhancement Compulsory Course-IV	PHY-1.2.4	English (Communication Skills)	2	50	35	15
Ability Enhancement Compulsory Course-V	PHY-1.2.5A/B*	Punjabi Compulsory/ Punjabi Mudla Gyan*	2	50	35	15
Ability Enhancement Compulsory Course-VI	PHY-1.2.6	Environmental and Road Safety Awareness	4	100	70	30
Interdisciplinary Choice Based Course (Choose any one course carrying 2 credits which is the second part of the same course chosen in previous semester carrying 2 credits. This makes a total of 4 credits with the same course.)	IDC-102	A. Fine Arts-II	2	50	35	15
		B. Music Vocal-II	2	50	35	15
		C. Gurmat Sangeet-II	2	50	35	15
		D. Religious Studies-II	2	50	35	15
		E. Creative Writing-II	2	50	35	15
		F. Punjabi Folk Stream and Culture-II	2	50	35	15
		G. Yoga and Stress Management	2	50	35	15
		H. Consumerism in India-II	2	50	35	15
			28	**700**		

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1. Those students who have passed their Matric Examination outside the State of Punjab and have not opted for Punjabi Subject in Matric.
2. Wards of Defense/Para-Military Personnel.

PROGRAM OVERVIEW

Program Code: BSCH-PHY

Duration: 3 Years

Bachelor of Science Honors in Physics program is designed to prepare students for pursuing higher education or working in industry by introducing advanced ideas and techniques that are applicable in a wide range of Physics learning and application while emphasizing the underlying concepts of Physics. This course provides in-depth understanding of principles and concept of Physics, proficiency in experimentation to understand the theoretical and experimental dimensions of Physics.

Program Educational Objectives

1. The graduates will have knowledge of fundamental laws and principles in a variety of areas of Physics along with their applications.
2. The graduates will develop research skills which might include advanced laboratory techniques, numerical techniques, computer algebra, computer interfacing.
3. The graduates will become effective researcher who will be able to provide lucid summation of the scientific literature on a given topic of study.
4. The graduates will develop the skill to plan, execute and report the results of an extended experimental or theoretical Physics based project in a research environment.

Program Outcomes

At the end of the program the students will be able to:

1. Apply theoretical knowledge of principles and concepts of Physics to practical problems.
2. Use mathematical techniques and interpret mathematical models of physical behavior.
3. Demonstrate the ability to plan, undertake, and report on a program of original work; including the planning and execution of experiments, the analysis and interpretation of experimental results.
4. Assess the errors involved in an experimental work and make recommendations based on the results in an effective manner.
5. Develop communication skills, both written and oral, for specialized and non-specialized audiences.

Core Course-I

PHY-1.1.1: MATHEMATICAL PHYSICS - I

Maximum Marks: 150 **Teaching Hours: 90 (5 Th.+1 Tu. Credits)**
External Examination: 100 (Pass Marks: 40) **Pass Percentage: 40 %**
Internal Assessment: 50 (Pass Marks: 20) **Time Allowed: 3 Hours**

50 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 15 marks and each question of section C will carry 4 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 15 marks and Section C carries 40 marks. **Use of scientific calculator is allowed.**

Course Objective: The purpose of the course is to introduce students to methods of mathematical physics and to develop required mathematical skills to solve differential equations in various fields of physics.

Instructional delivery strategy/Pedagogy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

Recapitulation of Vectors: Representation of a vector, Addition of vectors, Subtraction of vectors, Scalar multiplication of vectors, Resolution of a vector, Rectangular components along three axes and direction cosines, Scalar Product and its properties, Scalar product and its invariance under rotations. Vector product and its properties, triple Scalar product and triple vector product. Scalar and Vector fields.

Vector Differentiation: Derivatives of a vector, Derivative of the vector product, Gradient of a scalar function and its geometrical interpretation. Divergence of a vector function and its physical significance. Curl of a vector field. Curl in Cartesian coordinates, Del and Laplacian operators.

Vector Integration: Integration of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line element, surface and volume elements. Line, surface and volume integrals of Vector fields. Gauss' divergence theorem, Green's and Stokes Theorems.

Section B

Curvilinear Coordinates: Gradient, Divergence, Curl and Laplacian operator in terms of orthogonal curvilinear coordinates.

Determinants and Matrices: Determinant as eliminant, Minor, Cofactor, Properties of Determinant. Various types of matrices, addition subtraction and multiplication of matrices, Inverse of a matrix, Rank of matrix, Cramer's rule. Eigen values, Eigen vector, Caley Hamilton theorem. Similarity transformation, Diagonalization of matrix, Hermitian and Skew-Hermitian matrix.

Differential equations: Limits, continuity of a function, differentiability. Taylor and binomial series (statements only). Order and degree of ordinary differential equation, Existence and uniqueness of solutions of differential equation, Solution for number of atoms disintegrate in radioactive decay at any instant using separation of variables method. Second Order Homogeneous Differential Equations with constant coefficients. Wronskian and general solution.

Course learning outcome: Students will have achieved the ability and understanding of:

- Vector algebra and calculus
- Curvilinear coordinates and its applications
- Concepts and applications of matrices and determinants
- Intuitive ideas of differentiable equations
- Problem based on differential equations.

Text Books:

1. Mathematical Physics- I by T.S. Bhatia and Krishna K. Pathak, Vishal Publishing Co.
2. Mathematical Physics by H K Dass and Dr. Rama Verma 8th edition, S. Chand.

Reference Books:

- Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Ed.,Elsevier.

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- Differential Equations, George F. Simmons, 2007, McGraw Hill.
- Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
- Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book
- Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning

Core Course-II

PHY-1.1.2: MECHANICS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objective: The purpose of the course is to train the students in the Newtonian Mechanics and Special Theory of Relativity formalisms to an extent that they can use these in the modern branches of Physics.

Section A

Co-ordinates: Cartesian co-ordinate system, displacement, velocity, and acceleration of a particle moving in a plane and space in Cartesian co-ordinate system, spherical polar co-ordinate system, Relation between Cartesian and spherical polar co-ordinate system, solid angle.

Rotational Dynamics: Rigid body, Rotational Inertia, Moment of Inertia of a rigid body, Radius of gyration, Angular momentum, Torque, Theorems of parallel and perpendicular axes, Moment of inertia of rectangular lamina, circular ring, circular disc. Equation for rotational motion of a rigid body, Angular momentum of a rigid body about principal axes, precession.

Collision: Elastic and Inelastic collisions, Laboratory and Centre-of Mass co-ordinate systems, Elastic collision in Lab and CM frame of references, Relationship between angles of scattering in Lab and Centre-of-Mass systems for elastic collision in two dimensions, Relation between Recoil Angle in Lab system and Scattering angle in Centre-of Mass system, Cross section for elastic scattering, Impact parameter, Rutherford scattering.

Section B

Frames of Reference: Inertial and Non-inertial Frame of Reference, Galilean Transformations, Galilean Invariance of Space and Time Intervals, Transformation of velocity and acceleration under Galilean Transformations, Invariance of Newton's Laws of motion, Non-inertial frames and fictitious forces, Fictitious forces in non-inertial frame having translational accelerated motion, Fictitious forces in non-inertial frame having uniform rotational motion, Effect of rotation of Earth on acceleration due to gravity, Effect of Coriolis force on a particle freely falling under gravity, Effect of Coriolis force on the particle moving on the surface of earth.

Special Theory of Relativity: Ether Hypothesis, Michelson-Morley experiment, Postulates of Special Theory of Relativity, Lorentz Transformations, Lorentz contraction. Time dilation, Relativistic addition of velocities, Relativistic Doppler Effect, Variation of Mass with Velocity, Mass-energy Equivalence, Relativistic Energy and momentum, Lorentz Transformation of Energy and Momentum, Minkowski Space.

Course learning outcomes: On successful completion of the course, Students will be familiar with Newtonian Mechanics and Special Theory of Relativity formalisms and they will be able to use these in the modern branches of Physics.

Text Book:

1. Analytical Mechanics, Satish K. Gupta, Modern Publications, Jalandhar
2. Mechanics, Dr. A.K. Sikri, Paradeep Publications, Jalandhar

Reference Books:

- An Introduction to Mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
- Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.
- Feynman Lectures, Vol. I, R.P. Feynman, R.B. Leighton, M.Sands, 2008, Pearson Education
- Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.

Core Course-II Practical

PHY-1.1.2P: MECHANICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: (Credits: 2)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the radius of curvature of a given spherical surface by a spherometer.
3. Determination of Poisson's ratio for rubber.
4. To determine the Moment of Inertia of a flywheel.
5. Study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations) using objects of various geometrical shapes but of same mass.
6. To determine the Modulus of Rigidity of a wire by Maxwell's needle.
7. To determine the Elastic Constants of a wire by Searle's method.
8. To determine the value of 'g' by using Kater's Pendulum.
9. To determine g and velocity for a freely falling body using Digital Timing Technique.
10. To study the motion of a spring and calculate (a) Spring Constant (b) Value of g.
11. To plot a graph between the distance of knife-edges from the centre of gravity and the time period of a compound pendulum. From the graph find (a) the acceleration due to gravity. (b) the radius of gyration and moment of inertia of the bar about an axis through the centre of gravity.
12. Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length.
13. To find the value of g in the laboratory using a simple pendulum.
14. To measure the logarithmic decrement, coefficient of damping, relaxation time and quality factor of a given damped simple pendulum.
15. To determine the Young's modulus by bending of beam using traveling microscope.
16. To study one dimensional collision using two hanging spheres of different materials.
17. To verify the change in time period of simple pendulum by changing mass using ping pong ball.

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. Engineering Practical Physics, S. Panigrahi & B. Mallick,2015, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
5. B.Sc. Practical Physics, C. L. Arora. S Chand and Company Limited

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Generic Elective-1

PHY-1.1.3 A: CHEMISTRY I

Maximum Marks: 100 **Time Allowed: 3 Hours**
Internal Assessment: 30 **Teaching Hours: 60**
External Examination: 70 **Pass Percentage: 40%**
Credits: 4

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 2 marks each.

Instruction for the candidates: Candidates are required to attempt five questions in all by selecting two questions each from sections A & B and Section C (9^{th} question) is compulsory.

Course Objective: To teach the fundamental concepts of Chemistry and their applications. The syllabus contents are duly arranged section wise and contents are included in such a manner so that due importance is given to the requisite intellectual understanding of atomic structure, bonding, general organic chemistry & aliphatic and aromatic hydrocarbons and laboratory skills.

Section A

Atomic Structure

Review of Bohr's theory and its limitations,dual behavior of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of s, p and d atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, Anomalous electronic configurations.

Chemical Bonding and Molecular Structure

Covalent bonding: Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Shapes of some inorganic molecules and ions on the basis of VSEPR theory and hybridization. MO treatment of homonuclear diatomic molecules (H_2, N_2 and O_2) and heteronuclear diatomic molecules (CO, NO and $NO^{+)}$.

Section B

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules.

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength; Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges.

Basic Reaction Mechanisms: Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shapes and relative stability of Carbocations, Carbanions, Free radicals, Nitrenes and Carbenes. Introduction to types of organic reactions and their mechanism: Addition (to C=C), Elimination (E_1, E_2, E_1cb) and Substitution reactions (SN^1 and SN^2).

Aromatic Hydrocarbons Aromaticity: Huckel's rule, aromatic character of arenes, cyclic carbocations/carbanions.

Course Outcome: The students will acquire knowledge of

1. Atomic structure and Quantum mechanics
2. Chemical Bonding: Covalent Bonding
3. Basic of Organic Chemistry
4. Aromaticity

Text books:

1. Morrison, R.T. & Boyd, RN. Organic Chemistry, Pearson, 2010
2. Shriver, D. & Atkins, P.W. Inorganic Cheminy, Oxford University Press
3. Kalsi P.S. &ta, R.S. Organic Reactions (Stereochemistry and Mechanism) (5^{th} Ed), New Ag International (P) Ltd. Pub.

Generic Elective-1 (Practical)

PHY-1.1.3 AP: CHEMISTRY PRACTICAL

Maximum Marks: 50 **Time allowed: 3 Hours**
Pass Percentage: 40% **Number of Lectures: 60**
Credits: 2

Instruction for the Examiners and Candidates: The practical examination will be held in single session (morning/evening). Candidates are required to perform practicals from volumetric Analysis, element detection in organic compounds and TLC. Distribution of marks will be as under (Books may be consulted):

1. Volumetric Analysis = 15 marks
   [Initial write up: 5 marks (Equation: 1, Indicator: 1, End point: 1 and general calculations: 2)
   Performance and results: 10 marks (Initial burette reading: 1, Final reading: 1, End point: 1 and calculations and result: 7)]
2. TLC = 10 marks (Performance and Result)
3. Detection of Extra Elements = 10 marks (Performance and Result)
4. Viva-Voce = 10 marks
5. Note Books = 5marks

   Total = 50 marks

Section A

Inorganic Chemistry-Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture
2. Estimation of oxalic acid by titrating it with $KMnO_4$
3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$
4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$

Section B

Organic Chemistry

1. Separation of mixtures by Chromatography: Measure the Rf value in each case
   (combination of two compounds to be given)
   a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography
   b) Identify and separate the sugars present in the given mixture by paper chromatography.
2. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
3. Criteria of Purity: Determination of melting point

Reference Books:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Text book of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.

Generic Elective-1

PHY-1.1.3 B: PROGRAMMING USING C++

Teaching Hours Per Week: 4 **Internal Assessment: 30 Marks**
Time Allowed: 3 Hours **External Marks: 70**
Pass Marks: 35% **4 Credits: 4H (L)**

Instructions for Paper Setter/Examiners

The Question paper will consist of three sections-A, B & C. Section A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each. Candidates are required to attempt two questions each from section A and B. Section C will consist of 9 short answer type questions covering entire syllabus and will carry 3 marks each. Section C is Compulsory.

Section A

Evolution of OOP: Procedure Oriented Programming, OOP Paradigm, Advantages and disadvantages of OOP over its predecessor paradigms. Characteristics of Object Oriented Programming.

Introduction to C++: Identifier, Keywords, Constants. Operators: Arithmetic, relational, logical, conditional and assignment. Size of operator, Operator precedence and associativity. Type conversion, Variable declaration, expressions, statements, manipulators. Input and output statements, stream I/O, Conditional and Iterative statements, breaking control statements. Storage Classes, Arrays, Arrays as Character Strings, Structures, Unions, Bit fields, Enumerations and User defined types.

Pointers: Pointer Operations, Pointer Arithmetic, Pointers and Arrays, Multiple indirections, Pointer to functions.

Functions: Prototyping, Definition and Call, Scope Rules. Parameter Passing by value, by address and by reference, Functions returning references, Const functions, recursion, function overloading, Default Arguments, Const arguments, Pre-processor, Type casting.

Section B

Classes and Objects: Class Declaration and Class Definition, Defining member functions, making functions inline, Nesting of member functions, Members access control. THIS pointer. Objects: Object as function arguments, array of objects, functions returning objects, Const member. Static data members and Static member functions, Friend functions and Friend classes.

Constructors: properties, types of constructors, Dynamic constructors, multiple constructors in classes. Destructors: Properties, Virtual destructors. Destroying objects, Rules for constructors and destructors. Array of objects. Dynamic memory allocation using new and delete operators, Nested classes, Scopes: Local, Global, Namespace and Class.

Inheritance: Defining derived classes, inheriting private members, single inheritance, types of derivation, function redefining, constructors in derived class, Types of inheritance, Types of base classes, Code Reusability.

Polymorphism: Methods of achieving polymorphic behavior.

Operator overloading: overloading binary operator, overloading unary operators, rules for operator overloading, operator overloading using friend function. Function overloading: early binding, Polymorphism with pointers, virtual functions, late binding, pure virtual functions and abstract base class.

Templates: Generic Functions and Generic Classes, Overloading of template functions.

Exception Handling: Exception Handling catching class types, handling derived class exceptions, catching exceptions

Files and streams: Open/ Close Files commands. Read/write operations on files.

References:

1. Herbert Schildt, “The Complete Reference C++”, Tata McGraw-Hill. Deitel and Deitel, “C++ How to Program”, Pearson Education.
2. Robert Lafore, “Object Oriented Programming in C++”, Galgotia Publications. BjarneStrautrup, “The C++ Programming Language”, Addition- Wesley Publication Co. Stanley B. Lippman, JoseeLajoie, “C++ Primer”, Pearson Education.
3. E. Balagurusamy, “Object Oriented Programming with C++”, Tata McGraw-Hill.

Generic Elective-1 (Practical)

PHY-1.1.3 BP: SOFTWARE-I LAB

Time Allowed: Three Hours **External Evaluation: 50 Marks**
Pass Marks:35% **2 Credits: 4H (P)**

This laboratory course will comprise of exercises to supplement what is learnt under paper BHGE-1.1B Object Oriented Programming using C++.

Students are required to develop the following programs in C++ language with internal documentation:

1. Write a program to find area of rectangle using the concept of classes & object.
2. Write a program to implement the concept of array of object.
3. Write a program to show the use of friend function.
4. Write a program to show the use of constructor overloading.
5. Write a program to show the use of copy constructor.
6. Write a program to show the use of destructors.
7. Write a program to show the use of virtual function.
8. Write a program to implement the concept of multilevel inheritance.
9. Write a program to implement the concept of multiple inheritance.
10. Write a program of unary operator overloading.
11. Write a program of Binary operator overloading.
12. Write a program to swap two values independent of type of the variable using function template.
13. Write a program to illustrate how an exception is handled using try catch block using throw statements.
14. Write a program to demonstrate how to insert and extract an object to and from data files.

Generic Elective-1

PHY-1.1.3 C: BASIC MATHEMATICS

L	T	P
5	1	0

Time Allowed: 3 hours

External Assessment: 100 Marks
Internal Assessments: 50 Marks
Total: 150 Marks
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each of 20 marks each from the respective sections of the syllabus and Section C will consist of one compulsory question having ten short answer type questions each of 2 marks covering the entire syllabus uniformly.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Section A and B and compulsory question of Section C.

Course Objectives: The aim of the course is to introduce the students of BSc Honours (Physics and Chemistry) to various topics in mathematics which will be of great help to them in their course.

Pedagogy: The teacher should explain the concept diligently.

Section A

Integration:

Introduction, integration of some functions (x^n, e^x, xy, logarithmic and simple trigonometric), Integration using Partial Fractions, Integration by Parts.

Differentiation and Partial Differentiation:

Basic concepts: sets, functions, limit and their numerical problems. Differential coefficient of a function, derivatives of functions (x^n, xy, x/y, e^x, logarithmic and trigonometric) and application of differentiation for determination of maxima and minima of algebraic functions. Partial differentiation: Introduction, partial differentiation of functions (xy and logarithmic).

Section B

Theory of Probability

Random experiment and sample space, Types of events (simple and compound), Independent Events, Conditional Probability, Bayes' Theorem

Matrices and Determinant:

Review of Matrices and Determinants, Elementary Row and Column Transformation, Echelon Form, Rank of Matrix, Gauss Elimination Method, Gauss Jordan Method, System of Linear Equations, Eigen Values and Eigen Vectors, Cayley Hamilton Theorem (Without Proof)

Course Outcomes: The student after the completion of the course will have knowledge of Matrices, Determinants, Differentiation, Integration and other concepts.

Text Books:

1. S. P. Gupta, Statistical Methods, Sultan Chand and Sons.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers
3. Jain, Iyengar, Advance Engineering Mathematics, Narosa Publications

Reference Books:

1. Thomas and Finney, Calculus and Analytical Geometry
2. D. Somasundaram and B. Choudhary, *A First Course in Mathematical Analysis,* Narosa Publishing House, New Delhi, 1997.

Ability Enhancement Compulsory Course-I

PHY-1.1.4: ENGLISH (COMMUNICATION SKILLS)

Time Allowed: 3 Hours
Periods per week: 2
Credits: 02
Teaching Hours: 30

Max. Marks: 50
Written Examination: 35 Marks
Internal Assessment: 15 Marks
Pass Percentage: 40%

Instructions for the Paper Setter: The question paper will carry 35 marks and will be of three hours duration. The paper will consist of three Units. Following shall be the unit wise marks division:

- Unit-I – 12 Marks
- Unit-II – 11 Marks
- Unit-III – 12 Marks

Instructions for the candidates: Candidates are required to attempt all the questions as per the instructions given in the testing section.

Course Objective: The chief objective of the paper is to sharpen the literary and grammar skills of the students. Selected short stories have been incorporated in the syllabus to give impetus to creativity and imagination of the students. The syllabus will also help the students to understand the nuances of English language & usage.

Pedagogy: Primarily the chalk and duster method will be used to teach this course. To evoke the interest of the students in the curriculum due emphasis will be laid on assignments, homework and periodic tests.

Unit-I

Text Prescribed: ***Prose Parables*** (Orient Black Swan, 2013)

The following stories from the above volume are prescribed:

1. The Kabuliwallah: Rabindranath Tagore
2. The Eyes Are Not Here: Ruskin Bond
3. The Death of A Hero: Jai Nimbkar
4. Grief: Anton Chekov
5. Uncle Podger Hangs A Picture: Jerome K. Jerome

Unit-II

Text Prescribed: ***The Students' Companion*** by Wilfred D. Best, Rupa & Co.

The following contents of this book are to be studied:

1. One-word substitution (Professions or Trades)
2. Antonyms and Synonyms

Unit-III

Text Prescribed: ***Living English Structure*** by W. Stannard Allen

Grammar& Composition:

1. Change of Voice
2. Narration

Testing

Unit-I

1. The examiner shall set one long answer type question with internal alternative on theme, incident or character from the book ***Prose Parable*** **(stories prescribed in Unit-I of the syllabus)**. The candidate is required to answer the question in about 250 words. 6 marks
2. The examiner shall set 5 short answer type questions from the book ***Prose Parable*** **(stories prescribed in Unit-I of the syllabus)**. The candidate is required to attempt any 3 questions. The answer shall be in about 100 words. Each question shall carry 2 marks 3X2=6 marks

Unit-II

3. The examiner shall set seven sentences related to different Professions or Trades. The candidate shall give one word substitute for each sentence. The candidate is required to attempt any five out of given seven. The examiner shall set these sentences from the book *The Students' Companion* prescribed in unit-II of the syllabus. Each answer shall carry one mark. 5 marks

4. This question will be pertaining to Antonyms and Synonyms. The examiner shall set five words for antonyms and five for synonyms from the prescribed book *The Students' Companion.* The candidate is required to attempt any three from each. Each word shall carry one mark.
3+3=6 marks

Unit-III

5. The examiner shall set eight sentences for Change of Voice from the book *Living English Structure* prescribed in unit-III. The candidate is required to attempt any 6 sentences out of the given 8 sentences. Each correct answer shall carry one mark. 6 marks
6. The examiner shall set eight sentences for Change of Narration from the book *Living English Structure* prescribed in unit-III. The candidate is required to attempt any 6sentences out of the given 8 sentences. Each correct answer shall carry one mark. 6 marks

Course Learning Outcomes:

1. Students will learn the nuances of English language
2. The course content intends to improve their communicative skills and command over language
3. Students will acquire fundamental knowledge of language and literature.

Suggested Readings:

- *Oxford Practice Grammar* by John Eastwood (Ed. 2014).
- *Current English Grammar and Usage with Composition* by R.P. Sinha, Oxford University Press.

Ability Enhancement Compulsory Course-II

PHY-1.1.5 A: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ

ਕੁੱਲ ਅੰਕ: 50 **ਵਿਸ਼ੇ ਵਿਚੋਂ ਪਾਸ ਅੰਕ:** 40%
ਬਾਹਰੀ ਪਰੀਖਿਆ: 35 ਅੰਕ **ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ:** 15 ਅੰਕ
ਸਮਾਂ: 3 ਘੰਟੇ **ਕ੍ਰੈਡਿਟ-02, ਕੁੱਲ ਲੈਕਚਰ:** 30

ਪਾਠਕ੍ਰਮ ਅਤੇ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੀ ਰੂਪ-ਰੇਖਾ

ਭਾਗ-ਓ

ਓ- ਮੇਰਾ ਜੀਵਨ ਅਨੁਭਵ (ਵਾਰਤਕ-ਸੰਗ੍ਰਹਿ), ਮੁੱਖ ਸੰਪਾਦਕ ਡਾ. ਜਸਵੀਰ ਸਿੰਘ, ਸੰਪਾ. ਡਾ. ਅਵਤਾਰ ਸਿੰਘ, ਡਾ. ਗੁਰਪ੍ਰੀਤ ਕੌਰ, ਪ੍ਰੋ. ਸੁਖਵਿੰਦਰ ਸਿੰਘ, ਸ੍ਰੀ ਗੁਰੂ ਤੇਗ ਬਹਾਦਰ ਖ਼ਾਲਸਾ ਕਾਲਜ, ਸ੍ਰੀ ਅਨੰਦਪੁਰ ਸਾਹਿਬ ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ

ਭਾਗ-ਅ

ਅ-1: ਸਮਾਜਿਕ ਅਤੇ ਵਾਤਾਵਰਨ ਵਿਸ਼ਿਆ ਨਾਲ ਸੰਬੰਧਿਤ ਨਿਬੰਧ ਰਚਨਾ

ਅ-2: ਵਿਆਕਰਨ

(i) ਉਚਾਰਨ ਅੰਗ
(ii) ਸਵਰ: ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਵਰਗੀਕਰਨ
(iii) ਵਿਅੰਜਨ: ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਵਰਗੀਕਰਨ

ਭਾਗ-ਏ

ਭਾਗ-ਓ ਅਤੇ ਵਿਆਕਰਨ ਵਾਲੇ ਭਾਗ ਵਿਚੋਂ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ ਪ੍ਰਸ਼ਨ

ਪੇਪਰ ਸੈਟਰ/ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਹਦਾਇਤਾਂ

1. ਭਾਗ-ਓ: ਵਿਚੋਂ ਨਿਬੰਧ ਦਾ ਵਿਸ਼ਾ-ਵਸਤੂ ਜਾਂ ਸਾਰ (ਤਿੰਨ ਵਿਚੋਂ ਇੱਕ)07 ਅੰਕ
2. ਭਾਗ-ਅ: 1 ਵਿਚੋਂ ਨਿਬੰਧ ਰਚਨਾ (ਤਿੰਨ ਵਿਚੋਂ ਇੱਕ) 06 ਅੰਕ
3. ਭਾਗ-ਅ: 2 ਵਿਚੋਂ ਵਿਆਕਰਨ ਨਾਲ ਸੰਬੰਧਿਤ ਵਰਣਾਤਮਕ ਪ੍ਰਸ਼ਨ (ਦੋ ਵਿਚੋਂ ਇੱਕ) 07 ਅੰਕ
4. ਭਾਗ-ਏ ਵਿਚ ਭਾਗ ਓ ਅਤੇ ਵਿਆਕਰਨ ਵਿੱਚੋਂ ਕੁੱਲ 15 (8+7) ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ ਲਾਜ਼ਮੀ ਪ੍ਰਸ਼ਨ। ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਸਾਰੇ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹਨ ।ਹਰੇਕ ਪ੍ਰਸ਼ਨ 01 ਅੰਕ ਦਾ ਹੋਵੇਗਾ । 15x1=15 ਅੰਕ

ਸਹਾਇਕ ਪੁਸਤਕਾਂ:

1. ਬਲਵੀਰ ਸਿੰਘ ਦਿਲ, ਪੰਜਾਬੀ ਨਿਬੰਧ: ਸਰੂਪ, ਸਿਧਾਂਤ ਅਤੇ ਵਿਕਾਸ, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ।
2. ਖੋਜ ਪੱਤ੍ਰਿਕਾ, ਨਿਬੰਧ ਅੰਕ-29, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ
3. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਸ੍ਰੋਤ ਤੇ ਸਰੂਪ, ਵਾਰਿਸ਼ ਸ਼ਾਹ ਫਾਂਊਡੇਸ਼ਨ ਅੰਮ੍ਰਿਤਸਰ, 2012
4. ਬਲਦੇਵ ਸਿੰਘ ਚੀਮਾ, ਪੰਜਾਬੀ ਵਿਆਕਰਨ ਤੇ ਭਾਸ਼ਾ ਵਿਗਿਆਨ, ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਦਾ ਵਿਸ਼ਾ ਕੋਸ਼, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ, 2009
5. ਡਾ. ਜੋਗਿੰਦਰ ਸਿੰਘ ਪੁਆਰ ਅਤੇ ਹੋਰ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਵਿਆਕਰਨਕ ਭਾਗ I, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ, ਜਲੰਧਰ, 1991
6. ਗਿਆਨੀ ਲਾਲ ਸਿੰਘ ਤੇ ਹਰਕੀਰਤ ਸਿੰਘ, ਕਾਲਜ ਪੰਜਾਬੀ ਵਿਆਕਰਣ, ਪੰਜਾਬ ਸਟੇਟ ਯੂਨੀ. ਟੈਕਸਟ ਬੁੱਕ ਬੋਰਡ, ਚੰਡੀਗੜ੍ਹ
7. ਸੰਤ ਸਿੰਘ ਸੇਖੋਂ, ਸਾਹਿਤਆਰਥ, ਲਾਹੌਰ ਬੁੱਕ ਸ਼ਾਪ, ਲੁਧਿਆਣਾ

ਪਾਠਕ੍ਰਮ ਦਾ ਉਦੇਸ਼:

1. ਵਿਦਿਆਰਥੀਆਂ ਅੰਦਰ ਸਾਹਿਤ ਪੜ੍ਹਨ ਦੀ ਰੁਚੀ ਪੈਦਾ ਕਰਨਾ।
2. ਮਾਤ ਭਾਸ਼ਾ ਵਿੱਚ ਉਚੇਰੀ ਸਿੱਖਿਆ ਗ੍ਰਹਿਣ ਕਰਨ ਦੀ ਜਾਗ ਲਾਉਣਾ।
3. ਵਿਆਕਰਨਕ ਪੱਖਾਂ ਨਾਲ ਰਾਬਤਾ ਕਾਇਮ ਕਰਵਾਉਣਾ।
4. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਵਾਤਾਵਰਨ ਅਤੇ ਸਮਾਜਿਕ ਵਿਸ਼ਿਆਂ/ਸਮੱਸਿਆਵਾਂ ਤੋਂ ਜਾਣੂ ਕਰਵਾਉਣਾ।

ਪਾਠਕ੍ਰਮ ਦੀ ਸਾਰਥਕਤਾ:

1. ਵਿਦਿਆਰਥੀਆਂ ਅੰਦਰ ਨਿਬੰਧਾਂ ਨਾਲ ਸੰਬੰਧਿਤ ਪਰਤਾਂ ਨੂੰ ਉਜਾਗਰ ਕਰਨ ਦਾ ਹੁਨਰ ਪੈਦਾ ਹੋਵੇਗਾ।
2. ਵਿਦਿਆਰਥੀ ਵਿਆਕਰਨਕ ਨੇਮ-ਵਿਧਾਨ ਅਤੇ ਸਮਕਾਲੀ ਸਮਾਜ ਵਿਚਲੇ ਮਸਲਿਆਂ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ।

Ability Enhancement Compulsory Course-II

PHY-1.1.5B: ਪੰਜਾਬੀ ਮੁੱਢਲਾ ਗਿਆਨ

ਕੁੱਲ ਅੰਕ: 50 | **ਵਿਸ਼ੇ ਵਿਚੋਂ ਪਾਸ ਅੰਕ:** 40%
ਬਾਹਰੀ ਪਰੀਖਿਆ: 35 ਅੰਕ | **ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ:** 15 ਅੰਕ
ਸਮਾਂ: 3 ਘੰਟੇ | **ਕ੍ਰੈਡਿਟ-02, ਕੁੱਲ ਲੈਕਚਰ:** 30

ਪਾਠਕ੍ਰਮ ਅਤੇ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੀ ਰੂਪ-ਰੇਖਾ

ਭਾਗ-ਓ

ਓ -1. ਪੈਂਤੀ ਅੱਖਰੀ ਅਤੇ ਭੁਲਾਵੇਂ ਅੱਖਰ
2. ਦੋ ਅੱਖਰਾਂ ਵਾਲੇ, ਤਿੰਨ ਅੱਖਰਾਂ ਵਾਲੇ ਅਤੇ ਚਾਰ ਅੱਖਰਾਂ ਵਾਲੇ ਸ਼ਬਦ
3. ਲਗਾਮਾਤਰਾਵਾਂ ਦੀ ਵਰਤੋਂ ਵਾਲੇ ਸ਼ਬਦ
4. ਲਗਾਖਰਾਂ ਦੀ ਵਰਤੋ ਵਾਲੇ ਸ਼ਬਦ

ਭਾਗ-ਅ

ਅ- 1. ਇੱਕ ਤੋਂ ਪੰਜਾਹ ਤੱਕ ਗਿਣਤੀ
2. ਹਫ਼ਤੇ ਦੇ ਦਿਨਾਂ ਦੇ ਨਾਂ
3. ਪੰਜ ਫਲਾਂ ਅਤੇ ਸਬਜ਼ੀਆਂ ਦੇ ਨਾਂ
4. ਪੰਜ ਘਰੇਲੂ ਵਸਤਾਂ ਅਤੇ ਆਵਾਜਾਈ ਦੇ ਸਾਧਨਾਂ ਦੇ ਨਾਂ
5. ਪੰਜ ਰਿਸ਼ਤਿਆਂ ਦੇ ਨਾਂ
6. ਪੰਜ ਪਸ਼-ਪੰਛੀਆਂ ਦੇ ਨਾਂ

ਭਾਗ-ਏ

ਭਾਗ ਓ ਅਤੇ ਅ ਵਿਚੋਂ ਅਬਜੈਕਟਿਵ ਪ੍ਰਸ਼ਨ

ਪੇਪਰ ਸੈੱਟਰ ਅਤੇ ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਹਦਾਇਤਾਂ:

1. ਸਾਰਾ ਪੇਪਰ ਅੱਖਰ ਗਿਆਨ (ਭਾਗ-ਪਹਿਲਾ), ਡਾ. ਜਸਵੀਰ ਸਿੰਘ, ਡਾ. ਗੁਰਪ੍ਰੀਤ ਕੌਰ, ਸ੍ਰੀ ਗੁਰੂ ਤੇਗ਼ ਬਹਾਦਰ ਖ਼ਾਲਸਾ ਕਾਲਜ, ਸ੍ਰੀ ਅਨੰਦਪੁਰ ਸਾਹਿਬ, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ ਵਿਚੋਂ ਹੀ ਸੈੱਟ ਕੀਤਾ ਜਾਵੇ।
2. ਭਾਗ-ਓ: ਵਿਚੋਂ ਵਰਣਾਤਮਕ ਪ੍ਰਸ਼ਨ (ਦੋ ਵਿਚੋਂ ਇੱਕ) 04 ਅੰਕ
3. ਭਾਗ-ਓ ਵਿਚੋਂ ਸੰਖੇਪ ਪ੍ਰਸ਼ਨ (ਪੰਜ ਵਿਚੋਂ ਤਿੰਨ) 2+2+2=06 ਅੰਕ
4. ਭਾਗ-ਅ ਵਿਚੋਂ ਵਰਣਾਤਮਕ ਪ੍ਰਸ਼ਨ (ਦੋ ਵਿਚੋਂ ਇੱਕ) 04 ਅੰਕ
5. ਭਾਗ-ਅ ਵਿਚੋਂ ਸੰਖੇਪ ਪ੍ਰਸ਼ਨ (ਪੰਜ ਵਿਚੋਂ ਤਿੰਨ) 2+2+2=06 ਅੰਕ
6. ਭਾਗ-ਏ ਵਿਚ ਭਾਗ ਓ ਅਤੇ ਅ ਵਿਚੋਂ ਕੁੱਲ 15 ਅਬਜੈਕਟਿਵ ਪ੍ਰਸ਼ਨ। ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਸਾਰੇ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹਨ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ 01 ਅੰਕ ਦਾ ਹੋਵੇਗਾ । (15x1=15 ਅੰਕ)

ਨੋਟ: ਵਿਦਿਆਰਥੀ ਪਹਿਲੀ ਵਾਰ ਗੁਰਮੁਖੀ ਸਿੱਖ ਰਹੇ ਹਨ। ਇਸ ਲਈ ਵਿਦਿਆਰਥੀਆਂ ਦੇ ਪੱਧਰ ਨੂੰ ਧਿਆਨ ਵਿੱਚ ਰੱਖਦੇ ਹੋਏ ਸਰਲ ਅਤੇ ਸਪੱਸ਼ਟ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣ।

ਸਹਾਇਕ ਪੁਸਤਕਾਂ:

1. ਅੱਖਰ ਗਿਆਨ (ਭਾਗ-ਪਹਿਲਾ), ਡਾ. ਜਸਵੀਰ ਸਿੰਘ, ਡਾ. ਗੁਰਪ੍ਰੀਤ ਕੌਰ, ਸ੍ਰੀ ਗੁਰੂ ਤੇਗ਼ ਬਹਾਦਰ ਖ਼ਾਲਸਾ ਕਾਲਜ, ਸ੍ਰੀ ਅਨੰਦਪੁਰ ਸਾਹਿਬ ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ
2. ਸਤਿਨਾਮ ਸਿੰਘ ਸੰਧੂ, ਆਓ ਪੰਜਾਬੀ ਸਿੱਖੀਏ, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ, 2009
3. ਸਤਿਨਾਮ ਸਿੰਘ ਸੰਧੂ, ਗੁਰਮੁਖੀ ਸਿੱਖੋ, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ, 2011
4. ਸੀਤਾ ਰਾਮ ਬਾਹਰੀ, ਪੰਜਾਬੀ ਸਿੱਖੀਏ, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ, 2002
5. ਪੰਜਾਬੀ ਗਿਆਨ ਸੀ.ਡੀ. (ਕੰਪਿਊਟਰ ਐਪਲੀਕੇਸ਼ਨ ਟੂ-ਲਰਨ ਐਂਡ ਟੀਚ ਪੰਜਾਬੀ), ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ
6. ਚਰਨ ਪੁਆਧੀ, ਆਓ ਪੰਜਾਬੀ ਸਿੱਖੀਏ, ਸੰਗਮ ਪਬਲੀਕੇਸ਼ਨ, ਪਟਿਆਲਾ

ਪਾਠਕ੍ਰਮ ਦਾ ਉਦੇਸ਼:

1. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਸਾਹਿਤ ਪੜ੍ਹਨ ਲਈ ਪ੍ਰੇਰਿਤ ਕਰਨਾ।
2. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀ ਜਾਣਕਾਰੀ ਦੇਣਾ।
3. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਪੰਜਾਬੀ ਪੜ੍ਹਨਾ ਅਤੇ ਲਿਖਣਾ ਸਿਖਾਉਣਾ।

ਪਾਠਕ੍ਰਮ ਦੀ ਸਾਰਥਕਤਾ:

1. ਵਿਦਿਆਰਥੀ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਸ਼ੁੱਧ ਸੰਚਾਰ ਕਰਨ ਦੇ ਯੋਗ ਹੋਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੇ ਵਿਆਕਰਨਕ ਨੇਮਾਂ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ।

Ability Enhancement Compulsory Course-III

PHY-1.1.6: DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

Note: This is a compulsory qualifying paper, which the students have to study and qualify during three years of their degree course.

Total Marks: 50 **Theory Marks: 35**
Internal Assessment Marks: 15

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections: A, B & C. Section A & B will have four questions in each section from the respective sections of the syllabus and will carry 5 marks each. Section C will consist of 5 short-answer type questions will cover the entire syllabus uniformly and each will carry 3 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt two questions from each section A & B of the question paper and the entire section C.

Learning Objectives

This course is designed with the objective to provide students a deep knowledge about drug abuse and harmful effects on human, society and overall life. Also symptoms and cure strategies of the drug addicts was also explained.

Learning Outcomes

Upon completion of this course, the students should be able to:

- Differentiate between a social user, substance abuser and addict.
- Explain the differences between physical and psychological dependence.
- Identify the various sources of drugs
- Recognize various oral conditions that may be present with chronic nicotine, alcohol, prescription medication and/or illegal drug use.

Pedagogy of the Course Work

The pedagogy of the course work will consist of the following:

- 70% lectures (including expert lectures).
- 30% assignments, discussion and seminars and class tests.
- A visit to drug de-addiction centre could also be undertaken.

Section A

1. **Problem of Drug Abuse:** Concept and Overview; Types of Drug Often Abused
2. **Concept and Overview**
    - What are drugs and what constitutes Drug Abuse?
    - Prevalence of menace of Drug Abuse
    - How drug Abuse is different from Drug Dependence and Drug Addiction?
    - Physical and psychological dependence- concepts of drug tolerance
3. **Introduction to drugs of abuse:** Short Term, Long term effects & withdrawal symptoms
    - Stimulants: Cocaine, Nicotine
    - Depressants: Alcohol, Barbiturates- Nembutal
    - Benzodiazepines –Diazepam
    - Narcotics: Opium, heroin
    - Hallucinogens: Cannabis & derivatives (marijuana, hashish, hash oil)
    - Steroids
    - Inhalants

Section B

4. **Nature of the Problem**
    - Vulnerable Age Groups
    - Signs and symptoms of Drug Abuse
        (a) Physical indicators
        (b) Academic indicators
        (c) Behavioral and Psychological indicators

5. **Causes and Consequences of Drug Abuse**
    - **Causes**
        (a) Physiological
        (b) Psychological
        (c) Sociological
    - **Consequences of Drug Abuse**
        (a) For individuals
        (b) For families
        (c) For society & Nation
6. **Management & Prevention of Drug Abuse**
    - Management of Drug Abuse
    - Prevention of Drug Abuse
    - Role of Family, School, Media, Legislation & De addiction Centers

Suggested Readings:

- Kapoor. T. (1985) Drug Epidemic among Indian Youth, New Delhi: Mittal Pub
- Modi, Ishwarand Modi, Shalini (1997) Drugs: Addiction and Prevention, Jaipur: Rawat Publication.
- Ahuja, Ram (2003), Social Problems in India, Rawat Publications: Jaipur
- 2003 National Household Survey of Alcohol and Drug Abuse. New Delhi, Clinical Epidemiological Unit, All India Institute of Medical Sciences, 2004.
- World Drug Report 2011, United Nations Office of Drug and Crime.
- World Drug Report 2010, United nations Office of Drug and Crime.
- Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
- The Narcotic Drugs and Psychotropic Substances Act, 1985, (New Delhi: Universal, 2012)

Interdisciplinary Choice Based Course

IDC-101A: FINE ARTS

Credits: 2 **Maximum Marks: 50**
Number of lectures: 30 **Practical Paper: 40 (Pass Marks: 14)**
Time: 3Hrs + 3Hrs **Internal Assessment: 10**

PAPER- (PRACTICAL)
INSTRUCTIONS FOR THE PAPER SETTER
(For practical paper)

1. The syllabus is self-explanatory in the paper. Choice of the medium should be left to the candidates.
2. While evaluating, the examiner should see the competency, its technical, artistic, composition, tone, texture and quality.

Outcomes: The course serves to extend the student's awareness of the visual arts and the mechanism of Creativity, precision, tools and materials.

SECTION-A
Calligraphy

Time: 3 hrs **Max. Marks-20**

Use of a maximum of four colours. Emphasis is laid on conveying the theme, layout and lettering should be employed indorse to the sub-matter.
Medium: Poster Colours, Water Colours, High-tech pen n Ink etc.

SECTION-B
Poster making/ Cartooning

Poster making

Time: 3 hrs **Max. Marks-20**

Posters should convey the theme/subject. Layout and Lettering should be used to endorse the subject.
Medium: Poster Colours, Water Colours

or

Cartooning

Time: 3 hrs **Max. Marks-20**

Cartooning should convey the theme/subject. Expressions and lettering should be used to endorse the subject.
Medium: Water Colours or Poster Colours, High-tech pen n Ink
Size: 1/2 imperial

Interdisciplinary Choice Based Course

IDC-101B: MUSIC VOCAL

Maximum Marks: 30 **Time: One and Half Hours**
External Examination: 20 **Pass Marks: 35%**
Internal Assessment: 10 **Credit: 1 (1Hour)**

Course objectives:

- To introduce various definitions in the context of Indian Classical Music.
- To aware the students about brief knowledge of different Raag and Taals.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three Units: I, II & III. Unit I and II will have 2 questions from the respecting units of the syllabus and will carry five marks each and the candidates will attempt one question from each unit. Unit III will consist of 5 short answer type questions which will cover the entire syllabus uniformly and will carry 10 marks in all. Each question carries 2 marks. There will be no choice in this compulsory question.

INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt two questions each from the unit I and unit II of the question paper and entire Unit-III.

UNIT-I

1. Definitaion and explanation of the following technical terms: Sangeet, Naad, Swar, Saptak, Aroh-Avroh, Pakad, Taal, Laya.
2. Importance of Music in human life.

UNIT-II

1. Knowledge of the following instructions:
   Harmonium and Tabla instruments.
2. Discription and notation (Khayal) of the following Ragas and Taals :
   Raags: Bilawal , Kalyan
   Taals: Dadra, Kehrva, Teentaal

UNIT-III

This unit will consist of the short answer type questions from Unit-I and Unit-II as mentioned in instructions.

Course leaning outcomes:

- The student will be learning about the basic knowledge of the Indian classical musical terms, role of music in human life.
- The students will also know about the different Raags and Taals, and how Instruments are used.

Interdisciplinary Choice Based Course Practical

IDC-101BP: MUSIC VOCAL Practical

Maximum Marks: 20 **Time: 15 Minutes**
Credit: 1 (2 Hours) **Pass Marks: 35%**

INSTRUCTIONS FOR THE PRACTICAL EXAMINER

1. Ability to sing and play 05 basic Alankars on the harmonium. (5 Marks)
2. One drut khayal in each of the following Raagas with simple Alap and Taan: Bilawal and Kalyan (5 Marks)
3. Ability to sing National Anthem/Geet/Lok Geet. (5 Marks)
4. Ability to play Dadra Taal/Kehrva/ Teentaal on TabIa. (5 Marks)

Text Books:

1. Harish Chandra Srivastva: Raag Parichaya, Part I, II.
2. V.N. Patwardhan: Raag Vigyan, Part I, II.
3. V.S. Nigam: Sangeet Kaumudi, Part II & III (Punjabi) published by Punjabi University, Patiala
4. Prof. Harish Chandra Srivastva: swarlipi sangreh Part I, II.
5. Dr. Yashpal Sharma, Gayen kala, Published by Punjabi University Patiala.
6. Dr. Davinder Kaur, Sangeet Roop, I, II, III
7. Prof. Jagpinderpal Singh, Bharti Sangeet de Sangeetachariya, Publication Bureau, Sri Guru Teg bahadar Khalsa College Sri Anandpur Sahib

Reference Books:

1. Sangeet Shastra Darpan, Part I Punjabi University Patiala, Karyalya
2. Sangeet Vishard, Published by Sangeet Katyalya, Hathras.
3. Veena Mankaran: Sangeet Sar, Part-I
4. Shanti Givardhan: Sangeet Shastra Darpan.
5. Dr. Jagmohan Sharma: Tabla Vadan, Part-I Published by Punjabi University, Patiala.
6. Hamare Sangeet Ratan Published by Sangeet Karyalya, Hathras.
7. Dr. Gurnam Singh: Punjabi Sangeetkar, Published by Punjabi University, Patiala.
8. Dr. Devinder Kaur: Sangeet Roop Part-I
9. Sharatchndra Sharidhar Pranjpe: Sangeet Bodh
10. Prof. Tara Singh: Vadam Kala, Published by Punjabi University, Patiala.
11. Prof. Harish Chandra Srivastva: Raag Prichey Part I, II, III.
12. Pt. Tejpal Singh (Singh bandhu) Vidhivat sangeet sikshan Part I, II.
13. Pt. Vishnu Narayan Bhatkhandey: Karamik pustak maalika Part 1,2,3,4,5,6
14. Vasant: sangeet visharid
15. Prof. Jagpinderpal Singh: Raag Taal Shastar, published by Zohra Publication Patiala.
16. Prof. Jagpinderpal Singh: Gurmat Sangeet Prbandh, Published by Shaheed-E-Azam Patiala

Interdisciplinary Choice Based Course

IDC-101C: GURMAT SANGEET

Maximum Marks: 30 **Time: One and Half Hours**
External Examination: 20 **Pass Marks: 35%**
Internal Assessment: 10 **Credit: 1 (1 Hour)**

Course objectives:

- To introduce various definitions in the context of Gurmat Sangeet and Indian Classical Music.
- To aware the students about brief biographical sketches of different Sikh Guru Sahibaan.
- To increase the knowledge about different Raags of Sri Guru Granth sahib and different Taals.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three Units: I, II & III. Unit I and II will have 2 questions from the respecting units of the syllabus and will carry five marks each and the candidates will attempt one question from each units. Unit III will consist of 5 short answer type questions which will cover the entire syllabus uniformly and will carry 10 marks in all. Each question carries 2 marks. There will be no choice in this compulsory question.

INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt two questions each from the unit I and unit II of the question paper and entire Unit-III.

UNIT-I

1. Definitaion and explanation of the following technical terms:
   Naad, Swar, Saptak, Aroh-Avroh, Pakad, Taal, Laya, Rahao, Ank.
2. Origin and development of Gurmat sangeet & sepecial reference to Sri Guru Nanak Dev ji in the development of gurmat sangeet traditions.

UNIT-II

1. Discription and notation (Shabad) of the following Ragas and Taals: Raags: Bilawal, Kalyan
2. Taals: Dadra, Kehrva, Teentaal.

UNIT-III

This unit will consist of the short answer type questions from Unit-I and Unit-II as mentioned in instructions.

Course leaning outcomes:

- The student will be learning about the basic knowledge of the Indian classical & Gurmat Sangeet musical terms.
- The students will also know about the different Gurma Sangeet Raags and different Taals.

Text Books:

1. V.N. Patwardhan: Raag Vigyan, Part I, II.
2. V.S. Nigam: Sangeet Kaumudi, Part II & III (Punjabi) published by Punjabi University, Patiala
3. Dr. Davinder Kaur , Sangeet Roop , I,II,III
4. Prof.jagpinderpal singh,Bharti Sangeet de Sangeetachariya, Publication Bureau,Sri Guru Teg bahadar Khalsa College Sri Anandpur Sahib

Reference Books:

1. Gurmat Sangeet Parbandh te Pasaar: Dr. Gurnam Singh, Publication Bureau Pbi. Uni., Patiala.
2. TablaVadan Part-I: Dr. Jagmohan Sharma, Publication Bureau Punjabi University, Patiala.
3. Gurmat Sangeet Parbandh: Prof. Jagpinder pal singh, Shaheed - E -Azam Publication.
4. Samajik Vigyan Patar Gurmat Sangeet Vishesh Ank: Dr. Jasbir Kaur, Publication Bureau Punjabi University, Patiala.
5. Sangeet Roop: Dr. Davinder Kaur, Sangeetanjali Publications Patiala.
6. Gurmat Sangeet Di Itehasik Vilakhanta: Dr. Jasbir Kaur, Patiala
7. Sri Guru Granth Sahib Raag Ratnavali: Prof. Tara Singh.

8. Gurmat Sangeet Wich Paryukt Lok Sangeetak Tat: Dr. Gurpartap Singh Gill, Publication Bureau Punjabi University, Patiala.
9. Sangeet (Gurmat Sangeet Vishesh Ank): Sangeet Karayalaya, Hathras.
10. Sri Guru Granth Sahib Raag Ratan: Prof. Jagpinder pal singh, Shaheed - E -Azam Publication.
11. RaagTaal Sahaster Shabad Bandishan: Prof. Jagpinder pal singh, Shaheed - E -Azam Publication.
12. Sangeet Sidhant Te Sohaj Shaster: Dr. D.S. Narula, Publication Bureau Punjabi Uni., Patiala.
13. Prof. Jagpinderpal Singh: Raag Taal Shastar, published by Zohra Publication Patiala.
14. Prof. Jagpinderpal Singh: Gurmat Sangeet Prbandh, Published by Shaheed-E-Azam Patiala

Interdisciplinary Choice Based Course Practical

IDC-101CP: GURMAT SANGEET Practical

Maximum Marks: 20 **Time: 15 Minutes**
Credit: 1 (2 Hours) **Pass Marks: 35%**

INSTRUCTIONS FOR THE PRACTICAL EXAMINER

1. Ability to sing and play 05 basic Alankars on the harmonium. (5 Marks)
2. One Shabad from the prescribed Raags: Bhairav or Aasa. (5 Marks)
3. Ability to sing one Shabad Reet. (5 Marks)
4. Ability to demonstrate kehrva Taal, Dadra Taal, Teentaal on hand. (5 Marks)

Text Books:

1. V. N. Patwardhan: Raag Vigyan, Part I, II.
2. V. S. Nigam: Sangeet Kaumudi, Part II & III (Punjabi) published by Punjabi University, Patiala
3. Dr. Davinder Kaur, Sangeet Roop, I, II, III
4. Prof. Jagpinderpal Singh, Bharti Sangeet de Sangeetachariya, Publication Bureau, Sri Guru Teg bahadar Khalsa College Sri Anandpur Sahib

Reference Books:

1. Gurmat Sangeet Parbandh te Pasaar: Dr. Gurnam Singh, Publication Bureau Punjabi University, Patiala.
2. TablaVadan Part-I: Dr. Jagmohan Sharma, Publication Bureau Punjabi University, Patiala.
3. Gurmat Sangeet Parbandh: Prof. Jagpinder pal singh, Shaheed - E -Azam Publication.
4. SamajikVigyan Patar Gurmat Sangeet Vishesh Ank: Dr. Jasbir Kaur, Publication Bureau Punjabi University, Patiala.
5. Sangeet Roop: Dr. Davinder Kaur, Sangeetanjali Publications Patiala.
6. Gurmat Sangeet Di Itehasik Vilakhanta: Dr. Jasbir Kaur, Patiala
7. Sri Guru Granth Sahib Raag Ratnavali: Prof. Tara Singh.
8. Gurmat Sangeet Wich Paryukt Lok Sangeetak Tat: Dr. Gurpartap Singh Gill, Publication Bureau Punjabi University, Patiala.
9. Sangeet (Gurmat Sangeet Vishesh Ank): Sangeet Karayalaya, Hathras.
10. Sri Guru Granth Sahib Raag Ratan: Prof. Jagpinder pal singh, Shaheed - E -Azam Publication.
11. Raag Taal Sahaster Shabad Bandishan: Prof. Jagpinder pal singh, Shaheed - E -Azam Publication.
12. Sangeet Sidhant Te Sohaj Shaster: Dr. D.S. Narula, Publication Bureau Punjabi University, Patiala.
13. Prof. Jagpinderpal Singh: Raag Taal Shastar, published by Zohra Publication Patiala.
14. Prof. Jagpinderpal Singh: Gurmat Sangeet Prbandh, Published by Shaheed-E-Azam Patiala

ਅੰਤਰ ਅਨੁਸ਼ਾਸਨੀ ਕੋਰਸ

IDC-101D: ਧਰਮ ਅਤੇ ਧਾਰਮਿਕ ਸਰੋਕਾਰ

ਕੁੱਲ ਅੰਕ : 50 **ਵਿਸ਼ੇ ਵਿਚੋਂ ਪਾਸ ਅੰਕ : 40%**
ਬਾਹਰੀ ਪਰੀਖਿਆ : 35 ਅੰਕ **ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ : 15 ਅੰਕ**
ਸਮਾਂ : 3 ਘੰਟੇ **ਕ੍ਰੈਡਿਟ-02, ਕੁੱਲ ਲੈਕਚਰ : 30**

ਪਾਠਕ੍ਰਮ ਅਤੇ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੀ ਰੂਪ-ਰੇਖਾ

ਭਾਗ-ਓ

1 ਧਰਮ : ਅਰਥ ਅਤੇ ਪਰਿਭਾਸ਼ਾ
2 ਧਰਮ ਦੀ ਲੋੜ
3 ਧਰਮ ਦੇ ਉਦੇਸ਼

ਭਾਗ-ਅ

ਅ-1:

1. ਅੰਤਰ-ਧਰਮ-ਸੰਵਾਦ
2. ਨੈਤਿਕ ਕਦਰਾਂ-ਕੀਮਤਾਂ

ਅ-2:

1. ਮਨੁੱਖੀ ਅਧਿਕਾਰ
2. ਵਾਤਾਵਰਣ ਦੀ ਸੰਭਾਲ ਵਿੱਚ ਧਰਮ ਦੀ ਭੂਮਿਕਾ

ਭਾਗ-ਏ

ਭਾਗ ਓ, ਭਾਗ ਅ : 1, ਅ : 2 ਅਤੇ ਭਾਗ "ਏ" ਵਿਚੋਂ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 15 ਲਾਜ਼ਮੀ ਪ੍ਰਸ਼ਨ ਹੋਣਗੇ।

ਪੇਪਰ ਸੈਟਰ/ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਹਦਾਇਤਾਂ

1. ਭਾਗ-ਓ (ਤਿੰਨ ਵਿਚੋਂ ਇੱਕ) 07 ਅੰਕ
2. ਭਾਗ-ਅ:1 (ਦੋ ਵਿਚੋਂ ਇੱਕ) 06 ਅੰਕ
3. ਭਾਗ-ਅ:2 (ਦੋ ਵਿਚੋਂ ਇੱਕ) 07 ਅੰਕ
4. ਭਾਗ-ਏ ਵਿਚ ਭਾਗ ਓ ਅਤੇ ਭਾਗ ਅ: 1, ਭਾਗ ਅ :2 ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ ਲਾਜ਼ਮੀ ਪ੍ਰਸ਼ਨ ਹੋਣਗੇ
   ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਸਾਰੇ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹਨ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ 01 ਅੰਕ ਦਾ ਹੋਵੇਗਾ। 15*1=15 ਅੰਕ

ਸੁਝਾਈਆਂ ਪੁਸਤਕਾਂ:

ਪੰਜਾਬੀ:

1. ਪ੍ਰੋ. ਗੁਰਬਚਨ ਸਿੰਘ ਤਾਲਿਬ, ***ਧਰਮ ਦੀ ਉਤਪਤੀ ਤੇ ਵਿਕਾਸ***, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ।
2. ਵਾਈ ਮਸੀਹ, ***ਸਾਮਾਨਯ ਧਰਮ ਦਰਸ਼ਨ***,(ਹਿੰਦੀ), ਮੋਤੀ ਲਾਲ, ਬਨਾਰਸੀ ਦਾਸ, ਦਿੱਲੀ।

English Readings:

1. J. Streng, ***Understanding Religious Life***, Dickenson, Publishing Company, California.
2. J. S. Talib, (ed.)***, The Origin and Development of Religion***, Punjabi University, Patiala.

ਪਾਠ ਕ੍ਰਮ ਦਾ ਉਦੇਸ਼

1. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਧਰਮ ਦਾ ਅਧਿਐਨ ਕਰਨ ਅਤੇ ਸਾਹਿਤ ਪੜ੍ਹਨ ਲਈ ਪ੍ਰੇਰਿਤ ਕਰਨਾ।
2. ਮਨੁੱਖੀ ਜੀਵਨ ਵਿਚ ਧਾਰਮਿਕ ਮਹੱਤਤਾ ਬਾਰੇ ਮੁੱਢਲੀ ਜਾਣਕਾਰੀ ਪ੍ਰਦਾਨ ਕਰਨਾ।
3. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਮਨੁੱਖੀ ਕਦਰਾਂ ਕੀਮਤਾਂ ਅਤੇ ਨੈਤਿਕਤਾ ਸਿਖਾਉਣਾ।
4. ਧਾਰਮਿਕ ਗ੍ਰੰਥਾਂ, ਸਾਸ਼ਤਰਾਂ ਅਤੇ ਫ਼ਲਸਫ਼ੇ ਰਾਹੀਂ ਮਹਾਨ ਧਾਰਮਿਕ ਸਿੱਖਿਆਵਾਂ ਦੀ ਜਾਣ-ਪਛਾਣ ਕਰਵਾਉਣਾ।
5. ਵਿਦਿਆਰਥੀਆਂ ਦੀ ਸ਼ਖ਼ਸੀਅਤ ਦਾ ਸਰਵਪੱਖੀ ਵਿਕਾਸ ਕਰਨਾ।

ਪਾਠਕ੍ਰਮ ਦੀ ਸਾਰਥਕਤਾ:

1. ਵਿਦਿਆਰਥੀਆਂ ਅੰਦਰ ਧਰਮ ਨਾਲ ਸੰਬੰਧਿਤ ਪਰਤਾਂ ਨੂੰ ਉਜਾਗਰ ਕਰਨ ਦਾ ਹੁਨਰ ਪੈਦਾ ਹੋਵੇਗਾ।
2. ਵਿਦਿਆਰਥੀ ਧਰਮ ਅਧਿਐਨ ਵਿਸ਼ੇ ਦੀ ਸਮਾਜ ਵਿਚ ਲੋੜ ਅਤੇ ਮਹੱਤਵ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ।

Interdisciplinary Choice Based Course

IDC-101E: CREATIVE WRITING

Time Allowed: 3 Hours **Max. Marks: 50**
Total Lectures: 30 **Written Examination: 35**
Credits: 02 **Internal Assessment: 15**

Internal Assessment: Assignments/Projects

I. Critical Appreciation of any literary text chosen in consultation with the concerned teacher. (5 Marks)

II. Writing a piece of fiction- novella, story, play or poem with commentary on the written text as well as the experience of writing. (10 Marks)

Testing:

Question I will have one long answer type question which shall be set from Unit I with an internal choice.
Question II will have one long answer type question which shall be set from Unit I with an internal choice.
Question III will have one long answer type question which shall be set from Unit II with an internal choice**.**
Question IV will have one long answer type question which shall be set from Unit II with an internal choice.
(4x5=20 marks)

Question V shall comprise ten short-answer type questions of about 100-120 words each.
(10x1.5=15 marks)

Objectives:

- To acquaint the learners with ideas related to creative writing including the art, the craft and the basic skills required for a creative writer
- To help learners to understand the principles of creative writing and the distinction between the literary genres
- To explain the differences in writing for various literary and social media
- To enable learners to put into practice the various forms of creative writing that they have studied through the course.

UNIT I

Fundamentals of Creative Writing

- Meaning and Significance of Creative Writing
- Brief introduction to traditional forms of Creative Writing: poetry, fiction, non-fiction, drama, biography, memoir, travelogues and autobiography
- Research for Creative Writing

UNIT II

Elements of Creative Writing

- Plot, Setting, Character, Dialogue, Point of View
- Literary Devices
- Elements of Style
- Proof Reading and Editing

Learning Outcomes: At the end of the course, learners will be able to:

- Distinguish between the literary genres
- Write for various literary and social media
- Critically appreciate various forms of literature
- Make innovative use of their creative and critical faculties
- Seek employment in various creative fields

List of References:

- Abrams, M.H. *Glossary of Literary Terms*. Boston: Wadsworth Publishing Company, 2005.
- Bell, Julia and Magrs, Paul. *The Creative Writing Course-Book*. London: Macmillan, 2001.
- Berg, Carly. *Writing Flash Fiction: How to Write Very Short Stories and Get Them published*. **Then Re-Publish Them All Together as a Book*. Houston: Magic Lantern Press, 2015.
- Turabian, Kate L. *A Manual for Writers*. Chicago: Univ. of Chicago Press, 2007
- Samuel R Delany. *About Writing*

ਅੰਤਰ-ਅਨੁਸ਼ਾਸ਼ਨੀ ਕੋਰਸ

IDC-101F: ਪੰਜਾਬੀ ਲੋਕਧਾਰਾ ਅਤੇ ਸਭਿਆਚਾਰ

ਕੁੱਲ ਅੰਕ: 50 **ਪਾਸ ਅੰਕ:** 35%
ਬਾਹਰੀ ਪ੍ਰੀਖਿਆ: 35 ਅੰਕ **ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ:** 15 ਅੰਕ
ਪ੍ਰੀਖਿਆ ਦਾ ਸਮਾਂ: 3 ਘੰਟੇ **ਕ੍ਰੈਡਿਟ:** 02, **ਕੁੱਲ ਲੈਕਚਰ:** 30

ਪਾਠਕ੍ਰਮ ਅਤੇ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੀ ਰੂਪ-ਰੇਖਾ:

ਭਾਗ-ਓ

1. ਲੋਕਧਾਰਾ ਦੀ ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਲੱਛਣ
2. ਲੋਕਧਾਰਾ ਦੀ ਸਮੱਗਰੀ ਦਾ ਵਰਗੀਕਰਨ (ਡਾ. ਕਰਨੈਲ ਸਿੰਘ ਥਿੰਦ ਦੇ ਸੰਦਰਭ ਵਿਚ)
3. ਬੁਝਾਰਤਾਂ ਅਤੇ ਅਖੌਤਾਂ
4. ਪੰਜਾਬੀ ਸਿਨੇਮਾ ਤੇ ਲੋਕਧਾਰਾ

ਭਾਗ-ਅ

1. ਲੋਕ-ਨਾਚ: ਪ੍ਰਮੁੱਖ ਵੰਨਗੀਆਂ
2. ਮੇਲੇ ਅਤੇ ਤਿਉਹਾਰ
3. ਲੋਕ-ਵਿਸ਼ਵਾਸ: ਪ੍ਰਮੁੱਖ ਵੰਨਗੀਆਂ
4. ਰੀਤੀ-ਰਿਵਾਜ: ਪ੍ਰਮੁੱਖ ਵੰਨਗੀਆਂ

ਭਾਗ-ਏ

ਉਪਰੋਕਤ ਸਿਲੇਬਸ'ਤੇ ਆਧਾਰਿਤ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 05 ਪ੍ਰਸ਼ਨ

ਪੇਪਰ ਸੈਟਰ/ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਹਦਾਇਤਾਂ

1. ਸਾਰੇ ਸਿਲੇਬਸ ਵਿਚੋਂ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣ।
2. ਭਾਗ ਓ ਵਿਚੋਂ ਵਰਣਾਤਮਕ ਪ੍ਰਸ਼ਨ (ਦੋ ਵਿਚੋਂ ਇੱਕ) 09 ਅੰਕ
3. ਭਾਗ ਅ ਵਿਚੋਂ ਵਰਣਾਤਮਕ ਪ੍ਰਸ਼ਨ (ਦੋ ਵਿਚੋਂ ਇੱਕ) 09 ਅੰਕ
4. ਭਾਗ ਏ ਵਿਚ ਸਾਰੇ ਸਿਲੇਬਸ ਵਿਚੋਂ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 05 ਲਾਜ਼ਮੀ ਪ੍ਰਸ਼ਨ 5x3=15 ਅੰਕ

ਸਹਾਇਕ ਪੁਸਤਕਾਂ:

1. ਡਾ.ਵਣਜਾਰਾ ਬੇਦੀ, ਲੋਕਧਾਰਾ ਵਿਸ਼ਵਕੋਸ਼ (ਜਿਲਦ ਪਹਿਲੀ ਤੋਂ ਅੱਠਵੀਂ ਤੱਕ), ਨੈਸ਼ਨਲ ਬੁੱਕ ਸ਼ਾਪ, ਨਵੀਂ ਦਿੱਲੀ।
2. ਡਾ.ਨਾਹਰ ਸਿੰਘ, ਲੋਕ ਕਾਵਿ ਦੀ ਸਿਰਜਨ ਪ੍ਰਕਿਰਿਆ, ਲੋਕਗੀਤ ਪ੍ਰਕਾਸ਼ਨ, ਚੰਡੀਗੜ੍ਹ।
3. ਗਿਆਨੀ ਗੁਰਦਿੱਤ ਸਿੰਘ, ਮੇਰਾ ਪਿੰਡ, ਸਾਹਿਤ ਸਦਨ, ਚੰਡੀਗੜ੍ਹ।
4. ਟੀ. ਆਰ. ਵਿਨੋਦ, ਸੰਸਕ੍ਰਿਤੀ: ਸਿਧਾਂਤ ਤੇ ਵਿਹਾਰ, ਲੋਕਗੀਤ ਪ੍ਰਕਾਸ਼ਨ, ਚੰਡੀਗੜ੍ਹ।
5. ਜਸਵਿੰਦਰ ਸਿੰਘ, ਪੰਜਾਬੀ ਲੋਕ-ਸਾਹਿਤ ਸ਼ਾਸਤਰ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ।
6. ਨਾਹਰ ਸਿੰਘ, ਲੋਕ-ਕਾਵਿ ਦੀ ਸਿਰਜਨ ਪ੍ਰਕਿਰਿਆ, ਲੋਕਗੀਤ ਪ੍ਰਕਾਸ਼ਨ, ਚੰਡੀਗੜ੍ਹ।
7. ਕਰਨੈਲ ਸਿੰਘ ਥਿੰਦ, ਲੋਕਯਾਨ ਅਤੇ ਮੱਧਕਾਲੀਨ ਪੰਜਾਬੀ ਸਾਹਿਤ, ਜੀਵਨ ਮੰਦਰਿ, ਅੰਮ੍ਰਿਤਸਰ।
8. ਕਰਨਜੀਤ ਸਿੰਘ, ਪੰਜਾਬੀ ਲੋਕਧਾਰਾ ਅਤੇ ਲੋਕ-ਜੀਵਨ, ਨਵਯੁੱਗ ਪਬਲਿਸ਼ਰਜ਼, ਦਿੱਲੀ।
9. ਡਾ. ਗੁਰਪ੍ਰੀਤ ਕੌਰ, ਪੰਜਾਬੀ ਲੋਕਧਾਰਾ: ਸਿਧਾਂਤ ਤੇ ਵਿਹਾਰ, ਤਰਲੋਚਨ ਪਬਲਿਸ਼ਰਜ਼, ਚੰਡੀਗੜ੍ਹ।

ਪਾਠਕ੍ਰਮ ਦਾ ਉਦੇਸ਼:

1. ਪੰਜਾਬੀ ਲੋਕਧਾਰਾ ਅਤੇ ਸਭਿਆਚਾਰ ਬਾਰੇ ਮੁੱਢਲਾ ਗਿਆਨ ਦੇਣਾ।
2. ਪੰਜਾਬੀ ਲੋਕਧਾਰਾ ਅਤੇ ਸਭਿਆਚਾਰ ਨਾਲ ਸੰਬੰਧਿਤ ਖੇਤਰਾਂ ਬਾਰੇ ਜਾਣਕਾਰੀ ਦੇਣਾ।

ਪਾਠਕ੍ਰਮ ਦੀ ਸਾਰਥਕਤਾ:

1. ਵਿਦਿਆਰਥੀਆਂ ਦਾ ਬੌਧਿਕ ਪੱਧਰ'ਤੇ ਵਿਕਾਸ ਹੋਵੇਗਾ।
2. ਵਿਦਿਆਰਥੀ ਪੰਜਾਬੀ ਲੋਕਧਾਰਾ ਅਤੇ ਸਭਿਆਚਾਰ ਨੂੰ ਡੂੰਘਾਈ ਵਿਚ ਸਮਝਣਗੇ।

Interdisciplinary Choice Based Course

IDC-101G: HEALTH AND FITNESS

Maximum Marks: 50 | **Pass Percentage: 35%**
External Marks: 35 | **External Pass Marks: 13**
Internal Marks: 15 | **Internal Pass Marks: 05**
Credits: 02 | **Time Allowed: 3 Hrs**

INSTRUCTIONS FOR PAPER-SETTER

The question paper will consist of two Sections. A will have 4 questions from the respective section of the syllabus and will carry 10 marks each. Section B carries 10 short answer type questions which will cover the entire syllabus uniformly and will carry 15 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from sections A. Section B is compulsory.

Objectives:

1. To develop potentialities and organize physical education programs and activities.
2. To empower them to inspire their students to actively participate in physical and yogic exercises.
3. To make teachers capable of imparting basic knowledge about health, hygiene and nutrition
4. To cultivate the spirit of sportsmanship, mental and physical alertness, scientific temper and optimism.
5. To promote mental health, power of self- decision and self-control, correct judgment and action emotional stability and equanimity, respect for others and acceptance of authority and rules

Course Outcomes:

1. To produce quality physical education teachers for imparting instructions in the subject of physical education.
2. To make people aware about the benefits of physical activity through extension lectures and demonstrations.
3. To collaborate with the different organizations which are involved in promoting the quality life of the human beings i.e., educational institutions and NGOs
4. To promote mass participation in Physical Education activities (Games, Sports Displays etc.) through intra – mural and Extra- mural programs.
5. To provide opportunity to faculty and students of the department for their self-evaluations, accountability, autonomy and innovations in the area of physical education and sports.

SECTION A

Health Education: Meaning, Objectives, Importance of Health Education in the modern society.
Balance Diet: Meaning, components of balance diet and role of balance diet in sports.

SECTION B

Physical Fitness: Introduction, its Components and their Types (Speed, Strength, Endurance, Co-ordination and Flexibility), factors affecting physical fitness.
Obesity and Over Weight Management: Introduction, Components, Sources and Functions of each Component.

References:

- Aggarwal, J.C. (2006) "Health and Physical Education" Shipra Publications, Shakarpur, Delhi.
- Ahluwalia, P. S., Deol, N.S. and Kaushal, S. (2009) "A Textbook of Physical Education" Imperium Publishers, Khanna, Ludhiana.Dutta, A.K. (2004) "Games and Sports for Children" 1st edition - Janvani Prakashan, Shahdra, Delhi.
- Dutta, A.K. "Games and Sports for Children" (2004)1st edition - *Janvani Prakashan*Vishwas Nagar, Shahdra, Delhi-110032
- International Association of Athletics Federations Competition Rules (2017-18), Centenary Edition, Monaco. http://www.iaaf.org
- Jain, Deepak (2002) "Physical Education and Recreational Activities" Khel Sahitya Kendra, New Delhi.
- Jain, Deepak "Physical Education and Recreational Activities", *Khel Sahitya Kendra*, Delhi.
- Kang G.S. and Deol N.S. (2008) "An Introduction to Health and Physical Education" Twenty First Century, Patiala.

Interdisciplinary Choice Based Course

IDC-101H: CONSUMERISM IN INDIA

Maximum Marks: 50 **Time Allowed: 3hrs.**
External Examination: 35 **Pass Percentage: 35%**
Internal Assessment: 15 **Teaching Hours: 2 Hours/week**
Credit-2: 2H (L)

INSTRUCTIONS FOR PAPER SETTER/EXAMINERS

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from Unit-I and Unit-II respectively, will carry 05 marks each. Section C will consist of 12 short answer type questions covering entire syllabus and will carry 1.5 marks each. Total weightage of Section-C shall be 15 marks.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions each from Section A and B. In Section C candidates are required to attempt any ten questions.

Course Objective: To familiarize the students with their rights and responsibilities as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights.

Pedagogy-The course will be initiated through lectures, case study method, discussions and assignments

UNIT- I

Consumerism- Concept - Need and Scope of Consumerism- Origin of Consumer Movement. Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labeling and packaging along with relevant laws, Legal Metrology.

Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/Dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

UNIT- II

Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, and restrictive trade practice.

Organizational set-up under the Consumer Protection Act: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions, and National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial).

Course Learning Outcome: Students will become familiar with their rights and responsibilities as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights.

Suggested Readings:

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) *ConsumerAffairs,* Universities Press.
2. Choudhary, Ram Naresh Prasad (2005). *Consumer Protection Law Provisions andProcedure,* Deep and Deep Publications Pvt Ltd.
3. G. Ganesan and M. Sumathy. (2012). *Globalisation and Consumerism: Issuesand Challenges*, Regal Publications
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issuesand Concerns, IIPA, New Delhi
5. Rajyalaxmi Rao (2012), *Consumer is King,* Universal Law Publishing Company
6. Girimaji, Pushpa (2002). *Consumer Right for Everyone* Penguin Books.
7. E-books :- www.consumereducation.in

Articles:

1. Misra Suresh, (Aug 2017) "Is the Indian Consumer Protected? One India OnePeople.
2. Raman Mittal, Sonkar Sumit and Parineet Kaur (2016) Regulating Unfair Trade Practices: An Analysis of the Past and Present Indian Legislative Models, Journal ofConsumer Policy.
3. Chakravarthy, S. (2014). MRTP Act metamorphoses into Competition Act. CUTSInstitute for Regulation and Competition position paper. Available online at www.cuts-

international.org/doc01.doc.
4. Kapoor Sheetal (2013) “Banking and the Consumer” Akademos (ISSN 2231-0584)

Periodicals:

1. Consumer Protection Judgments (CPJ) (Relevant cases reported in various issues)
2. Recent issues of magazines: International Journal on consumer law and practice,National Law School of India University, Bengaluru
3. ‘*Consumer Voice*’, Published by VOICE Society, New Delhi.

Websites:

www.ncdrc.nic.in
www.consumeraffairs.nic.in
www.iso.org.
www.bis.org.in
www.consumered.in
www.consumer
www.fssai.gov.in www.cercindia.org

Core Course-III

PHY-1.2.1: ELECTRICITY AND MAGNETISM

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objective: The purpose of the course is to expose students to Electrostatics and Magneto statics, Maxwell equations and their applications and analysis of Alternating current circuits.

Section A

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate. Dielectric medium, Polarization, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Electrical Circuits: Series and Parallel LCR Circuits: (1) Resonance, (2) Quality Factor, and (3) Band Width.

Section B

Magnetic Field: Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of B: curl and divergence. Vector Potential. Derivation of Biot-Sevart's law using vector potential. Magnetic Force on (1) point charge (2) current carrying wire. Torque on a current loop in a uniform Magnetic Field. Hall effect.

Magnetic Properties of Matter: Magnetization vector (M). Magnetic Intensity (H). Magnetic Susceptibility and permeability. Relation between B, H and M. Ferromagnetism and Domain theory. B-H curve and hysteresis.

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 Conservation and Displacement current.

Course learning outcomes:

Students will have achieved the knowledge of Electrostatics and Magnetostatics, Maxwell equations and their applications and analysis of Alternating Current circuits.

Text Books:

1. Electricity and Magnetism, Dr. A. K. Sikri, Pradeep Publications.
2. Electricity and Magnetism, Ashok Sharma and R. C. Lakhanpal, Modern Publishers.
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.

Reference Books:

- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education
- Electricity & Magnetism, J.H. Fewkes & J.Yarwood.Vol. I, 1991, Oxford Univ. Press
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn, 1998, Benjamin Cummings.
- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw.

Core Course-III Practical

PHY-1.2.1P: ELECTRICITY AND MAGNETISM PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40% (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. Use a multimeter for measuring (a) Resistances, (b) Voltage (AC/DC), (c) Current (AC/DC) (d) Continuity of the circuit and (e) Checking electrical fuses.
2. To measure AC voltage and frequency using a C.R.O.
3. To study the working of household energy meter and to determine the power consumption of some electric appliances.
4. To study the characteristics of a series RC Circuit.
5. To determine a low resistance using Carey Foster bridge.
6. To determine resistance and specific resistance of copper with the help of Kelvin's double bridge.
7. To determine self-inductance of a coil by Anderson's bridge.
8. 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.
9. To study the response curve of a parallel LCR circuit and determine its (a) Antiresonant frequency and (b) Quality factor Q.
10. Study the phase relationships between voltage and current using impedance triangle.
11. To measure magnetic field strength B and its variation in a solenoid.
12. To study the induced emf as function of velocity of magnet.
13. To determine the unknown capacitance by flashing and quenching of a neon bulb.
14. To trace the B-H curves for different materials using CRO.
15. To study the magnetic field of a circular conductor as a function of the current (Biot Savart's law).
16. To study the magnetic field of a circular conductor as a function of distance from the axis of the conductor (Biot Savart's law).
17. To study the magnetic field as a function of loop radius (Biot Savart's law).

Reference Books:

1. B.Sc. Practical Physics, C. L. Arora. S Chand and Company Limited
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.

Core Course-IV

PHY-1.2.2: WAVES AND OPTICS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Objectives: The course covers concept of waves, longitudinal as well as transverse, wave equation, wave and group velocity. It also covers the interference, diffraction and polarization of light and their applications.

Instructional delivery strategy/Pedagogy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged

Section A

Wave Motion: Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation of waves. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves.

Velocity of Waves: Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction.

Superposition of Two Harmonic Waves: Standing (Stationary) Waves in a String: Standing waves generated with two fixed and free ends of a string. Energy of Vibrating String. Energy in the nth mode of a vibrating string. Standing wave ratio (SWR). Wave groups and group velocity. Melde's Experiment: Laws of vibrating stretched string, Longitudinal modes, Transverse modes. Longitudinal Standing Waves. Longitudinal vibrations of air columns in open and closed pipes. Normal modes of Longitudinal waves for pipe closed at one end and open at the other.

Section B

Wave Optics: Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence.

Interference: Division of wave front (Young's double slit experiment and Fresnel's Biprism). Phase change on reflection: Stokes' treatment. Interference in Thin Films (parallel Newton's Rings: Measurement of wavelength and refractive index. Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index.

Diffraction: Fresnel and Fraunhofer Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of Zone Plate: Multiple Foci of a Zone Plate. Fraunhofer diffraction due to single slit, double slit, multiple slits, diffraction grating and circular aperture, Resolving Power of Diffraction grating, Telescope and Microscope.

Learning Outcomes: Students will be able to articulate and describe:

- The concept of waves and their motion
- The concept of interference with many experiments associated with it.
- Difference between Fraunhofer and Fresnel diffraction
- The skill to find the wavelength of spectral lines using Plane diffraction grating

Text Books:

1. Waves and Optics, Shaweta Mohan and T.S. Bhatia, Vishal Publishing Co.
2. Optics and Laser, Ashok Sharma, Modern Publisher.

Reference Books:

- Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill

- Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
- Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
- The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.

Core Course-IV Practical

PHY-1.2.2P: WAVES AND OPTICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify λ^2–T law.
2. To determine the frequency of AC mains using a sonometer and an electro magnet.
3. To determine the frequency of a tuning fork using a sonometer.
4. To verify the laws of transverse vibrations of stretched strings using a sonometer.
5. To determine the velocity of sound in air using water column and tuning fork.
6. To determine the velocity of sound in air using resonance tube (Kundt's tube) apparatus.
7. To determine the angle of prism using spectrometer.
8. To determine refractive index of the Material of a prism using sodium source.
9. To determine the wavelength of sodium source using Michelson's interferometer.
10. To determine wavelength of sodium light using Fresnel's Biprism.
11. To determine wavelength of Na source using plane diffraction grating.
12. To find the number of lines per centimeter of the given grating using sodium light.
13. To determine wavelength of spectral lines of Hg source using plane diffraction grating.
14. To determine the principle points of a lens system.

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. B.Sc. Practical Physics, C. L. Arora. S Chand and Company Limited.
4. A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub.

Generic Elective-2

PHY-1.2.3 A: CHEMISTRY-II

Maximum Marks:100 **Time Allowed: 3 Hours**
External Examination: 70 (Pass Marks: 28) **Teaching Hours: 60 (4 Credits)**
Internal Assessment: 30 (Pass Marks: 12) **Pass Percentage: 40 %**

Instruction for the Paper Setter: The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each. Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 2 marks each.

Instruction for the candidates: Candidates are required to attempt five questions in all by selecting two questions each from sections A & B and Section C (9" question) is compulsory.

Course Objective: To teach the fundamental concepts of Chemistry and their applications. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to the requisite intellectual understanding of Chemical Energetics, Physical properties of liquid, Theories of Acids & Bases and laboratory skills.

Section A

Chemical Thermodynamics

Intensive and extensive properties, variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics.

First law: Concept of heat, q, work, w, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, Joule's law, Joule-Thomson Effect, Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature, calculations of q, w, dU and dH for reversible, irreversible processes. (Ideal Gas)

Second Law: Statement of the second law of thermodynamics, need for law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem, thermodynamic scale of temperature. Concept of entropy, molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.

Third Law: Statement of third law, Nernst heat theorem, concept of residual entropy, calculation of absolute entropy of molecules. Free Energy Functions: Gibbs and Helmholtz energy, Free energy change and spontaneity, Maxwell relations, Gibbs-Helmholtz equation.

Section B

Acids and Bases

Acids and Bases: Bronsted-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, Hard and soft acids and bases (HSAB concept), applications of HSAB process.

Liquids: Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

Course Outcomes: The students will acquire knowledge of

- Thermodynamics
- Theories of acids and bases
- Determination of viscosity and surface tension of liquids.

Text books:

1. Atkins, P. W. & Atkin's, P.J. Physical Chemistry, Oxford University Press, 2006.
2. Pathania, P.S Principles of Physical Chemistry (47" Ed), Vishal publisher Co. ;2016
3. Kiran, S Modern approach Physical chemistry, 2019.

Reference Books:

1. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill (2007).
2. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).

Generic Elective-2 (Practical)

PHY-1.2.3 AP: CHEMISTRY PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instruction for the Examiners and Candidates: The practical examination will be held in single session (morning/evening). Candidates are required to perform practicals from physical chemistry and organic chemistry. Distribution of marks will be as under (Books may be consulted):

1. Physical Chemistry Experiment = 15 marks
[Initial Write up: 7 marks (Theory/principle: 2, Procedure: 2, General Calculations: 3)
Performance and result: 8 marks (Full credit up to 10% error)]
2. Inorganic Qualitative Analysis = 20 marks
3. Viva-Voce = 10 marks
4. Note Books = 5 marks
Total = 50 marks

Section A: Physical Chemistry

1. Surface tension measurement (use of organic solvents excluded).
   a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.
   b) Study of the variation of surface tension of a detergent solution with concentration.
2. Viscosity measurement (use of organic solvents excluded).
   a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
   b) Study of the variation of viscosity of an aqueous solution with concentration of solute

Section B: Inorganic Chemistry

3. Semi-micro qualitative analysis (using H_2S or other methods) of mixtures- not more than two ionic species (one anion and one cation, excluding insoluble salts) out of the following:
   Cations: NH_4^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^+
   Anions: CO_3^{2-} S^{2-}, SO_3^{2-} $S_2O_3^{2-}$, NO^-, CH_3COO^-, Cl^-, Br^-, I^-, NO_3^-, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, $F^{-\cdot}$ $C_2O_4^{2-}$

Reference Books:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011)

Generic Elective-2

PHY-1.2.3 B: WEB DEVELOPMENT USING PHP

Total Teaching Hours: 60 | **Internal Assessment: 30 Marks**
Time Allowed: 3 Hrs | **External Marks: 70 Marks**
Pass Marks: 35% | **4 Credits: 4H (L)**

INSTRUCTIONS FOR PAPER SETTER/EXAMINERS

The Question paper will consist of three sections-A, B & C. Section A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each. Candidates are required to attempt two questions each from section A and B. Section C will consist of 9 short answer type questions covering entire syllabus and will carry 3 marks each. Section C is Compulsory.

Section A

PHP: A Brief History of PHP, Introduction to PHP, Syntax, Scope of Variables: Global and Local Variables, Data types, Control Statements, Operators- Arithmetic, Logical, Relational and Bit-Wise operators. Functions, JavaScript functions Local and Global scope, Calling Functions, Defining a Function, Built-in functions. Installing and Configuring PHP on Windows. Installing web site on web server-Apache, WAMP. Creating Arrays, Multidimensional Arrays, Cookies. Document Object Model and Finding Elements. Basic Events, Standard Event Model.
String: Quoting String Constants - Printing Strings - Accessing Individual Characters -Cleaning Strings - Encoding and Escaping -Comparing Strings - Manipulating and Searching Strings – Regular Expressions.

Section B

Connecting to MySQL from PHP: Server side programming, Client Side Scripting, WAMP tool, HTML Form Fields (Controls), PHP Form Handling, Form Validations.
Objects: Terminology - Creating an Object - Accessing Properties and Methods - Declaring a Class - Introspection – Serialization Extending PHP.
AJAX: Introduction, Identifiers, Variables, Defined Constants, Operators and Expressions.HTML Form Fields (Controls).
Architectural Overview: The pval/zval Data Type, Parameter Handling, Returning Values, References, Global Variables.
Introduction to MySql: Data Types, SqlQueries: Creating Database, Creating Table, Inserting, Updating, Deleting Data. Searching, Sorting, Altering table.

Reference Books:

1. Robin Nixon, Learning PHP, MySQL, and JavaScript, Shroff/O'Reilly.
2. Raj Kamal, Internet and Web Technologies, Tata McGraw-Hill.
3. Matt Zandstra, Sams Teach Yourself PHP in 24 Hours, Sams Publishing.
4. Steven M. Schafer, HTML, CSS, JavaScript, Perl, Python and PHP, Wiley India

Generic Elective-2 (Practical)

PHY-1.2.3 BP: SOFTWARE – II LAB

Time Allowed: Three Hours **External Evaluation: 50 Marks**
Pass Marks: 35% **2 Credits: 4H (P)**

This laboratory course will comprise of exercises to supplement what is learnt under paper BHGE-1.2B Web Development using PHP.

Students are required to develop the following programs in PHP language with internal documentation:

1. Write a program to print any text in PHP.
2. Write a program to print the data types of PHP i.e. using String, Integer, Floating point numbers, Boolean, Array, Object, NULL.
3. Write a program of arithmetic operators.
4. Write any program of using conditional Statements.
5. Write a program to implement switch case in PHP.
6. Write a program to add two numbers using functions.
7. Write a program to implement while loop.
8. Print different values using for each loop.
9. Create a Date From a String With PHP strtotime() function
10. Write a program to open, read and close file in PHP.
11. Write a function to connect and create database using PHP.
12. Write a program to implement mail function.
13. Write a program to implement WHERE clause in php MySQL.
14. Write a program to implement file upload using PHP.
15. Write a program to start, store and delete session variable.

Generic Elective-2

PHY-1.2.3 C: DIFFERENTIAL EQUATIONS

L	T	P
5	1	0

Time Allowed: 3 hours

External Assessment: 100 Marks
Internal Assessments: 50 Marks
Total: 150 Marks
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each of 20 marks each from the respective sections of the syllabus. Section C will consist of one compulsory question having ten short answer type questions each of 2 marks covering the entire syllabus uniformly.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Section A and B and compulsory question of Section C.

Course Objectives: The course will introduce the students to differential equations and its various other types.

Pedagogy: The teacher should explain the concept using numerical problems.

Section A

First order differential equations: Order and degree of a differential equation, separable differential equations, Homogeneous differential equations, equations reducible to Homogenous differential equations Exact differential equations. Linear differential equations and equations reducible to linear differential equations.

Higher order differential equations: Solution of Linear homogeneous and non-homogeneous differential equations of higher order with constant coefficients and with variable coefficients. method of Variation of Parameters.

Section B

Partial differential equations:

Partial differential equation of first order, Lagrange's solution, Integral surfaces passing through a given curve, surfaces orthogonal to a given system of surfaces, Partial differential equation of first order but of any degree, Charpit's general method of solution.

Partial differential equations of second and higher order: Partial differential equations of the second order and their classification into hyperbolic, elliptic and parabolic types.

Course Outcomes: The students will have strong hold on the concept of differential equations and partial differential equations.

Text Books:

1. Zafar Ahsan: Differential Equations and Their Applications, Prentice-Hall of India Pvt. Ltd. New Delhi-Second edition.
2. M. D. Raisinghania, Ordinary and Partial Differential Equations, S Chand.

Reference Books:

1. E. A. Coddington, An introduction to ordinary differential equation, Prentice-Hall of India.
2. I. N. Sneddon, Elements of Partial differential equations, Dover Publications, Inc. Newyork, 2006.

Ability Enhancement Compulsory Course-IV

PHY-1.2.4: ENGLISH (COMMUNICATION SKILLS)

Time Allowed: 3 Hours
Periods Per Week: 2
Credits: 02
Teaching Hours: 30

Max. Marks: 50
Written Examination: 35 Marks
Internal Assessment: 15 Marks
Pass Percentage: 40%

Instructions for the Paper Setter: The question paper will carry 70 marks and will be of three hours duration. The paper will consist of three Units. Following shall be the unit wise marks division:

- Unit-I – 12 Marks
- Unit-II – 23 Marks

Instructions for the candidates: Candidates are required to attempt all the questions as per the instructions given in the testing section.

Course Objective: The objective of the paper is to introduce the students to the theory, fundamentals and tools of communication. The course aims at developing the vital communication skills among students for personal, social and professional interactions

Pedagogy: Primarily the chalk and duster method will be used to teach this course. To evoke the interest of the students in the curriculum due emphasis will be laid on assignments, homework and periodic tests.

Unit I

Part-A

Communication Skills

1. Meaning of Communication
2. Importance of Communication
3. Process of Communication
4. Types of Communication
5. Channels of Communication
6. Barriers to Effective Communication
7. Effective listening skills
8. Public speaking skills

Part-B

Interview Skills

1. Types of Interview
2. Appearing for an Interview
3. Conducting an Interview
4. Body Language & Dress Code
5. Group Discussion

Unit II

Composition:

1. Report Writing
2. E-mail Writing (Address, Subject, Content, Complementary Closed)
3. Job application along with Resume/ Curriculum Vitae

Testing

Unit-I

1. The examiner shall set one long answer type question with internal choice from Part-A of Unit-I of the syllabus. 6 marks
2. The examiner shall set one long answer type question with internal choice from Part -B of Unit-I of the syllabus. 6 marks

Unit-II

3. The examiner shall set one question pertaining to report writing with internal choice. 7 marks
4. The examiner shall set one question pertaining to email writing with internal choice. 7 marks
5. The examiner shall set one question with an internal choice pertaining to job application & Resume/CV Writing. The candidate is required to write a job application along with resume/C.V. 4+5=9 marks

Course learning outcome:

1. Communication skills of students will improve.
2. The students will distinguish among various levels of organizational communication.
3. Students will develop an ability for effective business correspondence with brevity and clarity.

Suggested Readings:

- Business Communication by M K Sehgal, Vandana Khetarpal.
- Bovee and Thill. Business Communication Today, Pearson Education.
- Brian R Hollaway. Technical Writing Basis: A Guide to Style and Form. 4th Pearson -Prentice Hall.
- Kaur, Gurpreet. Communication Skills and Technical Writings. New Academic Publishing Co.

Ability Enhancement Compulsory Course-V

PHY-1.2.5A: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ

ਕੁੱਲ ਅੰਕ: 50 **ਵਿਸ਼ੇ ਵਿਚੋਂ ਪਾਸ ਅੰਕ: 40%**
ਬਾਹਰੀ ਪਰੀਖਿਆ: 35 ਅੰਕ **ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ: 15 ਅੰਕ**
ਸਮਾਂ: 3 ਘੰਟੇ **ਕ੍ਰੈਡਿਟ-02, ਕੁੱਲ ਲੈਕਚਰ: 30**

ਪਾਠਕ੍ਰਮ ਅਤੇ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੀ ਰੂਪ-ਰੇਖਾ

ਭਾਗ-ਓ

ਪਾਠਕ੍ਰਮ ਦਾ ਉਦੇਸ਼:

1. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਸਾਹਿਤ ਪੜ੍ਹਨ ਲਈ ਪ੍ਰੇਰਿਤ ਕਰਨਾ।
2. ਮਾਤ ਭਾਸ਼ਾ ਵਿੱਚ ਉਚੇਰੀ ਸਿੱਖਿਆ ਗ੍ਰਹਿਣ ਕਰਨ ਦੀ ਜਾਗ ਲਾਉਣਾ।
3. ਵਿਆਕਰਨਕ ਪੱਖਾਂ ਨਾਲ ਰਾਬਤਾ ਕਾਇਮ ਕਰਵਾਉਣਾ।
4. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਚਿੱਠੀ-ਪੱਤਰ ਲਿਖਣਾ ਸਿਖਾਉਣਾ।

ਓ- ਜੀਵਨ-ਵਿਹਾਰ (ਵਾਰਤਕ-ਸੰਗ੍ਰਹਿ), ਮੁੱਖ ਸੰਪਾ. ਡਾ. ਜਸਵੀਰ ਸਿੰਘ, ਸੰਪਾ. ਡਾ. ਅਵਤਾਰ ਸਿੰਘ, ਡਾ. ਗੁਰਪ੍ਰੀਤ ਕੌਰ, ਪ੍ਰੋ. ਸੁਖਵਿੰਦਰ ਸਿੰਘ, ਸ੍ਰੀ ਗੁਰੂ ਤੇਗ਼ ਬਹਾਦਰ ਖ਼ਾਲਸਾ ਕਾਲਜ, ਸ੍ਰੀ ਅਨੰਦਪੁਰ ਸਾਹਿਬ ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਦੂਜੀ ਐਡੀਸ਼ਨ।

ਭਾਗ-ਅ

ਅ-1: ਦਫ਼ਤਰੀ ਚਿੱਠੀ- ਪੱਤਰ

ਅ-2: ਵਿਆਕਰਨ

(i) ਭਾਸ਼ਾ ਦਾ ਟਕਸਾਲੀ ਰੂਪ
(ii) ਭਾਸ਼ਾ ਅਤੇ ਉਪਭਾਸ਼ਾ ਦਾ ਅੰਤਰ
(iii) ਪੂਰਬੀ ਪੰਜਾਬ ਦੀਆਂ ਉਪਭਾਸ਼ਾਵਾਂ ਦੇ ਪਛਾਣ-ਚਿੰਨ੍ਹ

ਭਾਗ-ਏ

ਜੀਵਨ-ਵਿਹਾਰ ਅਤੇ ਵਿਆਕਰਨ ਵਿਚੋਂ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 15 ਲਾਜ਼ਮੀ ਪ੍ਰਸ਼ਨ

ਪੇਪਰ ਸੈਟਰ/ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਹਦਾਇਤਾਂ:

1. ਭਾਗ-ਓ: ਵਿਚੋਂ ਨਿਬੰਧ ਦਾ ਵਿਸ਼ਾ-ਵਸਤੂ ਜਾਂ ਸਾਰ (ਤਿੰਨ ਵਿਚੋਂ ਇੱਕ) 07 ਅੰਕ
2. ਭਾਗ-ਅ:1 ਵਿਚੋਂ ਚਿੱਠੀ-ਪੱਤਰ (ਤਿੰਨ ਵਿਚੋਂ ਇੱਕ) 06 ਅੰਕ
3. ਭਾਗ-ਅ:2 ਵਿਚੋਂ ਵਿਆਕਰਨ ਨਾਲ ਸੰਬੰਧਿਤ ਵਰਣਾਤਮਕ ਪ੍ਰਸ਼ਨ (ਦੋ ਵਿਚੋਂ ਇੱਕ) 07 ਅੰਕ
4. ਭਾਗ-ਏ ਵਿਚ ਭਾਗ ਓ ਅਤੇ ਵਿਆਕਰਨ ਵਿੱਚੋਂ ਕੁੱਲ 15(8+7) ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ ਲਾਜ਼ਮੀ ਪ੍ਰਸ਼ਨ। ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਸਾਰੇ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹਨ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ 01 ਅੰਕ ਦਾ ਹੋਵੇਗਾ । 15X1=15ਅੰਕ

ਸਹਾਇਕ ਪੁਸਤਕਾਂ:

1. ਬਲਵੀਰ ਸਿੰਘ ਦਿਲ, ਪੰਜਾਬੀ ਨਿਬੰਧ: ਸਰੂਪ, ਸਿਧਾਂਤ ਅਤੇ ਵਿਕਾਸ, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ।
2. ਖੋਜ ਪੱਤ੍ਰਿਕਾ, ਨਿਬੰਧ ਅੰਕ-29, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਪੰਜਾਬੀ, ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ
3. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਸ੍ਰੋਤ ਤੇ ਸਰੂਪ, ਵਾਰਿਸ਼ ਸ਼ਾਹ ਫਾਂਊਡੇਸ਼ਨ ਅੰਮ੍ਰਿਤਸਰ, 2012
4. ਬਲਦੇਵ ਸਿੰਘ ਚੀਮਾ, ਪੰਜਾਬੀ ਵਿਆਕਰਨ ਤੇ ਭਾਸ਼ਾ ਵਿਗਿਆਨ, ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਦਾ ਵਿਸ਼ਾ ਕੋਸ਼, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ, 2009
5. ਡਾ. ਜੋਗਿੰਦਰ ਸਿੰਘ ਪੁਆਰ ਅਤੇ ਹੋਰ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਵਿਆਕਰਨਕ ਭਾਗ I, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ, ਜਲੰਧਰ, 1991
6. ਗਿਆਨੀ ਲਾਲ ਸਿੰਘ ਤੇ ਹਰਕੀਰਤ ਸਿੰਘ, ਕਾਲਜ ਪੰਜਾਬੀ ਵਿਆਕਰਣ, ਪੰਜਾਬ ਸਟੇਟ ਯੂਨੀ. ਟੈਕਸਟ ਬੁੱਕ ਬੋਰਡ, ਚੰਡੀਗੜ੍ਹ
7. ਸੰਤ ਸਿੰਘ ਸੇਖੋਂ, ਸਾਹਿਤਆਰਥ, ਲਾਹੌਰ ਬੁੱਕ ਸ਼ਾਪ, ਲੁਧਿਆਣਾ

ਪਾਠਕ੍ਰਮ ਦਾ ਉਦੇਸ਼:

1. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਸਾਹਿਤ ਪੜ੍ਹਨ ਲਈ ਪ੍ਰੇਰਿਤ ਕਰਨਾ।
2. ਮਾਤ ਭਾਸ਼ਾ ਵਿੱਚ ਉਚੇਰੀ ਸਿੱਖਿਆ ਗ੍ਰਹਿਣ ਕਰਨ ਦੀ ਜਾਗ ਲਾਉਣਾ।
3. ਵਿਆਕਰਨਕ ਪੱਖਾਂ ਨਾਲ ਰਾਬਤਾ ਕਾਇਮ ਕਰਵਾਉਣਾ।
4. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਚਿੱਠੀ-ਪੱਤਰ ਲਿਖਣਾ ਸਿਖਾਉਣਾ।

ਪਾਠਕ੍ਰਮ ਦੀ ਸਾਰਥਕਤਾ:

1. ਵਿਦਿਆਰਥੀਆਂ ਅੰਦਰ ਨਿਬੰਧਾਂ ਨਾਲ ਸੰਬੰਧਿਤ ਪਰਤਾਂ ਨੂੰ ਉਜਾਗਰ ਕਰਨ ਦਾ ਹੁਨਰ ਪੈਦਾ ਹੋਵੇਗਾ।
2. ਵਿਦਿਆਰਥੀ ਵਿਆਕਰਨਕ ਨੇਮ-ਵਿਧਾਨ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ।

Ability Enhancement Compulsory Course-V

PHY-1.2.5B: ਪੰਜਾਬੀ ਮੁੱਢਲਾ ਗਿਆਨ

ਕੁੱਲ ਅੰਕ: 50 **ਵਿਸ਼ੇ ਵਿਚੋਂ ਪਾਸ ਅੰਕ:** 40%
ਬਾਹਰੀ ਪਰੀਖਿਆ: 35 ਅੰਕ **ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ :**15 ਅੰਕ
ਸਮਾਂ: 3 ਘੰਟੇ **ਕ੍ਰੈਡਿਟ-02, ਕੁੱਲ ਲੈਕਚਰ:** 30

ਪਾਠਕ੍ਰਮ ਅਤੇ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੀ ਰੂਪ-ਰੇਖਾ

ਭਾਗ-ਓ

ਓ- 1. ਵਿਰੋਧੀ ਸ਼ਬਦ, ਸਮਾਨਾਰਥਕ ਸ਼ਬਦ
2. ਲਿੰਗ, ਵਚਨ, ਕਾਲ ਅਤੇ ਪੁਰਖ
3. ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ (ਨਾਂਵ, ਪੜਨਾਂਵ ਅਤੇ ਕਿਰਿਆ): ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਉਦਾਹਰਣਾਂ
4. ਵਿਸ਼ਰਾਮ ਚਿੰਨ੍ਹਾਂ ਦੀ ਵਰਤੋਂ

ਭਾਗ-ਅ

ਅ – 1. ਚਿੱਠੀ ਪੱਤਰ: ਫ਼ੀਸ ਮੁਆਫ਼ੀ ਅਤੇ ਬਿਮਾਰੀ ਕਾਰਨ ਛੁੱਟੀ ਲੈਣ ਸੰਬੰਧੀ
2. ਦੇਸੀ ਅਤੇ ਅੰਗਰੇਜ਼ੀ ਮਹੀਨਿਆਂ ਦੇ ਨਾਂ
3. ਇੱਕ ਤੋਂ ਸੌ ਤੱਕ ਗਿਣਤੀ

ਭਾਗ-ਏ

ਭਾਗ ਓ ਅਤੇ ਅ ਵਿਚੋਂ ਅਬਜੈਕਟਿਵ ਪ੍ਰਸ਼ਨ

ਪੇਪਰ ਸੈੱਟਰ ਅਤੇ ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਹਦਾਇਤਾਂ:

1. ਸਾਰਾ ਪੇਪਰ ਅੱਖਰ ਗਿਆਨ (ਭਾਗ-ਪਹਿਲਾ), ਡਾ. ਜਸਵੀਰ ਸਿੰਘ, ਡਾ. ਗੁਰਪ੍ਰੀਤ ਕੌਰ, ਸ੍ਰੀ ਗੁਰੂ ਤੇਗ਼ ਬਹਾਦਰ ਖ਼ਾਲਸਾ ਕਾਲਜ, ਸ੍ਰੀ ਅਨੰਦਪੁਰ ਸਾਹਿਬ, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ ਵਿਚੋਂ ਹੀ ਸੈੱਟ ਕੀਤਾ ਜਾਵੇ।
2. ਭਾਗ-ਓ: ਵਿਚੋਂ ਵਰਣਾਤਮਕ ਪ੍ਰਸ਼ਨ (ਦੋ ਵਿਚੋਂ ਇੱਕ) 04 ਅੰਕ
3. ਭਾਗ-ਓ ਵਿਚੋਂ ਸੰਖੇਪ ਪ੍ਰਸ਼ਨ (ਪੰਜ ਵਿਚੋਂ ਤਿੰਨ) 2+2+2= 06 ਅੰਕ
4. ਭਾਗ-ਅ ਵਿਚੋਂ ਚਿੱਠੀ-ਪੱਤਰ (ਦੋ ਵਿਚੋਂ ਇੱਕ) 04 ਅੰਕ
5. ਭਾਗ-ਅ ਵਿਚੋਂ ਸੰਖੇਪ ਪ੍ਰਸ਼ਨ (ਪੰਜ ਵਿਚੋਂ ਤਿੰਨ)2+2+2= 06 ਅੰਕ
6. ਭਾਗ-ਏ ਵਿਚ ਭਾਗ ਓ ਅਤੇ ਅ ਵਿਚੋਂ ਕੁੱਲ 15 ਅਬਜੈਕਟਿਵ ਪ੍ਰਸ਼ਨ। ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਸਾਰੇ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹਨ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ 01 ਅੰਕ ਦਾ ਹੋਵੇਗਾ । (15X1=15 ਅੰਕ)

ਨੋਟ: ਵਿਦਿਆਰਥੀ ਗੁਰਮੁਖੀ ਸਿੱਖ ਰਹੇ ਹਨ। ਇਸ ਲਈ ਵਿਦਿਆਰਥੀਆਂ ਦੇ ਪੱਧਰ ਨੂੰ ਧਿਆਨ ਵਿੱਚ ਰੱਖਦੇ ਹੋਏ ਸਰਲ ਅਤੇ ਸਪੱਸ਼ਟ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣ।

ਸਹਾਇਕ ਪੁਸਤਕਾਂ:

1. ਗਿਆਨ (ਭਾਗ-ਪਹਿਲਾ), ਡਾ. ਜਸਵੀਰ ਸਿੰਘ, ਡਾ. ਗੁਰਪ੍ਰੀਤ ਕੌਰ, ਸ੍ਰੀ ਗੁਰੂ ਤੇਗ਼ ਬਹਾਦਰ ਖ਼ਾਲਸਾ ਕਾਲਜ, ਸ੍ਰੀ ਅਨੰਦਪੁਰ ਸਾਹਿਬ, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ ।
2. ਸਤਿਨਾਮ ਸਿੰਘ ਸੰਧੂ, ਆਓ ਪੰਜਾਬੀ ਸਿੱਖੀਏ, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ, 2009
3. ਸਤਿਨਾਮ ਸਿੰਘ ਸੰਧੂ, ਗੁਰਮੁਖੀ ਸਿੱਖੋ, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ, 2011
4. ਸੀਤਾ ਰਾਮ ਬਾਹਰੀ, ਪੰਜਾਬੀ ਸਿੱਖੀਏ, ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ, 2002
5. ਪੰਜਾਬੀ ਗਿਆਨ ਸੀ. ਡੀ. (ਕੰਪਿਊਟਰ ਐਪਲੀਕੇਸ਼ਨ ਟੂ-ਲਰਨ ਐਂਡ ਟੀਚ ਪੰਜਾਬੀ), ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ
6. ਚਰਨ ਪੁਆਧੀ, ਆਓ ਪੰਜਾਬੀ ਸਿੱਖੀਏ, ਸੰਗਮ ਪਬਲੀਕੇਸ਼ਨ, ਪਟਿਆਲਾ

ਪਾਠਕ੍ਰਮ ਦਾ ਉਦੇਸ਼:

1. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਲੇਖ ਲਿਖਣਾ ਅਤੇ ਚਿੱਠੀ ਪੱਤਰ ਲਿਖਣਾ ਸਿਖਾਉਣਾ।
2. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਸ਼ੁੱਧ ਪੰਜਾਬੀ ਬੋਲਣਾ, ਪੜ੍ਹਨਾ ਅਤੇ ਲਿਖਣਾ ਸਿਖਾਉਣਾ।

ਪਾਠਕ੍ਰਮ ਦੀ ਸਾਰਥਕਤਾ:

1. ਵਿਦਿਆਰਥੀ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਸ਼ੁੱਧ ਸੰਚਾਰ ਕਰਨ ਦੇ ਯੋਗ ਹੋਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੇ ਵਿਆਕਰਨਕ ਨੇਮਾਂ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ।

Ability Enhancement Compulsory Course-VI

PHY-1.2.6: ENVIRONMENTAL AND ROAD SAFETY AWARENESS

Total Marks: 100 **Max Time: 3 Hrs.**
Theory: 70 Marks **Credits: 4**
Internal Assessment: 30 Marks **Passing Marks: 40%**
Mandatory Field Visit

(Internal assessment consists of 5 marks for Attendance, 10 marks for MST and 15 marks for Report to the visit of Local Area/Science City)

INSTRUCTIONS FOR THE PAPER SETTERS

The question paper will consist of three sections A, B and C. Each of sections A and B will have four questions from the respective sections of the syllabus. Each question shall carry 10 marks. Section C will consist of 10 short answer type questions of 3 marks each.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt any two questions from each section A and B. Section C is compulsory.

Section A

Introduction to Environmental Studies:

The Multidisciplinary Nature of Environmental Studies. Definition, Scope and Importance
Concept of Biosphere – Lithosphere, Hydrosphere, Atmosphere.

Ecosystem and Biodiversity Conservation

Ecosystem and its Components, Types of Ecosystems.
Biodiversity - Definition and Value, Threats to Biodiversity and its Conservation. Level of Biological Diversity: Genetic, Species and Ecosystem Diversity; Bio-geographic Zones of India; Biodiversity Patterns and Global Biodiversity Hot Spots. India as Mega-Biodiversity Nation; Endangered and Endemic Species of India. Ecosystem and Biodiversity Services: Ecological, Economic, Social, Ethical, Aesthetic and Informational Value.

Natural Resources–Renewable and Non Renewable Resources

Land Resources and Land Use Change, Land Degradation, Soil Erosion and Desertification.
Deforestation, Causes and Impacts due to Mining, Dam Building on Environment, Forests, Biodiversity and Tribal Populations. Water Use and Over-Exploitation of Surface and Ground Water, Floods, Droughts, Conflicts over Water (International and Inter-State) Energy Resources: Renewable and Nonrenewable Energy Sources, Use of Alternate Energy Sources, Growing Energy Needs, Case Studies.

Environmental Pollution

Types, Causes, Effects and Controls of Air, Water, Soil and Noise Pollution. Nuclear Hazards and Human Health Risks, Solid Waste Management, Source Segregations: Control Measures of Urban and Industrial Wastes Pollution Case Studies.

Section B

Environmental Protection Laws in India

Environmental Protection Act for Air (Prevention and Control of Pollution), Water (Prevention and Control Of Pollution), Wild Life, Forest Conservation, Issues Involved in the Enforcement of Environmental Legislation, Role of an Individual in Prevention of Pollution.
Environmental Policies and Practices; Climate Change, Global Warming, Ozone Layer Depletion, Acid Rain and Impacts on Human Communities and Agriculture.

Human Communities and The Environment

Human Population Growth, Impacts on Environment, Human Health and Welfare, Sanitation and Hygiene. Resettlement and Rehabilitation of Project Affected Persons; Case Studies. Disaster Management: Floods, Earthquake, Cyclones and Landslides. Environment Movements: Chipko, Silent Valley, Bishnois of Rajasthan. Environmental Ethics: Role of Indian and other Religions and Cultures in Environmental Conservation for a Clean-Green Pollution Free State. Environmental Communication and Public Awareness, Case Studies (E.G., CNG Vehicles in Delhi)

Road Safety Awareness

Concept and Significance of Road Safety, Traffic Signs, Traffic Rules, Traffic Offences and Penalties, How to obtain License, Role of First Aid in Road Safety.

Stubble Burning

Meaning of Stubble Burning, Impact on Health and Environment, Management and Alternative Uses of Crop Stubble, Environmental Legislations and Policies for Restriction of Agriculture Residue Burning in Punjab.

Field Work

Visit to an Area to Document Environmental Assets: River/Forest/Flora/Fauna, etc.
Visit to Local Polluted Site –Urban/Rural/Industrial/Agricultural.
Study of Common Plants, Insects, Birds and Basic Principles of Identification.
Study of Simple Ecosystems - Pond, River, Delhi Ridge, etc.

Suggested Readings:

1. Carson, R. (2002). Silent Spring, Houghton Mifflin Harcourt.
2. Gadgil, M., and Guha, R. (1993). This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) (1999). Global Ethics and Environment, London, Routledge.
4. Gleick, P.H. (1993). Water in Crisis. Pacific Institute for Studies in Dev. Environment and Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, M.J., Gary K.M. and Carl R.C. (2006). Principles of Conservation Biology. Sunderland: Sinauer Associates.
6. Grumbine, R.E. and Pandit, M.K. (2013). Threats from India's Himalayas Dams. Science, 339: 36-37.
7. McCully, P. (1996). Rivers No More: The Environmental Effects of Dams, Zed Books. pp.29-64.
8. McNeill, J.R. (2000). Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., and Barrett, G.W. (1971). Fundamentals of Ecology. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. and Brusseau, M.L. (2011). Environmental and Pollution Sciences, Academic Press.
11. Rao, M.N. andDatta, A.K. (1987). Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. and Berg, L.R. (2012). Environment. 8th Edition. John Wiles and Sons.
13. Rosencranz, A., Divan, S. and Nobie, M.L. (2001). Environmental Law and Policy in India.
14. Sengupta, R. (2003). Ecology and Economics: An Approach to Sustainable Development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. (2014). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
16. Sodhi, N.S. Gibson, L. and Raven, P.H. (eds). (2013). Conservation Biology: Voices from the Tropics. John Wiley and Sons.
17. Thapar, V. (1998). Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Warren, C.E. (1971). Biology and Water Pollution Control. WB Saunders.
19. Wilson, E.O. (2006). The Creation: An Appeal to Save Life on Earth. New York: Norton.
20. World Commission on Environment and Development. (19870. Our Common Future. Oxford University Press.

Interdisciplinary Choice Based Course

IDC-102A: FINE ARTS

Credits: 2 **Maximum Marks: 50**
Number of lectures: 30 **Practical Paper: 40 (Pass Marks: 14)**
Time: 3Hrs + 3Hrs **Internal Assessment: 10**

PAPER- (PRACTICAL)
INSTRUCTIONS FOR THE PAPER SETTER
(For practical paper)

1. The syllabus is self-explanatory in the paper. Choice of medium should be left to the candidates.
2. While evaluating the examiner should see the competency, its technical, artistic, composition, tone, texture and quality.

Outcomes: The course serves to extend the student's awareness of the visual arts and the mechanism of Creativity, precision, tools and materials.

SECTION-A
Still Life Study

Time: 3 hrs **Max. Marks: 20**

(a) Objects to Study proportion, Volume, Texture, Study of Light and Shade
(b) Rhythmic relationship of masses.

Number of objects: Three objects excluding drapery
Medium: Pencil shading, Pastel Colour, Water Colour, Oil Colours or Acrylic Colours
Size: 1/2 imperial

SECTION-B
Landscape Painting

Time: 3 hrs **Max. Marks: 20**

(a) To study the relationship of objects, their arrangements in the foreground, middle distance and distance, texture, relative size of masses, tones and colours, use of linear and aerial perspective.

Medium: Water or Pastel Colours, Oil Colours or Acrylic Colours
Size: 1/2 imperial

Interdisciplinary Choice Based Course

IDC-102B: MUSIC VOCAL

Maximum Marks: 30 **Time: One and Half Hours**
External Examination: 20 **Pass Marks: 35%**
Internal Assessment: 10 **Credit: 1 (1Hour)**

Course objectives:

- To introduce various definitions in the context of Indian Classical Music.
- To aware the students about brief knowledge of different Raag and Taals

INSTRUCTIONS FOR THE PAPER -SETTER

The question paper will consist of three Units: I, II & III. Unit I and II will have 2 questions from the respecting units of the syllabus and will carry five marks each and the candidates will attempt one question from each unit. Unit III will consist of 5 short answer type questions which will cover the entire syllabus uniformly and will carry 10 marks in all. Each question carries 2 marks. There will be no choice in this compulsory question.

INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt two questions each from the unit I and unit II of the question paper and entire Unit-III.

UNIT-I

1. Definition and example of the following technical terms: Thaat, Raag, Sam, Avartan,
2. Importance of Voice culture in Music.

UNIT-II

1. Discription and notation of following Raags: Khamaj, Bhupali.
2. Discritption of following Taals with Ekgun and Dugun layakaries: Ektaal, Ropak Taal,

UNIT-III

This unit will consist of the short answer type questions from Unit-I and Unit-II as mentioned in instructions.

Course leaning outcomes:

- The student will be learning about the basic knowledge of the Indian classical musical terms, role of music in human life.
- The students will also know about the different Raags and Taals, and Importance of Voice culture in Music.

Interdisciplinary Choice Based Course Practical

IDC-102BP: MUSIC VOCAL Practical

Maximum Marks: 20 **Time: 15 Minutes**

Pass Marks: 35% **Credit: 1 (2 Hours)**

INSTRUCTIONS FOR THE PRACTICAL EXAMINER

1. One drut khayal in each of the following Raagas with simple Alap and Taan: Khamaj, Bhupali. (5 Marks)
2. Ability to sing Shabad/Bhajan on Harmonium. (5 Marks)
3. Ability to demonstrate the following Taals by hand with Dugun Layakaries: Ektaal, Roopak (5 Marks)
4. Ability to play Roopak Taal on Tabla. (5 Marks)

Text Books:

1. Harish Chandra Srivastva: Raag Parichaya, Part I, II.
2. V.N. Patwardhan: Raag Vigyan, Part I, II.
3. V.S. Nigam: Sangeet Kaumudi, Part II & III (Punjabi) published by Punjabi University, Patiala
4. Prof. Harish Chandra Srivastva: swarlipi sangreh Part I, II.
5. Dr. Yashpal Sharma, Gayen kala, Published by Punjabi University Patiala.
6. Dr. Davinder Kaur, Sangeet Roop, I, II, III
7. Prof. Jagpinderpal Singh, Bharti Sangeet de Sangeetachariya, Publication Bureau, Sri Guru Teg Bahadar Khalsa College, Sri Anandpur Sahib

Reference Books:

1. Sangeet Shastra Darpan, Part I Punjabi University Patiala, Karyalya
2. Sangeet Vishard, Published by Sangeet Katyalya, Hathras.
3. Veena Mankaran: Sangeet Sar, Part-I
4. Shanti Givardhan: Sangeet Shastra Darpan.
5. Dr. Jagmohan Sharma: Tabla Vadan, Part-I Published by Punjabi University, Patiala.
6. Hamare Sangeet Ratan Published by Sangeet Karyalya, Hathras.
7. Dr. Gurnam Singh: Punjabi Sangeetkar, Published by Punjabi University, Patiala.
8. Dr. Devinder Kaur: Sangeet Roop Part-I
9. Sharatchndra Sharidhar Pranjpe: Sangeet Bodh
10. Prof. Tara Singh: Vadam Kala, Published by Punjabi University, Patiala.
11. Prof. Harish Chandra Srivastva: Raag Prichey Part I, II, III.
12. Pt. Tejpal Singh (Singh Bandhu) Vidhivat sangeet sikshan Part I, II.
13. Pt. Vishnu Narayan Bhatkhandey: Karamik pustak maalika Part 1,2,3,4,5,6
14. Vasant: sangeet visharid
15. Prof. Jagpinderpal Singh: Raag Taal Shastar, published by Zohra Publication Patiala.
16. Prof. Jagpinderpal Singh: Gurmat Sangeet Prbandh, Published by Shaheed-E-Azam Patiala

Interdisciplinary Choice Based Course

IDC-102C: GURMAT SANGEET

Maximum Marks: 30 **Time: One and Half Hours**
External Examination: 20 **Pass Marks: 35%**
Internal Assessment: 10 **Credit: 1 (1 Hour)**

Course objectives:

- To introduce various definitions in the context of Gurmat Sangeet and Indian Classical Music.
- To aware the students about brief biographical sketches of different Sikh Guru Sahibaan.
- To increase the knowledge about different Raags of Sri Guru Granth sahib and different Taals.

INSTRUCTIONS FOR THE PAPER -SETTER

The question paper will consist of three Units: I, II & III. Unit I and II will have 2 questions from the respecting units of the syllabus and will carry five marks each and the candidates will attempt one question from each unit. Unit III will consist of 5 short answer type questions which will cover the entire syllabus uniformly and will carry 10 marks in all. Each question carries 2 marks. There will be no choice in this compulsory question.

INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt two questions each from the unit I and unit II of the question paper and entire Unit- III.

UNIT-I

1. Definition and example of the following technical terms:
   Thaat, Raag, Alaap, Sam, Avartan, Kirtan Chaunki, Shaan, Manglacharan.
2. Contribution of Guru Ramdas ji, Guru Arjun dev ji in the development of Gurmat Sangeet.

UNIT-II

1. Discription and notation of following Raags: Bhairav, Aasa.
2. Discritption of following Taals with Ekgun and Dugun layakaries: Ektaal, Roopak Taal,

UNIT-III

This unit will consist of the short answer type questions from Unit-I and Unit-II as mentioned in instructions.

Course leaning outcomes:

- The student will be learning about the basic knowledge of the Indian classical & Gurmat Sangeet musical terms.
- The students will also know about the different Gurma Sangeet Raags and different Taals.

Interdisciplinary Choice Based Course Practical

IDC-102CP: GURMAT SANGEET Practical

Maximum Marks: 20 **Time: 15 Minutes**
Credit: 1 (2 Hours) **Pass Marks: 35%**

INSTRUCTIONS FOR THE PRACTICAL EXAMINER

1. Ability to play Shaan in any of the prescribed Raags (Bhairav or Aasa). (5 Marks)
2. One Shabad from the prescribed Raags: Bhairav or Aasa. (5 Marks)
3. Ability to demonstrate Ektaal and Roopak taal on hand. (5 Marks)
4. Ability to play Roopak taal on Tabla. (5 Marks)

Text Books:

5. V.N. Patwardhan: Raag Vigyan, Part I, II.
6. V.S. Nigam: Sangeet Kaumudi, Part II & III (Punjabi) published by Punjabi University, Patiala
7. Dr. Davinder Kaur, Sangeet Roop, I, II, III
8. Prof.Jagpinderpal Singh, Bharti Sangeet de Sangeetachariya, Publication Bureau, Sri Guru Teg Bahadar Khalsa College, Sri Anandpur Sahib

Reference Books:

1. Gurmat Sangeet Parbandh te Pasaar: Dr. Gurnam Singh, Publication Bureau Punjabi University, Patiala.
2. TablaVadan Part-I: Dr. Jagmohan Sharma, Publication Bureau Punjabi University, Patiala.
3. Gurmat Sangeet Parbandh: Prof. Jagpinder pal singh, Shaheed - E -Azam Publication.
4. SamajikVigyan Patar Gurmat Sangeet Vishesh Ank: Dr. Jasbir Kaur, Publication Bureau Punjabi University, Patiala.
5. Sangeet Roop: Dr. Davinder Kaur, Sangeetanjali Publications Patiala.
6. Gurmat Sangeet Di Itehasik Vilakhanta: Dr. Jasbir Kaur, Patiala
7. Sri Guru Granth Sahib Raag Ratnavali: Prof. Tara Singh.
8. Gurmat Sangeet Wich Paryukt Lok Sangeetak Tat: Dr. Gurpartap Singh Gill, Publication Bureau Punjabi University, Patiala.
9. Sangeet (Gurmat Sangeet Vishesh Ank): Sangeet Karayalaya, Hathras.
10. Amrit Kirtan, (Gurmat Sangeet Vishesh Ank): Amrit kirtan Trust, Chandigarh.
11. Sri Guru Granth Sahib Raag Ratan: Prof. Jagpinder pal singh, Shaheed - E -Azam Publication.
12. RaagTaal Sahaster Shabad Bandishan: Prof. Jagpinder pal singh, Shaheed - E -Azam Publication.
13. Sangeet Sidhant Te Sohaj Shaster: Dr. D.S. Narula, Publication Bureau Punjabi University, Patiala.
14. Sri Guru Granth Sahib Raag Ratankar: Dr. Gurnam Singh, Publication, SGPC, Sri Amritsar Sahib
15. Gyan ShailiyanVishesh Ank Samajik Vigyan Patrika Dr. Jasbir Kaur, Publication Bureau Punjabi University, Patiala.
16. Prof. Jagpinderpal Singh: Raag Taal Shastar, published by Zohra Publication Patiala.
17. Prof. Jagpinderpal Singh: Gurmat Sangeet Prbandh, Published by Shaheed-E-Azam Patiala

ਅੰਤਰ ਅਨੁਸ਼ਾਸਨੀ ਕੋਰਸ

IDC-102D: ਸਿੱਖ ਧਰਮ

ਕੁੱਲ ਅੰਕ : 50 **ਵਿਸ਼ੇ ਵਿਚੋਂ ਪਾਸ ਅੰਕ : 40%**
ਬਾਹਰੀ ਪਰੀਖਿਆ : 35 ਅੰਕ **ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ : 15 ਅੰਕ**
ਸਮਾਂ : 3 ਘੰਟੇ **ਕ੍ਰੈਡਿਟ-02, ਕੁੱਲ ਲੈਕਚਰ : 30**

ਪਾਠਕ੍ਰਮ ਅਤੇ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੀ ਰੂਪ-ਰੇਖਾ

ਭਾਗ-ਓ

1. ਸਿੱਖ ਧਰਮ : ਆਰੰਭ ਅਤੇ ਵਿਕਾਸ
2. ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਜੀ: ਜੀਵਨ ਅਤੇ ਸਿਖਿਆਵਾਂ
3. ਕਿਰਤ ਕਰਨਾ, ਨਾਮ ਜਪਣਾ ਅਤੇ ਵੰਡ ਛਕਣਾ

ਭਾਗ-ਅ

ਅ-1:

1. ਸ਼ਹਾਦਤ ਦਾ ਸੰਕਲਪ
2. ਗੁਰਦੁਆਰਾ: ਮੁੱਢਲੀ ਜਾਣਕਾਰੀ

ਅ-2:

1. ਸ੍ਰੀ ਗੁਰੂ ਗ੍ਰੰਥ ਸਾਹਿਬ
2. ਅਜੋਕੇ ਸਮੇਂ ਵਿੱਚ ਸਿੱਖ ਧਰਮ ਦੀ ਸਾਰਥਕਤਾ

ਭਾਗ-ਏ

ਭਾਗ ਓ, ਭਾਗ ਅ : 1, ਅ : 2 ਅਤੇ ਭਾਗ "ਏ" ਵਿਚੋਂ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 15 ਲਾਜ਼ਮੀ ਪ੍ਰਸ਼ਨ ਹੋਣਗੇ।

ਪੇਪਰ ਸੈਟਰ/ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਹਦਾਇਤਾਂ

1.ਭਾਗ-ਓ (ਤਿੰਨ ਵਿਚੋਂ ਇੱਕ) 07 ਅੰਕ
2.ਭਾਗ-ਅ:1 (ਦੋ ਵਿਚੋਂ ਇੱਕ) 06 ਅੰਕ
3.ਭਾਗ-ਅ:2 (ਦੋ ਵਿਚੋਂ ਇੱਕ) 07 ਅੰਕ
4. ਭਾਗ-ਏ ਵਿਚ ਭਾਗ ਓ ਅਤੇ ਭਾਗ ਅ: 1, ਭਾਗ ਅ :2 ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ ਲਾਜ਼ਮੀ ਪ੍ਰਸ਼ਨ ਹੋਣਗੇ ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਸਾਰੇ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹਨ ।ਹਰੇਕ ਪ੍ਰਸ਼ਨ 01 ਅੰਕ ਦਾ ਹੋਵੇਗਾ। 15*1=15 ਅੰਕ

ਸੁਝਾਈਆਂ ਪੁਸਤਕਾਂ:

ਪੰਜਾਬੀ :

1. ਸਰਬਜਿੰਦਰ ਸਿੰਘ, ***ਧਰਮ,*** ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ।
2. ਵਜ਼ੀਰ ਸਿੰਘ, ***,,ਫ਼ਲਸਫ਼ਾ ਅਤੇ ਸਿੱਖ ਫ਼ਲਸਫ਼ਾ,*** ਮਦਾਨ ਪਬਲਿਸ਼ਰਜ਼, ਪਟਿਆਲਾ।
3. ਜਸਪਾਲ ਸਿੰਘ, ***ਸ੍ਰੀ ਗੁਰੂ ਗ੍ਰੰਥ ਸਾਹਿਬ ਸਦੀਵੀ ਪ੍ਰੇਰਨਾ ਸਰੋਤ***, ਪੰਜਾਬੀ ਅਕਾਦਮੀ, ਦਿੱਲੀ।

English readings:

1. Gopal Singh, ***Thus Spoke the Tenth Master***, Punjabi University, Patiala.
2. Ganda Singh and Teja Singh, **A Short History of the Sikhs**, Punjabi University, Patiala.

ਪਾਠ ਕ੍ਰਮ ਦਾ ਉਦੇਸ਼

1. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਧਰਮ ਦਾ ਅਧਿਐਨ ਕਰਨ ਅਤੇ ਸਾਹਿਤ ਪੜ੍ਹਨ ਲਈ ਪ੍ਰੇਰਿਤ ਕਰਨਾ।
2. ਮਨੁੱਖੀ ਜੀਵਨ ਵਿਚ ਧਾਰਮਿਕ ਮਹੱਤਤਾ ਬਾਰੇ ਮੁੱਢਲੀ ਜਾਣਕਾਰੀ ਪ੍ਰਦਾਨ ਕਰਨਾ।
3. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਮਨੁੱਖੀ ਕਦਰਾਂ ਕੀਮਤਾਂ ਅਤੇ ਨੈਤਿਕਤਾ ਸਿਖਾਉਣਾ।
4. ਧਾਰਮਿਕ ਗ੍ਰੰਥਾਂ, ਸਾਸ਼ਤਰਾਂ ਅਤੇ ਫ਼ਲਸਫ਼ੇ ਰਾਹੀਂ ਮਹਾਨ ਧਾਰਮਿਕ ਸਿੱਖਿਆਵਾਂ ਦੀ ਜਾਣ-ਪਛਾਣ ਕਰਵਾਉਣਾ।
5. ਵਿਦਿਆਰਥੀਆਂ ਦੀ ਸ਼ਖ਼ਸੀਅਤ ਦਾ ਸਰਵਪੱਖੀ ਵਿਕਾਸ ਕਰਨਾ।

ਪਾਠਕ੍ਰਮ ਦੀ ਸਾਰਥਕਤਾ:

1. ਵਿਦਿਆਰਥੀਆਂ ਅੰਦਰ ਧਰਮ ਨਾਲ ਸੰਬੰਧਿਤ ਪਰਤਾਂ ਨੂੰ ਉਜਾਗਰ ਕਰਨ ਦਾ ਹੁਨਰ ਪੈਦਾ ਹੋਵੇਗਾ।
2. ਵਿਦਿਆਰਥੀ ਧਰਮ ਅਧਿਐਨ ਵਿਸ਼ੇ ਦੀ ਸਮਾਜ ਵਿਚ ਲੋੜ ਅਤੇ ਮਹੱਤਵ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ।

Interdisciplinary Choice Based Course

IDC-102E: CREATIVE WRITING

Time Allowed: 3 Hours **Max. Marks: 50**
Total Lectures: 30 **Written Examination: 35**
Credits: 02 **Internal Assessment: 15**

Internal Assessment: Assignments/Projects

I. Critical appreciation of any literary text chosen in consultation with the concerned teacher. (5 Marks)

II. Writing a piece of fiction- novella, story, play or poem with commentary on the written text as well as the experience of writing. (10 Marks)

Testing:

Question I will have one long answer type question which shall be set from Unit I with an internal choice.
Question II will have one long answer type question which shall be set from Unit I with an internal choice.
Question III will have one long answer type question which shall be set from Unit II with an internal choice
Question IV will have one long answer type question which shall beset from Unit II with an internal choice. (4x5=20 marks)

Question V shall comprise ten short-answer type questions of about 100-120 words each. (10x1.5=15 marks)

Objectives:

- To acquaint the learners with ideas related to creative writing including the art, the craft and the basic skills required for a creative writer
- To help learners to understand the principles of creative writing and the distinction between the literary genres
- To explain the differences in writing for various literary and social media
- To enable learners to put into practice the various forms of creative writing that they have studied through the course.

UNIT I

Introduction to new trends in Creative Writing –I

- Web Content Writing and Blog Writing: Meaning, Process, Benefits
- Script Writing: Meaning, Process, Benefits
- Journalistic Writing: Meaning, Process, Benefits

UNIT II

Introduction to new trends in Creative Writing-II

- Copy writing
- Graphic Novel
- Popular Fiction

Learning Outcomes: At the end of the course, learners will be able to:

- Distinguish between the literary genres
- Write for various literary and social media
- Critically appreciate various forms of literature
- Make innovative use of their creative and critical faculties
- Seek employment in various creative fields

List of References:

- Abrams, M.H. *Glossary of Literary Terms*. Boston: Wadsworth Publishing Company, 2005.
- Bell, Julia and Magrs, Paul. *The Creative Writing Course-Book*. London: Macmillan, 2001.
- Berg, Carly. *Writing Flash Fiction: How to Write Very Short Stories and Get Them Published*. **Then Re-Publish Them All Together as a Book*. Houston: Magic Lantern Press, 2015.
- Turabian, Kate L. *A Manual for Writers*. Chicago: Univ. of Chicago Press, 2007
- Samuel R Delany. *About Writing*

ਅੰਤਰ-ਅਨੁਸ਼ਾਸ਼ਨੀ ਕੋਰਸ

IDC-102F: ਪੰਜਾਬੀ ਲੋਕਧਾਰਾ ਅਤੇ ਸਭਿਆਚਾਰ

ਕੁੱਲ ਅੰਕ: 50 **ਪਾਸ ਅੰਕ:** 35%
ਬਾਹਰੀ ਪ੍ਰੀਖਿਆ: 35 ਅੰਕ **ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ:** 15 ਅੰਕ
ਪ੍ਰੀਖਿਆ ਦਾ ਸਮਾਂ: 3 ਘੰਟੇ **ਕ੍ਰੈਡਿਟ:** 02, **ਕੁੱਲ ਲੈਕਚਰ:** 30

ਪਾਠਕ੍ਰਮ ਅਤੇ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੀ ਰੂਪ-ਰੇਖਾ

ਭਾਗ-ਓ

1. ਸਭਿਆਚਾਰ ਦੀ ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਲੱਛਣ
2. ਸਭਿਆਚਾਰ ਦੇ ਅੰਗ
3. ਸਭਿਆਚਾਰ ਅਤੇ ਲੋਕਧਾਰਾ
4. ਸਭਿਆਚਾਰ ਅਤੇ ਪੰਜਾਬੀ ਮੀਡੀਆ

ਭਾਗ-ਅ

1. ਪੰਜਾਬੀ ਸਭਿਆਚਾਰ ਦੇ ਨਿਖੜਵੇਂ ਲੱਛਣ
2. ਪੰਜਾਬੀ ਸਭਿਆਚਾਰ ਦਾ ਬਦਲਦਾ ਮੁਹਾਂਦਰਾ
3. ਪਹਿਰਾਵਾ
4. ਰਿਸ਼ਤਾ-ਨਾਤਾ ਪ੍ਰਬੰਧ

ਭਾਗ-ਏ

ਉਪਰੋਕਤ ਸਿਲੇਬਸ'ਤੇ ਆਧਾਰਿਤ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 05 ਪ੍ਰਸ਼ਨ

ਪੇਪਰ ਸੈਟਰ/ਵਿਦਿਆਰਥੀਆਂ ਲਈ ਹਦਾਇਤਾਂ

1. ਸਾਰੇ ਸਿਲੇਬਸ ਵਿਚੋਂ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣ।
2. ਭਾਗ ਓ ਵਿਚੋਂ ਵਰਣਾਤਮਕ ਪ੍ਰਸ਼ਨ (ਦੋ ਵਿਚੋਂ ਇੱਕ) 09 ਅੰਕ
3. ਭਾਗ ਅ ਵਿਚੋਂ ਵਰਣਾਤਮਕ ਪ੍ਰਸ਼ਨ (ਦੋ ਵਿਚੋਂ ਇੱਕ) 09 ਅੰਕ
4. ਭਾਗ ਏ ਵਿਚ ਸਾਰੇ ਸਿਲੇਬਸ ਵਿਚੋਂ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 05 ਲਾਜ਼ਮੀ ਪ੍ਰਸ਼ਨ 5x3=15 ਅੰਕ

ਸਹਾਇਕ ਪੁਸਤਕਾਂ:

1. ਡਾ. ਵਣਜਾਰਾ ਬੇਦੀ, ਲੋਕਧਾਰਾ ਵਿਸ਼ਵਕੋਸ਼ (ਜਿਲਦ ਪਹਿਲੀ ਤੋਂ ਅੱਠਵੀਂ ਤੱਕ), ਨੈਸ਼ਨਲ ਬੁੱਕ ਸ਼ਾਪ, ਨਵੀਂ ਦਿੱਲੀ।
2. ਗਿਆਨੀ ਗੁਰਦਿੱਤ ਸਿੰਘ, ਮੇਰਾ ਪਿੰਡ, ਸਾਹਿਤ ਸਦਨ, ਚੰਡੀਗੜ੍ਹ।
3. ਟੀ. ਆਰ. ਵਿਨੋਦ, ਸੰਸਕ੍ਰਿਤੀ: ਸਿਧਾਂਤ ਤੇ ਵਿਹਾਰ, ਲੋਕਗੀਤ ਪ੍ਰਕਾਸ਼ਨ, ਚੰਡੀਗੜ੍ਹ।
4. ਟੀ. ਆਰ. ਵਿਨੋਦ, ਸੰਸਕ੍ਰਿਤੀ ਤੇ ਪੰਜਾਬੀ ਸੰਸਕ੍ਰਿਤੀ, ਲੋਕਗੀਤ ਪ੍ਰਕਾਸ਼ਨ, ਚੰਡੀਗੜ੍ਹ।
5. ਗੁਰਬਖਸ਼ ਸਿੰਘ ਫ਼ਰੈਕ, ਸਭਿਆਚਾਰ ਅਤੇ ਪੰਜਾਬੀ ਸਭਿਆਚਾਰ, ਦੀ ਪੰਜਾਬੀ ਰਾਈਟਰਜ਼ ਕੋਆਪਰੇਟਿਵ ਸੁਸਾਇਟੀ ਲਿਮਿਟਿਡ, ਲੁਧਿਆਣਾ।
6. ਜਸਵਿੰਦਰ ਸਿੰਘ, ਪੰਜਾਬੀ ਸਭਿਆਚਾਰ: ਪਛਾਣ ਚਿੰਨ੍ਹ, ਪੁਨੀਤ ਪ੍ਰਕਾਸ਼ਨ, ਪਟਿਆਲਾ
7. ਡਾ. ਧਨਵੰਤ ਕੌਰ ਅਤੇ ਇੰਦਰਜੀਤ ਕੌਰ (ਅਨੁਵਾਦਕ), ਸਭਿਆਚਾਰ ਦੇ ਚਾਰ ਅਧਿਆਇ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ।

ਪਾਠਕ੍ਰਮ ਦਾ ਉਦੇਸ਼:

1. ਸਭਿਆਚਾਰ ਦੇ ਸੰਕਲਪ ਬਾਰੇ ਜਾਣਕਾਰੀ ਦੇਣਾ।
2. ਪੰਜਾਬੀ ਸਭਿਆਚਾਰ ਦੇ ਨਿਵੇਕਲੇ ਅਤੇ ਵਿਲੱਖਣ ਸੁਭਾਅ ਤੋਂ ਜਾਣੂ ਕਰਵਾਉਣਾ।
3. ਸਭਿਆਚਾਰ ਨਾਲ ਸੰਬੰਧਿਤ ਅਨੁਸ਼ਾਸ਼ਨਾਂ ਬਾਰੇ ਜਾਣਕਾਰੀ ਦੇਣਾ।

ਪਾਠਕ੍ਰਮ ਦੀ ਸਾਰਥਕਤਾ:

1. ਵਿਦਿਆਰਥੀਆਂ ਦਾ ਬੌਧਿਕ ਪੱਧਰ'ਤੇ ਵਿਕਾਸ ਹੋਵੇਗਾ ਅਤੇ ਰਚਨਾਮਕਤਾ ਵਿਚ ਨਿਖਾਰ ਆਵੇਗਾ।
2. ਵਿਦਿਆਰਥੀ ਸਭਿਆਚਾਰ ਵਿਸ਼ੇਸ਼ ਕਰ ਪੰਜਾਬੀ ਸਭਿਆਚਾਰ ਨੂੰ ਡੂੰਘਾਈ ਵਿਚ ਸਮਝਣਗੇ।

Interdisciplinary Choice Based Course

IDC-102G: YOGA AND STRESS MANAGEMENT

Maximum Marks: 50 | Pass Percentage: 35%
External Marks: 35 | External Pass Marks: 13
Internal Marks: 15 | Internal Pass Marks: 05
Credits: 02 | Time Allowed: 3 Hrs

INSTRUCTIONS FOR PAPER-SETTER

The question paper will consist of two Sections. A will have 4 questions from the respective section of the syllabus and will carry 10 marks each. Section B carries 10 short answer type questions which will cover the entire syllabus uniformly and will carry 15 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from sections A. Section B is compulsory.

Objectives:

1. To develop potentialities and organize physical education programs and activities.
2. To empower them to inspire their students to actively participate in physical and yogic exercises.
3. To make teachers capable of imparting basic knowledge about health, hygiene and nutrition
4. To cultivate the spirit of sportsmanship, mental and physical alertness, scientific temper and optimism.
5. To promote mental health, power of self- decision and self-control, correct judgment and action emotional stability and equanimity, respect for others and acceptance of authority and rules

Course Outcomes:

1. To produce quality physical education teachers for imparting instructions in the subject of physical education.
2. To make people aware about the benefits of physical activity through extension lectures and demonstrations.
3. To collaborate with the different organizations which are involved in promoting the quality life of the human beings i.e., educational institutions and NGOs
4. To promote mass participation in Physical Education activities (Games, Sports Displays etc.) through intra – mural and Extra- mural programs.

SECTION A

Yoga: Meaning, Aims, Importance and Types of Yoga. The practice of Asana and their Importance.

Meditative Pose: Padma Asana, Vazra Asana, Sukh Asana.

SECTION B

Cultural Poses: Halasan Asana, Sarvang Asana, Bhujanga Asana, Salbha Asana, Dhanur Asana, Chakara Asana.

Paranayam: Its types, Objective, Physiological Value

Stress: Meaning of stress and Management of stress.

References:

1. Kang, G.S. and DEOL, N.S: - An introduction to Health and Physical 21th Century, Patiala, 2008.
2. Singh, Kanwaljeet and Singh, Inderjeet: Sports Sociology, Friend Publication New Delhi, 2000.
3. Tandan, D. K *et.al*, Scientific basis of physical education and sports Friends Publication New Delhi.
4. Singh Ajmer, Bains Jagdish, Gill Singh Jagtar and Brar Singh Rachhpal: Essentials of Physical Education and Olympics Movement, Kalyani Publisher, Ludhiana, 2004.
5. Kang, G.S.: Anatomy, Physiology and Health Education Publication Bureau, Punjabi University, Patiala, 2000.

Interdisciplinary Choice Based Course

IDC-102H: CONSUMERISM IN INDIA

Maximum Marks: 50 **Time Allowed: 3hrs.**
External Examination: 35 **Pass Percentage: 35%**
Internal Assessment: 15 **Teaching Hours: 2 Hours/week**
Credit-2: 2H (L)

INSTRUCTIONS FOR PAPER SETTER/EXAMINERS

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from Unit-I and Unit-II respectively, will carry 05 marks each. Section C will consist of 12 short answer type questions covering entire syllabus and will carry 1.5 marks each. Total weightage of Section-C shall be 15 marks.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions each from Section A and B. In Section C candidates are required to attempt any ten questions.

Course Objective: To provides an understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards. The student shouldbe able to comprehend the business firms' interface with consumers and the consumer related regulatory and business.

Pedagogy-The course will be initiated through lectures, case study method, discussions and assignments

UNIT- I

Grievance Redressal Mechanism under the Indian Consumer Protection Law: Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Leading Cases decided under Consumer Protection law by Supreme Court/National Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

UNIT- II

Role of various Regulators in Consumer Protection

i. Banking: RBI and Banking Ombudsman
ii. Insurance: IRDA and Insurance Ombudsman
iii. Telecommunication: TRAI
iv. Food Products: FSSAI

Course Learning Outcome: Students will become familiar with the procedure of redress of consumer complaints, andthe role of different agencies in establishing product and service standards**.**

Suggested Readings:

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) *ConsumerAffairs,* Universities Press.
2. Choudhary, Ram Naresh Prasad (2005). *Consumer Protection Law Provisions andProcedure,* Deep and Deep Publications Pvt Ltd.
3. G. Ganesan and M. Sumathy. (2012). *Globalisation and Consumerism: Issuesand Challenges*, Regal Publications
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issuesand Concerns, IIPA, New Delhi
5. Rajyalaxmi Rao (2012), *Consumer is King,* Universal Law Publishing Company
6. Girimaji, Pushpa (2002). *Consumer Right for Everyone* Penguin Books.

Articles:

1. Bhatt K. N., Misra Suresh and Chadah Sapna (2010). Consumer, Consumerism andConsumer Protection, Abhijeet Publications.
2. Kapoor Sheetal (2010) "Advertising-An Essential Part of Consumer's Life-Its Legaland Ethical Aspects", Consumer Protection and Trade Practices Journal*,* October 2010.
3. Verma, D.P.S. (2002). Regulating Misleading Advertisements, Legal Provisions andInstitutional Framework. Vikalpa. Vol. 26. No. 2. pp. 51-57.

Periodicals:

1. Consumer Protection Judgments (CPJ) (Relevant cases reported in various issues)
2. Recent issues of magazines: International Journal on consumer law and practice,National Law School of India University, Bengaluru
3. '*Consumer Voice*', Published by VOICE Society, New Delhi.

Websites:

www.ncdrc.nic.in
www.consumeraffairs.nic.in
www.iso.org.
www.bis.org.in
www.fssai.gov.in
www.cercindia.org.

PHYSICS DEPARTMENT

Syllabus

Bachelor of Science (Honors) Physics

Program Code: BSCH-PHY

Part-II

(Semester: III, IV)

2022-23, 2023-24 and 2024-25

Sri Guru Teg Bahadur Khalsa College

Sri Anandpur Sahib-140118, Punjab

*An Autonomous College, Affiliated to Punjabi University, Patiala
*NAAC Accredited 'A' Grade College
*College with Potential for Excellence Status by UGC
*STAR College Status by Department of Biotechnology, Govt. of India
* Department of Science & Technology-FIST Scheme, Govt. of India

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Phone: 01887-232037
Email: physicsdepartment321@gmail.com
Website: www.sgtbcollege.org.in

APPROVED
Board of Studies Meeting held on 1st August, 2022

SCHEME OF STUDIES

B.SC. HONOURS PHYSICS PART II
Program Code: BSCH-PHY

SEMESTER III

Course Opted	Course Code	Course Name	Credits	Maximum Marks	External Examination	Internal Assessment
Core Course-V	PHY-2.1.1	Mathematical Physics-II	6	150	100	50
Core Course-VI	PHY-2.1.2	Thermal Physics	4	100	70	30
Core Course-VI Practical	PHY-2.1.2P	Thermal Physics Practical	2	50	50	--
Core Course-VII	PHY-2.1.3	Analog Systems and Applications	4	100	70	30
Core Course-VII Practical	PHY-2.1.3P	Analog Systems and Applications Practical	2	50	50	--
Skill Enhancement Course-1	PHY-2.1.4	Radiation Safety	1	50	--	25
		Radiation Safety Practical	1		--	25
Generic Elective-3 (Student will choose any one paper out of the three but other than chosen in Semester-I and II)	PHY-2.1.5 A	Chemistry I	4	100	70	30
	PHY-2.1.5 AP	Chemistry Practical	2	50	50	--
	PHY-2.1.5 B	Programming Using C++	4	100	70	30
	PHY-2.1.5 BP	Software-I Lab	2	50	50	--
	PHY-2.1.5 C	Basic Mathematics	6	150	100	50
			26	**650**		

SEMESTER IV

Course Opted	Course Code	Course Name	Credits	Maximum Marks	External Examination	Internal Assessment
Core Course-VIII	PHY-2.2.1	Quantum Mechanics	4	100	70	30
Core Course-VIII Practical	PHY-2.2.1P	Quantum Mechanics Practical	2	50	50	--
Core Course-IX	PHY-2.2.2	Spectroscopy	4	100	70	30
Core Course-IX Practical	PHY-2.2.2P	Spectroscopy Practical	2	50	50	--
Core Course-X	PHY-2.2.3	Digital Systems and Applications	4	100	70	30
Core Course- X Practical	PHY-2.2.3P	Digital Systems and Applications Practical	2	50	50	--
Skill Enhancement Course - 2	PHY-2.2.4	Applied Optics	1	50	--	25
		Applied Optics Practical	1		--	25
Generic Elective-4 (Student will choose any one paper out of the three but same subject as chosen in Semester-III)	PHY-2.2.5 A	Chemistry-II	4	100	70	30
	PHY-2.2.5 AP	Chemistry Practical	2	50	50	--
	PHY-2.2.5 B	Web Development Using PHP	4	100	70	30
	PHY-2.2.5 BP	Software – II Lab	2	50	50	--
	PHY-2.2.5 C	Differential Equations	6	150	100	50
			26	**650**		

PROGRAM OVERVIEW

Programme Code: BSCH-PHY

Duration: 3 Years

Bachelor of Science Honors in Physics programme is designed to prepare students for pursuing higher education or working in industry by introducing advanced ideas and techniques that are applicable in a wide range of Physics learning and application while emphasizing the underlying concepts of Physics. This course provides in-depth understanding of principles and concept of Physics, proficiency in experimentation to understand the theoretical and experimental dimensions of Physics.

Programme Educational Objectives

5. The graduates will have knowledge of fundamental laws and principles in a variety of areas of Physics along with their applications.
6. The graduates will develop research skills which might include advanced laboratory techniques, numerical techniques, computer algebra, computer interfacing.
7. The graduates will become effective researcher who will be able to provide lucid summation of the scientific literature on a given topic of study.
8. The graduates will develop the skill to plan, execute and report the results of an extended experimental or theoretical Physics based project in a research environment.

Programme Outcomes

At the end of the programme the students will be able to:

6. Apply theoretical knowledge of principles and concepts of Physics to practical problems.
7. Use mathematical techniques and interpret mathematical models of physical behavior.
8. Demonstrate the ability to plan, undertake, and report on a programme of original work; including the planning and execution of experiments, the analysis and interpretation of experimental results.
9. Assess the errors involved in an experimental work and make recommendations based on the results in an effective manner.
10. Develop communication skills, both written and oral, for specialized and non-specialized audiences.

Core Course-V

PHY-2.1.1: MATHEMATICAL PHYSICS - II

Maximum Marks: 150 **Teaching Hours: 90 (5 Th.+1 Tu. Credits)**
External Examination: 100 (Pass Marks: 40) **Pass Percentage: 40 %**
Internal Assessment: 50 (Pass Marks: 20) **Time Allowed: 3 Hours**

50 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 15 marks and each question of section C will carry 4 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 15 marks and Section C carries 40 marks. **Use of scientific calculator is allowed.**

Course Objective: The purpose of the course is to introduce students to methods of mathematical physics and to develop required mathematical skills to solve problems in quantum mechanics, electrodynamics and other field of Physics.

Instructional delivery strategy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

Fourier Series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet's 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.

Legendre and Bessel Functions: Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions ($J_o(x)$ and $J_1(x)$) and Orthogonality.

Section B

Some Special Integrals: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions.

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.

Partial Differential Equations: Solutions to partial differential equations using separation of variables, Equation of vibrating string, Solution of wave equation by D'Alembert's method, One dimensional heat flow, Two dimensional heat flow for rectangular membrane, Equation of heat flow in two dimensions in polar coordinates, Laplace equation, Solution of the equation of the vibrating rectangular membrane.

Basics of Tensors: Coordinate transformation, summation convention, Kronecker delta symbol, Scalars, contravariant and covariant vectors, Algebraic operations of tensors.

Course learning outcome: Students will have achieved the ability to:

- Use of Fourier series in various problems
- Use and solution of Legendre and Bessel polynomials
- Describe special function and their recurrence relations
- Explain beta and gamma functions
- Explain the error theory and its various laws
- Describe the partial differential equations and its applications

Textbooks:

1. Mathematical Physics: H K Dass, S. Chand, 2008
2. Mathematical Physics with Classical Mechanics, Satya Prakash, Sultan Chand & Sons, 2014

Reference Books:

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

Core Course-VI

PHY-2.1.2: THERMAL PHYSICS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objectives:

- To familiarize with the various laws of thermodynamics and their applications.
- To have knowledge of entropy and heat engines.
- To Familiarize with various thermodynamic potentials and application and to Clausius-Clapeyorn equation and Joule's-Thomson Effect.
- To acquaint with the concept Kinetic Theory of Gases**.**

Instructional delivery strategy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

Introduction to Thermodynamics: Zeroth and First Law of Thermodynamics: Concept of Heat and Work, Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics, Equation of State, State Functions, Various Thermodynamical Processes, First Law of Thermodynamics and its Differential Form, Applications and Limitations of First Law.

Second Law of Thermodynamics: 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work: Heat Engines. General Relation between C_P and C_V, Work Done during Isothermal and Adiabatic Processes Cyclic Thermodynamic Processes, Carnot engine & efficiency. Refrigerator & coefficient of performance, Thermoelectric Effect, Peltier Effect, Thomson Effect.

Section B

Entropy: Concept of Entropy, Additive nature of entropy, Entropy Changes in Reversible and Irreversible processes with examples. Clausius Theorem. Clausius Inequality, Carnot's Theorem. Temperature–Entropy diagrams for Carnot's Cycle, Principle of Increase of Entropy, Heat death of the Universe. Third Law of Thermodynamics. Unattainability of Absolute Zero.

Maxwell's Thermodynamic Relations: Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy, Their Definitions and Properties. Maxwell's thermodynamic relations, Application to Clausius-Clapeyorn equation and Joule's-Thomson Effect, Thomson and Adiabatic Cooling, Expression for $(C_P - C_V)$, C_P/C_V, TdS equations. Liquefaction of gases. Low temperatures: Production and measurement of very low temperatures, Adiabatic Demagnetization.

Kinetic Theory of Gases, Distribution of Velocities, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion. Brownian Motion and its Significance (Only Theory).

Course learning outcome: On successful completion of this course, students will be able to:

- Understand the laws of thermodynamics, entropy, and Maxwell's thermodynamic relations etc.
- Acknowledge the concept Heat Engines, application to Clausius-Clapeyorn equation and Joule's-Thomson effect
- Understand the basics of Kinetic theory of gases-distribution of velocities etc.

Text Books:

1. Statistical Physics and Thermodynamics, V.S. Bhatia, Punjab University, Chandigarh, 1977.
2. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, Tata McGraw-Hill, 1993.
3. Thermal Physics, A. Kumar and S.P. Taneja, R. Chand Publications, 2014.

Reference Books:

- Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1958, Indian Press
- Thermodynamics and Statistical Physics - Khandelwal and Loknathan, Shivlal Agnawala, Agna, 1979.
- Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University Press.

Core Course-VI Practical

PHY-2.1.2P: THERMAL PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

5. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
6. Brief theory (05)
7. Viva-Voce (10)
8. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. Measurement of Planck's constant using black body radiation.
2. (a) To draw the temperature resistance characteristic of a thermistor (b) To find the temperature co-efficient of resistance of thermistor.
3. To draw the voltage current (V-I) characteristics of a thermistor.
4. To study the adiabatic expansion of a gas and hence to calculate the value of ratio between two specific heats of the gas.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee's disc method.
7. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
8. To study the variation of Thermo-emf of a Thermocouple with Difference of Temperature of its Two Junctions.
9. To record and analyse the cooling temperature of hot object as a function of time using a thermocouple and suitable data acquisition system
10. To determine the heating efficiency of an electric kettle with varying input voltages.
11. To determine the coefficient of linear expansion for different metals and alloys.
12. To measure the speed of EM wave using a microwave oven.
13. To study the dissipation of heat using a copper plate.

Text Books

1. A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub.
2. B.Sc. Practical Physics, C.L Arora, S. Chand Pub.
3. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.

Reference Books

- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

(BOS Chairman) (VC Nominee) (Academic Council Nominees) (Industry Expert) (Student Alumni) (Members)

Core Course-VII

PHY-2.1.3: ANALOG SYSTEMS AND APPLICATIONS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objectives: The main objective of the course is to provide knowledge of basic semiconducting devices such as diodes, transistors, amplifiers and oscillators.

Section A

Semiconductor Diodes: Classification of materials, Intrinsic semiconductors, Extrinsic semiconductors, PN junction with no external voltage, Forward and reverse biasing of PN junction diode, V-I characteristics, Ideal diode, Static and dynamic resistance of a diode.

Two-terminal Devices and their Applications: Semiconductor diodes as half wave rectifiers, center-tapped and bridge full-wave rectifiers; Calculation of average value and root mean square value of output current, efficiency, ripple factor, peak inverse voltage and voltage regulation, RC, LC and π-filter (qualitative), Zener Diode, Zener Diode as voltage stabilizer. Principle and structure of (1) LEDs, (2) Photodiode and (3) Solar Cell.

Bipolar Junction transistors: Junction transistor structure, Surprising action of a transistor, Transistor amplifying action, n-p-n and p-n-p Transistors. Three configurations, Transistor characteristics of CB, CE and CC Configurations. Active, Cutoff and Saturation Regions. Current gains α and β, Relations between α and β. Expression for collector current, DC Load line and Q-point.

Section B

Transistor Biasing: Selection of Operating Point, Need for Bias Stabilization, Requirement of a Biasing Circuit, Transistor Biasing and Stabilization Circuits; Fixed Bias Circuit, Collector to Base Bias Circuit, Bias Circuit with Emitter Resistor, Voltage Divider Biasing Circuit.

Transistor as 2-port Network: Hybrid parameters, Obtaining the h-parameter equivalent circuit, transistor hybrid model. Analysis of a single-stage CE amplifier using hybrid model for input and output impedance, current, voltage and power gains.

Feedback in Amplifiers: General theory of feedback, Voltage and current feedback. Advantages of negative feedback; Stabilization of gain, reduction of non-linear distortion, reduction of output noise.

Sinusoidal Oscillators: Advantages of an oscillator, Barkhausen criteria for self-sustained oscillations, Essentials of an oscillator circuit, Types of transistor oscillators, General form of an LC oscillator, Colpitt's oscillator, Hartley oscillator, oscillations frequency of Hartley and Colpitt's oscillators.

Course learning outcome: Students will have achieved the ability:

- To understand fundamentals of semiconducting diodes, rectifier diodes, Zener diode and applications.
- To understand about Bipolar Junction Transistor.
- To understand basic construction of feedback circuits and their application in oscillators.
- To understand operational Amplifier and its applications.

Text Books:

1. Basic Electronics and Linear Circuits by N. N. Bhargava, D.C. Kulshreshtha and S. C. Gupta
2. Electronics and Solid State Devices by Ashok Sharma, Modern Publishers
3. Electronic Devices and Circuits: J. B. Gupta, Kataria & Sons Publishers

Reference Books:

- Electronic Devices and Circuits: G. K. Mithal, Khanna Publishers
- Fundamentals of Electronics by D. Chatopadhyay, P.C. Rakshit, B. Saha and N.N. Purkit.
- Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

Core Course-VII Practical

PHY-2.1.3P: ANALOG SYSTEMS AND APPLICATIONS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40% (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of experiments:

1. To study V-I characteristics of PN junction diode.
2. To study the characteristics of a Light Emitting diode (LED).
3. To study the response of RC-circuit to various input voltages (square, sine and triangular).
4. To study the Zener Diode characteristics and find the Zener breakdown voltage.
5. Study the Zener diode as a voltage regulator.
6. To study the function of diode as a clipping element.
7. To study the function of diode as a clamping element.
8. To study the reduction of ripples in the rectified output with RC, LC and π filters.
9. To measure the efficiency and ripple factor for Half wave rectifier circuit.
10. To measure the efficiency and ripple factor for Full wave rectifier circuit.
11. Study of V-I & power curves of solar cells, and find maximum power point & efficiency.
12. To study the characteristics of a Bipolar Junction Transistor in CE configuration.
13. To plot common base characteristics and determine h-parameters of a given transistor.
14. To study the gain of an amplifier at different frequencies and to find band-width and gain-band width product.
15. To study the frequency response of voltage-gain of a RC-coupled transistor amplifier.
16. To study the Hartley oscillator.
17. To study Colpit's oscillator.

Reference Books:

1. B. Sc. Practical Physics, C. L. Arora, S Chand and Company Limited.
2. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.

Skill Enhancement Course-1

PHY-2.1.4: RADIATION SAFETY
(Theory and Practical)

Maximum Marks: 50 | **Credit: Theory (1) + Practical (1)**
Pass Marks: 40% (20 Marks) | **Teaching Hours: 15 (Theory)**
Time: 3 Hours | **30 (Practical)**

Instructions for the Paper Setter/Student: The question paper will be set by appointed external examiner (Subject Expert) on the day of exam and the distribution of marks will be as under:

1. Theory exam from Section A - 25 Marks
2. Experiment to be performed from Section B - 15 Marks
3. Viva-voce - 5 Marks
4. Note-book - 5 Marks

Course Objective: To know the general concepts of Interaction of Radiation with Matter: Types of Radiation, Radiation Detection and Monitoring Devices, Radiation Quantities and Units and Radiation Safety Management.

Section A

Basic Radiation Physics: Atomic Structure, atomic number, mass number, isotopes, radioisotopes, radioactivity, specific activity, types of radioactive disintegrations, electron capture, characteristics of alpha, beta and gamma rays; energy of ionizing radiations, half-life (physical, biological), effective half-life, isomeric transitions, X-rays (characteristic and Bremsstrahlung) [Qualitative Only]

Interaction of Radiation with matter: Interaction of charged particles with matter, bremsstrahlung, range of charged particles, interaction of photon with matter (photoelectric, Compton scattering and pair production), absorption, scattering and attenuation of photons, Half Value Thickness (HVT) and tenth value Thickness (TVT)**.** [Qualitative Only]

Radiation Quantities and Units: Activity (Becquerel & Curie), energy, exposure (C/kg & Roentgen), Linear energy transfer (LET), air kerma, absorbed dose (Gray & rad), radiation weighting factors (WR), tissue weighting factors (WT), equivalent dose (Sievert & rem), effective dose (Sievert & rem), collective effective dose (Person Sv), Annual Limit of Intake {ALI} (Bq) and Derived Air Concentration {DAC} (Bq/m^3).

Biological Effects of Radiation: Interaction of radiation with cell, direct and indirect interactions, effect of radiation on living cells, chromosomal aberration, somatic and genetic effects, deterministic and stochastic (probabilistic) effects, partial body and whole body exposures [Qualitative Only].

Operational Limits: Introduction to natural background radiation, concept of occupational risk, philosophy of radiation protection, system of dose limitation, ALARA, dose limits to radiation workers and general public, AERB/ICRP recommendations.

Section B

Experiments:

1. Study the background radiation levels using Radiation meter
2. Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source).
3. Study of counting statistics using background radiation using GM counter.
4. Study of radiation in various materials (e.g. KSO_4 etc.). Investigation of possible Radiation in different routine materials by operating GM at operating voltage.
5. Study of absorption of beta particles in Aluminum using GM counter.

6. Detection of α particles using reference source & determining its half-life using spark counter.
7. Gamma spectrum of Gas Light mantle (Source of Thorium).
8. To determine the linear attenuation coefficient of given material using gamma source and scintillation detector.
9. To measure the pulse-height of gamma ray spectrum with multichannel analyzer (MCA).
10. To plot the complete gamma ray spectrum of 137 Cs and mark the different peaks of the spectrum

Course learning outcome:

- Be aware and understand the hazards of radiation and the safety measures to guard against these hazards.
- Have a comprehensive knowledge about the nature of interaction of matter with radiations like gamma, beta, alpha rays, neutrons etc. and radiation shielding by appropriate materials.
- Know about the units of radiations and their safety limits, the devises to detect and measure radiation, such as the Geiger-Mueller counter and scintillation counter.
- The students are expected to learn radiation safety management, biological effects of ionizing radiation, operational limits and basics of radiation hazards evaluation and control, radiation protection standards, 'International Commission on Radiological Protection' (ICRP) its principles, justification, optimization, limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management, brief idea about 'Accelerator driven Sub-Critical System' (ADS) for waste management.
- The students are expected to do various experiments based on radiation safety.

Text Books

1. An Introduction to Nuclear Physics by M.R. Bhiday and V.A. Joshi, Orient Longman Publishers.
2. Nuclear Physics by D.C. Tayal, Himalaya Publishing House

Reference Books:

- Radiation Detection and Measurement, Glenn F. Knoll, Wiley Publishers
- Practical Applications of Radioactivity and Nuclear Radiations, Gerhart C. Lowenthal and Peter Airey, Cambridge University Press

Generic Elective-3

PHY-2.1.5 A: CHEMISTRY I

Maximum Marks: 100 **Time Allowed: 3 Hours**
Internal Assessment: 30 **Teaching Hours: 60 External**
Examination: 70 **Pass Percentage: 40%**
Credits: 4

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 2 marks each.

Instruction for the candidates: Candidates are required to attempt five questions in all by selecting two questions each from sections A & B and Section C (9^{th} question) is compulsory.

Course Objective: To teach the fundamental concepts of Chemistry and their applications. The syllabus contents are duly arranged section wise and contents are included in such a manner so that due importance is given to the requisite intellectual understanding of atomic structure, bonding, general organic chemistry & aliphatic and aromatic hydrocarbons and laboratory skills.

Section A

Atomic Structure

Review of Bohr's theory and its limitations,dual behavior of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of s, p and d atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, Anomalous electronic configurations.

Chemical Bonding and Molecular Structure

Covalent bonding: Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Shapes of some inorganic molecules and ions on the basis of VSEPR theory and hybridization. MO treatment of homonuclear diatomic molecules (H_2, N_2 and O_2) and heteronuclear diatomic molecules (CO, NO and $NO^{+)}$.

Section B

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules.

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength; Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges.

Basic Reaction Mechanisms: Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shapes and relative stability of Carbocations, Carbanions, Free radicals, Nitrenes and Carbenes. Introduction to types of organic reactions and their mechanism: Addition (to C=C), Elimination (E_1, E_2, E_1cb) and Substitution reactions (SN^1 and SN^2).

Aromatic Hydrocarbons Aromaticity: Huckel's rule, aromatic character of arenes, cyclic carbocations/carbanions.

Course Outcome: The students will acquire knowledge of

5. Atomic structure and Quantum mechanics
6. Chemical Bonding: Covalent Bonding
7. Basic of Organic Chemistry
8. Aromaticity

Text books:

4. Morrison, R.T. & Boyd, RN. Organic Chemistry, Pearson, 2010
5. Shriver, D. & Atkins, P.W. Inorganic Cheminy, Oxford University Press
6. Kalsi P.S. &ta, R.S. Organic Reactions (Stereochemistry and Mechanism) (5^{th} Ed), New Ag International (P) Ltd. Pub.

Generic Elective-3 (Practical)

PHY-2.1.5AP: CHEMISTRY PRACTICAL

Maximum Marks: 50 **Time allowed: 3 Hrs.**
Pass Percentage: 40% **Number of Lectures: 60**
Credits: 2

Instruction for the Examiners and Candidates: The practical examination will be held in single session (morning/evening). Candidates are required to perform practicals from volumetric Analysis, element detection in organic compounds and TLC. Distribution of marks will be as under (Books may be consulted):

2. **Volumetric Analysis** **= 15 marks**
   [Initial write up: 5 marks (Equation: 1, Indicator: 1, End point: 1 and general calculations: 2)
   Performance and results: 10 marks (Initial burette reading: 1, Final reading: 1, End point: 1 and calculations and result: 7)]
2. **TLC** = 10 marks (Performance and Result)
3. **Detection of Extra Elements** = 10 marks (Performance and Result)
4. **Viva-Voce** = 10 marks
5. **Note Books** = 5marks

Total **= 50 marks**

Section A

Inorganic Chemistry-Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture
2. Estimation of oxalic acid by titrating it with $KMnO_4$
3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$
4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$

Section B

Organic Chemistry

2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)
   c) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography
   d) Identify and separate the sugars present in the given mixture by paper chromatography.
2. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
3. Criteria of Purity: Determination of melting point

Reference Books:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Text book of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.

Generic Elective-3

PHY-2.1.5 B: PROGRAMMING USING C++

Teaching Hours per week: 4 | Internal Assessment: 30
Time Allowed: 3Hrs. | External Marks:70
Pass Marks: 35% | 4 Credits: 4H (L)

Instructions for Paper Setter/Examiners

The Question paper will consist of three sections-A, B & C. Section A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each. Candidates are required to attempt two questions each from section A and B. Section C will consist of 9 short answer type questions covering entire syllabus and will carry 3 marks each. Section C is Compulsory.

Section A

Evolution of OOP: Procedure Oriented Programming, OOP Paradigm, Advantages and disadvantages of OOP over its predecessor paradigms. Characteristics of Object Oriented Programming.

Introduction to C++: Identifier, Keywords, Constants. Operators: Arithmetic, relational, logical, conditional and assignment. Size of operator, Operator precedence and associativity. Type conversion, Variable declaration, expressions, statements, manipulators. Input and output statements, stream I/O, Conditional and Iterative statements, breaking control statements. Storage Classes, Arrays, Arrays as Character Strings, Structures, Unions, Bit fields, Enumerations and User defined types.

Pointers: Pointer Operations, Pointer Arithmetic, Pointers and Arrays, Multiple indirections, Pointer to functions.

Functions: Prototyping, Definition and Call, Scope Rules. Parameter Passing by value, by address and by reference, Functions returning references, Const functions, recursion, function overloading, Default Arguments, Const arguments, Pre-processor, Type casting.

Section B

Classes and Objects: Class Declaration and Class Definition, Defining member functions, making functions inline, Nesting of member functions, Members access control. THIS pointer. Objects: Object as function arguments, array of objects, functions returning objects, Const member. Static data members and Static member functions, Friend functions and Friend classes.

Constructors: properties, types of constructors, Dynamic constructors, multiple constructors in classes. Destructors: Properties, Virtual destructors. Destroying objects, Rules for constructors and destructors. Array of objects. Dynamic memory allocation using new and delete operators, Nested classes, Scopes: Local, Global, Namespace and Class.

Inheritance: Defining derived classes, inheriting private members, single inheritance, types of derivation, function redefining, constructors in derived class, Types of inheritance, Types of base classes, Code Reusability.

Polymorphism: Methods of achieving polymorphic behavior.

Operator overloading: overloading binary operator, overloading unary operators, rules for operator overloading, operator overloading using friend function. Function overloading: early binding, Polymorphism with pointers, virtual functions, late binding, pure virtual functions and abstract base class.

Templates: Generic Functions and Generic Classes, Overloading of template functions.

Exception Handling: Exception Handling catching class types, handling derived class exceptions, catching exceptions

Files and streams: Open/ Close Files commands. Read/write operations on files.

References:

4. Herbert Schildt, “The Complete Reference C++”, Tata McGraw-Hill. Deitel and Deitel, “C++ How to Program”, Pearson Education.
5. Robert Lafore, “Object Oriented Programming in C++”, Galgotia Publications. BjarneStrautrup, “The C++ Programming Language”, Addition- Wesley Publication Co. Stanley B. Lippman, JoseeLajoie, “C++ Primer”, Pearson Education.
6. E. Balagurusamy, “Object Oriented Programming with C++”, Tata McGraw-Hill.

Generic Elective-3 (Practical)

PHY-2.1.5 BP: SOFTWARE-I LAB

Time Allowed: Three Hours | External Evaluation: 50 Marks
Pass Marks:35% | 2 Credits: 4H (P)

This laboratory course will comprise of exercises to supplement what is learnt under paper BHGE-1.1B Object Oriented Programming using C++.

Students are required to develop the following programs in C++ language with internal documentation:

15. Write a program to find area of rectangle using the concept of classes & object.
16. Write a program to implement the concept of array of object.
17. Write a program to show the use of friend function.
18. Write a program to show the use of constructor overloading.
19. Write a program to show the use of copy constructor.
20. Write a program to show the use of destructors.
21. Write a program to show the use of virtual function.
22. Write a program to implement the concept of multilevel inheritance.
23. Write a program to implement the concept of multiple inheritance.
24. Write a program of unary operator overloading.
25. Write a program of Binary operator overloading.
26. Write a program to swap two values independent of type of the variable using function template.
27. Write a program to illustrate how an exception is handled using try catch block using throw statements.
28. Write a program to demonstrate how to insert and extract an object to and from data files.

Generic Elective-3

PHY-2.1.5 C: BASIC MATHEMATICS

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Time Allowed: 3 hours

External Assessment: 100 Marks
Internal Assessments: 50 Marks
Total: 150 Marks
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each of 20 marks each from the respective sections of the syllabus and Section C will consist of one compulsory question having ten short answer type questions each of 2 marks covering the entire syllabus uniformly.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Section A and B and compulsory question of Section C.

Course Objectives: The aim of the course is to introduce the students of BSc Honours (Physics and Chemistry) to various topics in mathematics which will be of great help to them in their course.

Pedagogy: The teacher should explain the concept diligently.

Section A

Integration:

Introduction, integration of some functions (x^n, e^x, xy, logarithmic and simple trigonometric), Integration using Partial Fractions, Integration by Parts.

Differentiation and Partial Differentiation:

Basic concepts: sets, functions, limit and their numerical problems. Differential coefficient of a function, derivatives of functions (x^n, xy, x/y, e^x, logarithmic and trigonometric) and application of differentiation for determination of maxima and minima of algebraic functions. Partial differentiation: Introduction, partial differentiation of functions (xy and logarithmic).

Section B

Theory of Probability

Random experiment and sample space, Types of events (simple and compound), Independent Events, Conditional Probability, Bayes' Theorem

Matrices and Determinant:

Review of Matrices and Determinants, Elementary Row and Column Transformation, Echelon Form, Rank of Matrix, Gauss Elimination Method, Gauss Jordan Method, System of Linear Equations, Eigen Values and Eigen Vectors, Cayley Hamilton Theorem (Without Proof)

Course Outcomes: The student after the completion of the course will have knowledge of Matrices, Determinants, Differentiation, Integration and other concepts.

Text Books:

1. S. P. Gupta, Statistical Methods, Sultan Chand and Sons.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers
3. Jain, Iyengar, Advance Engineering Mathematics, Narosa Publications

Reference Books:

1. Thomas and Finney, Calculus and Analytical Geometry
2. D. Somasundaram and B. Choudhary, *A First Course in Mathematical Analysis,* Narosa Publishing House, New Delhi, 1997.

Core Course-VIII

PHY-2.2.1: QUANTUM MECHANICS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objectives- The objective of the course on Quantum Mechanics for the student of B.Sc. (Hons.) Physics is to equip them with the knowledge of wave particle duality, Planck's quantum, fundamental of quantum relations, and related problems and applications.

Section A

Origin of Quantum Mechanics: Brief Introduction to Need and Development of Quantum Mechanics, Wave Particle Duality, de-Broglie Hypothesis, Uncertainty Principle and Its Application, Postulates of Quantum Mechanics, Operator Correspondence and Equation for a Particle Subject to Force.

Wave Mechanics: Gaussian Wave Packet, Schrodinger Equation for a Free Particle, Physical Interpretation of Wave Function, Superposition Principle, Expectation Value, probability current and Conservation of Probability, Admissibility Conditions on the Wave Function, Normalization and Orthogonality Property, Ehrenfest Theorem.

Section B

Operators, Eigenvalues and Eigen function: Operators, Eigenvalues and Eigen function, Linear Operators, Hamiltonian Operator, Linear Momentum and Angular Momentum Operators, Product of Two Operators, Commuting and Non-Commuting Operators, Simultaneous Eigen functions, Orthogonal Functions, Hermitian Operators, their Eigenvalues, Hermitian Adjoint Operators, Expectation Value of Position and Momentum Operator.

Problems in One Dimension: Time Dependent Schrodinger Equation, Application to Stationary States for One Dimension, One dimensional box, Potential Step, Potential Barrier, Rectangular Potential Well, Degeneracy, Orthogonality, Linear Harmonic Oscillator.

Problem in Three Dimensions: Schrodinger Equation for Spherically Symmetric Potential, Spherical Harmonics, Hydrogen Atom Energy Levels and Eigen Functions, Degeneracy, Angular Momentum.

Course learning outcome: Students will have achieved the understanding of:

- The basic laws of quantum and their relations etc.
- Wave function and its properties
- Solving Schrodinger equation and related problems
- One and many atom spectra and related phenomenon

Text Books:

1. Concepts of Modern Physics, Arthur Beiser (McGraw Hill Pub. Co., Delhi, 9th ed.), 1995.
2. Elements of Modern Physics, S.H. Patil (McGraw Hill), 1998.

Reference Books:

- Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill

- Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson,2009, PHI Learning
- Quantum Mechanics, V.K. Thankappan, 2014, New Academic Science Ltd.
- Quantum Mechanics: Concepts and Applications, Nouredine Zettili, Wiley
- Quantum Physics, Berkeley Physics, Vol.4. E.H. Wichman, 2008, Tata McGrawHill Co.
- Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill

Core Course-VIII Practical

PHY-2.2.1P: QUANTUM MECHANICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. To determine the Planck's constant using filters of at least 4 different colours.
2. Study of variation of light intensity using photovoltaic cell/inverse square law
3. To determine the capacitance of a capacitor using flashing and quenching of neon bulb.
4. Measurement of reverse saturation current of P-N junction diode and find the approximate value of energy band gap.
5. To show the tunnelling effect in tunnel diode using I-V characteristics.
6. Study of V-I & power curves of solar cells, and find maximum power point & efficiency
7. To study spectral characteristics of a photo-voltaic cell.
8. To compare the luminous intensities of two light sources using a photo-voltaic cell.
9. To study characteristics of solar cell.
10. To determine charge of electron using Millikan's oil drop method.
11. To determine material constant h.
12. To determine Temperature Coefficient of current.
13. To find Planks constant by LED method.

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

Core Course-IX

PHY-2.2.2: SPECTROSCOPY

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objectives- The objective of the course on Spectroscopy for the student of B.Sc. (Hons.) Physics is to equip them with the knowledge of various theories related to single and multi-atom interaction spectra, various types of orbital coupling and properties and production of X-rays.

Section A

One Electron Atomic Spectra: Excitation of Atom with Radiation, Transition Probability, Spontaneous Transition, Selection Rules and Life Time, Spectrum of Hydrogen Atom, Bohr's Theory and Hydrogen Spectrum, Evidences in favor of Bohr's Theory, Experimental Confirmation of Bohr's Theory, Frank Hertz Experiment, Line Structure, Normal Zeeman Effect.

The Spinning Electron and the Vector Model, Electron Spin, Stern Gerlach Experiment, Spin Orbit Coupling (electron magnetic moment, total angular momentum), Fine Structure, Examples of One Electron Systems, Anomalous Zeeman Effect, Lande-g Factor (sodium D-lines), Paschen-Back Effect, Selection Rules for the Paschen-Back Effect.

Section B

Many Electron System Spectra: Exchange Symmetry of Wave Functions, Exclusion Principle, Shells and Sub shells in Atoms, Atomic Spectra (Helium), LS Coupling, JJ Coupling, Terms of Equivalent and Non Equivalent Electrons, Selection Rules, Regularities in Atomic Spectra, Interaction Energy, Different Series in Alkali Spectra.

Characteristics and Continuous X-ray Spectra, Comparison of Optical and X-ray Spectra, Moseley's Law, Applications of Moseley's Law, Auger Effect, Molecular Bonding, Molecular Spectra, Selection Rules, Symmetric Structures, Rotational, Vibrational and Vibrational-rotational Electronic Levels of a Diatomic Molecule, Raman Spectra.

Course learning outcome: Students will have achieved the ability to:

- Understand the single and multi-atom system spectra
- Understand effect of electric and magnetic field on the spectrum
- Understand various type of coupling of orbitals
- Understand production and properties of x-rays

Text Books:

1. Atomic and Molecular Spectra: Laser, Raj Kumar KNRN Publisher 2020th Ed.
2. Elements of Spectroscopy, Gupta Kumar Sharma, Pragati prakashan.
3. Molecular Structure and Spectroscopy: G. Aruldhas (Prentice Hall of India), 2007.

Reference Books:

- Concepts of Modern Physics, Arthur Beiser (McGraw Hill Pub. Co., Delhi, 9th ed.), 1995.
- Elements of Modern Physics, S.H. Patil (McGraw Hill), 1998.
- Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson,2009, PHI Learning
- Quantum Mechanics, V.K. Thankappan, 2014, New Academic Science Ltd.
- Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill

Core Course-IX Practical

PHY-2.2.2P: SPECTROSCOPY PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. To calibrate a prism spectrometer with a mercury lamp.
2. To find the height of a building/inaccessible height using a Sextant.
3. To determine angular diameter of sun using Sextant
4. To plot a graph between the angle of incidence and the corresponding angle of deviation and to find refractive index of the material of prism.
5. To find the number of lines per centimeter of the given grating. Given mean wavelength of sodium light to be 5893 X 10^{-10} m.
6. To determine the minimum deviation of a prism
7. To determine the Cauchy's constants.
8. To determine refractive index of calcite prism.
9. To study the refractive index of doubly refracting prism
10. To determine the wave length of a given light using bi-prism
11. To determine the resolving power of a prism.
12. Set up Newton's rings to determine wave length of sodium light
13. To determine the wave length and dispersive power using plane diffraction grating (use Hg source)
14. To study the absorption spectra of iodine vapours.
15. Determine the value of Rydberg constant using Balmer series of Hydrogen spectrum.

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

Core Course-X

PHY-2.2.3: DIGITAL SYSTEMS AND APPLICATIONS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.
Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**
Course Objective: The main objective of this course is to provide basic knowledge of Digital Electronics to design digital circuits using diodes, transistors; to solve Boolean expressions; to understand various combinational circuits such as logic gates, adders, subtractors, multiplexers, de-multiplexers and to understand various sequential circuits such as flip-flops, shift registers etc.

Section A

Number Systems: The Binary Number System, Binary to decimal and decimal to binary conversion, binary addition, subtraction multiplication and division, Representation of Signed Numbers using 2's (or 1's) compliment method, 2's and 1's complement athematic, double precision numbers and floating point numbers. Octal to binary and binary to octal conversions. Octal to decimal and decimal to octal conversions.
Binary Codes: Numeric and alphanumeric codes, Weighted and non-weight codes, BCD code, BCD addition and subtraction, XS-3 code, XS-3 addition and subtraction, Gray code, binary to Gray and Gray to binary conversion.
Logic Gates: AND, OR, NOT Gates, Realization using diode logic or resister transistor logic, Logic design and Truth Table, NAND, NOR Gates, Universal property of NAND NOR Gates, Exclusive-OR Gate, Properties of Exclusive-OR Gate, Exclusive-NOR Gate.
Boolean algebra: Logic Operations, Laws of Boolean Algebra, De Morgan's Theorems, Reducing Boolean expressions, Boolean expression and logic diagrams. Determination of output level from the diagram, Converting AND/OR/INVERT logic to NAND/NOR logic.

Section B

Minimization of Switching Functions: Minterms, Maxterms, two variable K-map, Mapping and minimization of SOP and POS expressions, three variable K-map, minimization of SOP and POS expressions, Reading the K-maps.
Combinational Logic Design: Half adder, Full adder, half subtractor, Full subtractor, Ripple carry adder, 4-bit parallel subtractor.
Data processing circuits: Basic idea of Multiplexers, De-multiplexers, Decoders, 1-of-10 decoder, Encoders.
Sequential Circuits: SR flip-flop, Gated SR flip-flop, Edge triggered SR flip-flop, Race around condition, Master-slave (pulse triggered) SR flip-flop, JK flip-flop, SR to JK flip-flop. D & T flip-flop.
Shift registers: Buffer registers, Controlled buffer registers, Data transmission in shift registers, Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).

Course learning outcome: Students will have achieved the ability to:

- Learn function of basic digital circuits and use of transistors to create logic gates in order to perform Boolean logic.
- Learn different theorems for simplification of basic Digital electronics circuits.
- Understands symbols, Truth tables, Boolean equations, & working principle.

- Understand combinational and sequential logics and their differences.
- Understand flip-flop and shifts register.
- Recognize and analyze the basic digital circuits

Text Books:

1. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
2. Digital Principles and Applications: A.P. Malvino & D.P. Leach, Tata McGraw-Hill, New Delhi

Reference Books:

- An Introduction to Digital Electronics: M. Singh, Kalyani Publishers, New Delhi
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Digital Electronics G K Kharate ,2010, Oxford University Press
- Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning

Core Course-X Practical

PHY-2.2.3P: DIGITAL SYSTEMS AND APPLICATIONS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. To measure (a) Voltage (b) Time period and frequency of a periodic waveform using CRO.
2. To test a Diode and Transistor using a Multimeter.
3. To design a switch (NOT gate) using a transistor.
4. To verify and design AND, OR, NOT and XOR gates using NAND gates.
5. To design a combinational logic system for a specified Truth Table.
6. Verify De-Morgan's laws using logic gates circuit.
7. To convert a Boolean expression into logic circuit and design it using logic gate ICs.
8. To minimize a given logic circuits.
9. To study 2 Bit, 3 Bit and 4 Bit adder and subtracter.
10. To study Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
11. To build JK Master-slave flip-flop using Flip-Flop ICs
12. To study Digital to Analog Converter and Analog to Digital Converter.
13. To study multivibrators (astable, monostable and bistable) using discrete components.
14. To study the multivibrators (BMV, AMV and MMV) using IC-555.
15. To study Timer Integrated circuit IC-555.

Reference Books:

1. Modern Digital Electronics, R.P. Jain, 4th Edition, 2010, Tata McGraw Hill.
2. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
3. Microprocessor Architecture Programming and applications with 8085, R.S. Goankar, 2002, Prentice Hall.
4. Digital Electronics G.K. Kharate ,2010, Oxford University Press
5. Digital Systems: Principles & Applications, R.J.Tocci, N.S. Widmer, 2001, PHI Learning

Skill Enhancement Course-2

PHY-2.2.4: APPLIED OPTICS

(Theory and Practical)

Maximum Marks: 50 **Credit: Theory (1) + Practical (1)**
Pass Marks: 40%(20 Marks) **Teaching Hours: 15 (Theory)**
Time: 3 Hours **30 (Practical)**

Course Objective: The aim of this course is not just to impart theoretical knowledge of optics to the students but to enable them to develop an awareness and understanding about its various practical uses in different areas like holography, fibre optics, lasers etc. The practical will provide a hands-on training related to some of the applications.

Instructions for The Paper Setter: The question paper will be set by appointed external examiner (Subject Expert) on the day of exam and the distribution of marks will be as under:

1. Theory exam from Section A - 25 Marks
2. Experiment to be performed from Section B - 15 Marks
3. Viva-voce - 5 Marks
4. Note-book - 5 Marks

Course Objectives: The aim of this course is not just to impart theoretical knowledge of optics to the students but to enable them to develop an awareness and understanding about its various practical uses in different areas like holography, fibre optics, lasers etc. The practical will provide a hands-on training related to all these applications.

Section A

Sources and Detectors: Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers.

Non-Linear Optics: Harmonic generation, Second harmonic generation, Third harmonic generation, Optical mixing, Parametric generation of light, Self-focussing of light.

Holography: Introduction, Principle and theory of holography, Recording of the hologram, Reconstruction of the image, Important properties of a hologram, Advances in holography: Reflection holography, Volume holography White light reflection and Rainbow holography, Applications of holography: Holographic interferometry, Acoustic holography, Holographic optical elements.

Photonics: Fibre Optics: Optical fibres and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres, Fibre optic sensors: Fibre Bragg Grating.

Section B

List of experiments:

1. Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid-state laser.
2. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or Solid-state laser.
3. To find the polarization angle of laser light using polarizer and analyser
4. V-I characteristics of LED
5. Study the characteristics of solid state laser
6. Photovoltaic Cell
7. Constructing a Michelson interferometer
8. Measuring the refractive index of air
9. To measure the numerical aperture of an optical fibre
10. To study the variation of the bending loss in a multimode fibre

Course Outcomes: Within the course structure offered, students will gain a good understanding of the building blocks of lasers, Fourier optics, holography and fiber optics. In particular, they will be able to:

- Predict fundamental (and ultimate) characteristics of laser systems
- Find the interrelations between Einstein coefficients

- Understand the basic Non-linear optics
- Understand the basic holography and optical fiber communication

Text Books

1. Laser and Non-Linear Optics by B B Laud, 2nd Edition, New Age International.
2. A text book of Optics by Subrahmanyam, Brij Lal and Avadhanulu, S.Chand.
3. Optical Fibre Communications: principles and practice by John M. Senior, 2nd Edition, Prentice-Hall of India

Reference Books

- LASERS: Fundamentals & applications, K. Thyagrajan & A. K. Ghatak, 2010, Tata McGraw Hill
- Fibre optics through experiments, M. R. Shenoy, S. K. Khijwania, et.al. 2009, Viva Books
- Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.
- Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.

Generic Elective-4

PHY-2.2.5 A: CHEMISTRY-II

Maximum Marks:100 **Time Allowed: 3 Hours**
External Examination: 70 (Pass Marks: 28) **Teaching Hours: 60 (4 Credits)**
Internal Assessment: 30 (Pass Marks: 12) **Pass Percentage: 40 %**

Instruction for the Paper Setter: The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each. Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 2 marks each.

Instruction for the candidates: Candidates are required to attempt five questions in all by selecting two questions each from sections A & B and Section C (9" question) is compulsory.

Course Objective: To teach the fundamental concepts of Chemistry and their applications. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to the requisite intellectual understanding of Chemical Energetics, Physical properties of liquid, Theories of Acids & Bases and laboratory skills.

Section A

Chemical Thermodynamics

Intensive and extensive properties, variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics.

First law: Concept of heat, q, work, w, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, Joule's law, Joule-Thomson Effect, Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature, calculations of q, w, dU and dH for reversible, irreversible processes. (Ideal Gas)

Second Law: Statement of the second law of thermodynamics, need for law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem, thermodynamic scale of temperature. Concept of entropy, molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.

Third Law: Statement of third law, Nernst heat theorem, concept of residual entropy, calculation of absolute entropy of molecules. Free Energy Functions: Gibbs and Helmholtz energy, Free energy change and spontaneity, Maxwell relations, Gibbs-Helmholtz equation.

Section B

Acids and Bases

Acids and Bases: Bronsted-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, Hard and soft acids and bases (HSAB concept), applications of HSAB process.

Liquids: Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

Course Outcomes: The students will acquire knowledge of

- Thermodynamics
- Theories of acids and bases
- Determination of viscosity and surface tension of liquids.

Text books:

1. Atkins, P. W. & Atkin's, P.J. Physical Chemistry, Oxford University Press, 2006.
2. Pathania, P.S Principles of Physical Chemistry (47" Ed), Vishal publisher Co. ;2016
3. Kiran, S Modern approach Physical chemistry, 2019.

Reference Books:

1. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill (2007).
2. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).

Generic Elective-4 (Practical)

PHY-2.2.5 AP: CHEMISTRY PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instruction for the Examiners and Candidates: The practical examination will be held in single session (morning/evening). Candidates are required to perform practicals from physical chemistry and organic chemistry. Distribution of marks will be as under (Books may be consulted):

1. Physical Chemistry Experiment = 15 marks
   [Initial Write up: 7 marks (Theory/principle: 2, Procedure: 2, General Calculations: 3)
   Performance and result: 8 marks (Full credit up to 10% error)]
2. Inorganic Qualitative Analysis = 20 marks
3. Viva-Voce = 10 marks
4. Note Books = 5 marks

Total = 50 marks

Section A: Physical Chemistry

1. Surface tension measurement (use of organic solvents excluded).
   a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.
   b) Study of the variation of surface tension of a detergent solution with concentration.
2. Viscosity measurement (use of organic solvents excluded).
   a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
   b) Study of the variation of viscosity of an aqueous solution with concentration of solute

Section B: Inorganic Chemistry

3. Semi-micro qualitative analysis (using H_2S or other methods) of mixtures- not more than two ionic species (one anion and one cation, excluding insoluble salts) out of the following:
   Cations: NH_4^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^+
   Anions: CO_3^{2-} S^{2-}, SO_3^{2-} $S_2O_3^{2-}$, NO^-, CH_3COO^-, Cl^-, Br^-, I^-, NO_3^-, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, F^- $C_2O_4^{2-}$

Reference Books:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011)

Generic Elective-4

PHY-2.2.5 B: WEB DEVELOPMENT USING PHP

Total Teaching Hours:60
Time Allowed: 3 Hrs
Pass Marks:35%

Internal Assessment: 30 Marks
External Marks: 70 Marks
4 Credits: 4H (L)

Instructions for Paper Setter/Examiners

The Question paper will consist of three sections-A, B & C. Section A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each. Candidates are required to attempt two questions each from section A and B. Section C will consist of 9 short answer type questions covering entire syllabus and will carry 3 marks each. Section C is Compulsory.

Section A

PHP: A Brief History of PHP, Introduction to PHP, Syntax, Scope of Variables: Global and Local Variables, Data types, Control Statements, Operators- Arithmetic, Logical, Relational and Bit-Wise operators. Functions, JavaScript functions Local and Global scope, Calling Functions, Defining a Function, Built-in functions. Installing and Configuring PHP on Windows. Installing web site on web server-Apache, WAMP. Creating Arrays, Multidimensional Arrays, Cookies. Document Object Model and Finding Elements. Basic Events, Standard Event Model.
String: Quoting String Constants - Printing Strings - Accessing Individual Characters -Cleaning Strings - Encoding and Escaping -Comparing Strings - Manipulating and Searching Strings – Regular Expressions.

Section B

Connecting to MySQL from PHP: Server side programming, Client Side Scripting, WAMP tool, HTML Form Fields (Controls), PHP Form Handling, Form Validations.
Objects: Terminology - Creating an Object - Accessing Properties and Methods - Declaring a Class - Introspection – Serialization Extending PHP.
AJAX: Introduction, Identifiers, Variables, Defined Constants, Operators and Expressions.HTML Form Fields (Controls).
Architectural Overview: The pval/zval Data Type, Parameter Handling, Returning Values, References, Global Variables.
Introduction to MySql: Data Types, SqlQueries: Creating Database, Creating Table, Inserting, Updating, Deleting Data. Searching, Sorting, Altering table.

Reference Books:

1. Robin Nixon, Learning PHP, MySQL, and JavaScript, Shroff/O'Reilly.
2. Raj Kamal, Internet and Web Technologies, Tata McGraw-Hill.
3. Matt Zandstra, Sams Teach Yourself PHP in 24 Hours, Sams Publishing.
4. Steven M. Schafer, HTML, CSS, JavaScript, Perl, Python and PHP, Wiley India

Generic Elective-4 (Practical)

PHY-2.2.5 BP: SOFTWARE – II LAB

Time Allowed: Three Hours | External Evaluation: 50 Marks
Pass Marks: 35% | 2 Credits: 4H (P)

This laboratory course will comprise of exercises to supplement what is learnt under paper BHGE-1.2B Web Development using PHP.

Students are required to develop the following programs in PHP language with internal documentation:

1. Write a program to print any text in PHP.
2. Write a program to print the data types of PHP i.e. using String, Integer, Floating point numbers, Boolean, Array, Object, NULL.
3. Write a program of arithmetic operators.
4. Write any program of using conditional Statements.
5. Write a program to implement switch case in PHP.
6. Write a program to add two numbers using functions.
7. Write a program to implement while loop.
8. Print different values using for each loop.
9. Create a Date From a String With PHP strtotime() function
10. Write a program to open, read and close file in PHP.
11. Write a function to connect and create database using PHP.
12. Write a program to implement mail function.
13. Write a program to implement WHERE clause in php MySQL.
14. Write a program to implement file upload using PHP.
15. Write a program to start, store and delete session variable.

Generic Elective-4

PHY-2.2.5 C: DIFFERENTIAL EQUATIONS

L	T	P
5	1	0

Time Allowed: 3 hours

External Assessment: 100 Marks
Internal Assessments: 50 Marks
Total: 150 Marks
Pass Percentage: 40%

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each of 20 marks each from the respective sections of the syllabus. Section C will consist of one compulsory question having ten short answer type questions each of 2 marks covering the entire syllabus uniformly.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Section A and B and compulsory question of Section C.

Course Objectives: The course will introduce the students to differential equations and its various other types.
Pedagogy: The teacher should explain the concept using numerical problems.

Section A

First order differential equations: Order and degree of a differential equation, separable differential equations, Homogeneous differential equations, equations reducible to Homogenous differential equations Exact differential equations. Linear differential equations and equations reducible to linear differential equations.
Higher order differential equations: Solution of Linear homogeneous and non-homogeneous differential equations of higher order with constant coefficients and with variable coefficients. method of Variation of Parameters.

Section B

Partial differential equations:
Partial differential equation of first order, Lagrange's solution, Integral surfaces passing through a given curve, surfaces orthogonal to a given system of surfaces, Partial differential equation of first order but of any degree, Charpit's general method of solution.
Partial differential equations of second and higher order: Partial differential equations of the second order and their classification into hyperbolic, elliptic and parabolic types.

Course Outcomes: The students will have strong hold on the concept of differential equations and partial differential equations.

Text Books:

1. Zafar Ahsan: Differential Equations and Their Applications, Prentice-Hall of India Pvt. Ltd. New Delhi-Second edition.
2. M. D. Raisinghania, Ordinary and Partial Differential Equations, S Chand.

Reference Books:

1. E. A. Coddington, An introduction to ordinary differential equation, Prentice-Hall of India.
2. I. N. Sneddon, Elements of Partial differential equations, Dover Publications, Inc. New York, 2006.

PHYSICS DEPARTMENT

Syllabus

Bachelor of Science Honors Physics

Program Code: BSCH-PHY

Part-III

(Semester: V, VI)

2022-23, 2023-24, 2024-25

Sri Guru Teg Bahadur Khalsa College

Sri Anandpur Sahib-140118, Punjab

- An Autonomous College, Affiliated to Punjabi University Patiala
- NAAC Accredited 'A' Grade College
- College with Potential for Excellence Status by UGC
- STAR College Status by Department of Biotechnology, Govt. of India
- Department of Science & Technology-FIST Scheme, Govt. of India

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Phone: 01887-232037
Email: physicsdepartment321@gmail.com
Website: www.sgtbcollege.org.in

APPROVED
Board of Studies Meeting held on 1st August, 2022

SCHEME OF STUDIES
Program Code: BSCH-PHY

B.SC. HONORS PHYSICS PART III
SEMESTER V

Course Code	Course Opted	Course Name		Credits	Maximum Marks	External Marks	Internal Marks
PHY-3.1.1	Core Course-XI	Nuclear Physics		4	100	70	30
PHY-3.1.1P	Core Course-XI Practical	Nuclear Physics Practical		2	50	50	--
PHY-3.1.2	Core Course-XII	Solid State Physics		4	100	70	30
PHY-3.1.2P	Core Course-XII Practical	Solid State Physics Practical		2	50	50	--
PHY-3.1.3* & PHY-3.1.4*	Discipline Specific Elective-1* & Discipline Specific Elective-2*	A	Experimental Techniques	4	100	70	30
		AP	Experimental Techniques Practical	2	50	50	--
		B	Physics of Devices and Instruments	4	100	70	30
		BP	Physics of Devices and Instruments Practical	2	50	50	--
		C	Classical Dynamics	6	150	100	50
		D	Atmospheric Physics	4	100	70	30
		DP	Atmospheric Physics Practical	2	50	50	--
		E	Nano Materials and Applications	4	100	70	30
		EP	Nano Materials and Applications Practical	2	50	50	--
		F	Medical Physics	6	150	100	50
		G	Laser Physics	4	100	70	30
		GP	Laser Physics Practical	2	50	50	--
		H	Particle Physics and Accelerators	6	150	100	50
				24	**600**		

* Discipline Specific Elective Papers: Student will choose any two papers.

SCHEME OF STUDIES
Program Code: BSCH-PHY

B.SC. HONORS PHYSICS PART III
SEMESTER VI

Course Code	Course Opted	Course Name		Credits	Maximum Marks	External Marks	Internal Marks
PHY-3.2.1	Core Course-XIII	Electromagnetic Theory		4	100	70	30
PHY-3.2.1P	Core Course-XIII Practical	Electromagnetic Theory Practical		2	50	50	--
PHY-3.2.2	Core Course-XIV	Statistical Mechanics		6	100	100	50
PHY-3.2.3* & PHY-3.2.4*	Discipline Specific Elective-1* & Discipline Specific Elective-2*	A	Experimental Techniques	4	100	70	30
		AP	Experimental Techniques Practical	2	50	50	--
		B	Physics of Devices and Instruments	4	100	70	30
		BP	Physics of Devices and Instruments Practical	2	50	50	--
		C	Classical Dynamics	6	150	100	50
		D	Atmospheric Physics	4	100	70	30
		DP	Atmospheric Physics Practical	2	50	50	--
		E	Nano Materials and Applications	4	100	70	30
		EP	Nano Materials and Applications Practical	2	50	50	--
		F	Medical Physics	6	150	100	50
		G	Laser Physics	4	100	70	30
		GP	Laser Physics Practical	2	50	50	--
		H	Particle Physics and Accelerators	6	150	100	50
				24	**600**		

*Discipline Specific Elective Papers: Student will choose any two papers but other than two chosen in previous semester.

PROGRAM OVERVIEW

Program Code: BSCH-PHY

Duration: 3 Years

Bachelor of Science Honors in Physics program is designed to prepare students for pursuing higher education or working in industry by introducing advanced ideas and techniques that are applicable in a wide range of Physics learning and application while emphasizing the underlying concepts of Physics. This course provides in-depth understanding of principles and concept of Physics, proficiency in experimentation to understand the theoretical and experimental dimensions of Physics.

Program Educational Objectives

1. The graduates will have knowledge of fundamental laws and principles in a variety of areas of Physics along with their applications.
2. The graduates will develop research skills which might include advanced laboratory techniques, numerical techniques, computer algebra, computer interfacing.
3. The graduates will become effective researcher who will be able to provide lucid summation of the scientific literature on a given topic of study.
4. The graduates will develop the skill to plan, execute and report the results of an extended experimental or theoretical Physics based project in a research environment.

Program Outcomes

At the end of the program the students will be able to:

1. Apply theoretical knowledge of principles and concepts of Physics to practical problems.
2. Use mathematical techniques and interpret mathematical models of physical behavior.
3. Demonstrate the ability to plan, undertake, and report on a program of original work; including the planning and execution of experiments, the analysis and interpretation of experimental results.
4. Assess the errors involved in an experimental work and make recommendations based on the results in an effective manner.
5. Develop communication skills, both written and oral, for specialized and non-specialized audiences.

Core Course-XI

PHY-3.1.1: NUCLEAR PHYSICS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objectives: To impart knowledge about basic Nuclear Physics properties and nuclear models for understanding of related reaction dynamics.

Instructional delivery strategy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

Nuclear Properties: Constituents of nucleus and their intrinsic properties, Qualitative facts about size, mass, density, energy, charge. Binding energy, angular momentum, magnetic moment and electric quadruple moments of the nucleus, Wave mechanical properties of nucleus, average binding energy and its variation with mass numbers, Properties of nuclear forces.

Nuclear Models: Non-existence of electrons in the nucleus and neutron-proton model, Liquid drop model and semi empirical mass formula, Conditions of nuclear stability, Fermi gas model, Experimental evidence of magic numbers and its explanation, Nuclear shell model.

Section B

Nuclear Decay Processes: Modes of decay and successive radioactivity. Alpha emission. Electron emission, Positron emission. Electron capture, Gamma-ray emission, internal conversion, Qualitative discussion of alpha, beta and gamma spectra, Geiger-Nuttal rule, Neutrino hypothesis of beta decay. Evidence of existence of neutrino, Qualitative discussion of alpha and beta decay theories.

Interaction of radiation and charged particles with matter: Energy loss of electrons and positrons, Positron annihilation in condensed media, stopping power and range of heavier charged particles, derivation of Bethe-Bloch formula, interaction of gamma rays with matter.

Radiation detection: Basic concept and working principle of gas detectors (Ionization Chambers, Proportional Counter, and Geiger Muller Counter), Scintillation Detectors, Solid States Detectors and Thermo-Luminescent Dosimetry.

Course learning outcomes: Students will have achieved the ability to:

- Explain the ground state properties of the nucleus for study of the nuclear structure behavior.
- Demonstration of the shell model and collective model descriptions.
- Explain the radioactivity and various decay processes.
- Apply various aspects of nuclear reactions in view of compound nuclear dynamics.

Text Books

1. Introductory Nuclear Physics: K.S. Krane, John Wiley & Sons, New York
2. Introductory Nuclear Physics by K.S. Thind, M. Singh, V. Kumar, L. Gerward (Vishal Pub. Co.)

Reference Books

- Nuclear Physics by I. Kaplan, Addision-Wiley Pub. Co. Inc.
- Nuclear and Particle Physics by W.E. Burcham Prentice Hall Publishers
- Concepts of Nuclear Physics by Bernard Leonard Cohen, McGraw Hill Education
- Introductory Nuclear Physics by D.C. Tayal, Himalaya Publishers

Core Course-XI Practical

PHY-3.1.1P: NUCLEAR PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Practicals:

1. To find the half-life period of a given radioactive substance using a GM counter.
2. To draw the plateau of a GM counter and find its operating voltage.
3. To study the statistical fluctuations of G.M. Counter to find its standard deviation.
4. To find the absorption co-efficient of β-particles in aluminum using a GM counter.
5. Verify inverse square law using GM counter.
6. To determine the dead time of given GM counter
7. To determine the resolving time of GM counter using half disc radioactive beta source.
8. To determine the radon concentration in air at different locations.
9. To find range and energy of β-particles.
10. To study the energy resolution and calibration of a scintillation counter.
11. To determine the linear attenuation coefficient of given material using gamma source and scintillation detector.
12. To measure the pulse-height of gamma ray spectrum with multichannel analyzer (MCA).
13. To plot the complete gamma ray spectrum of 137Cs and mark the different peaks of the spectrum.

Course Outcomes: On satisfying the requirements of this course, students will have the knowledge and skills to:

- Design a complete experimental apparatus able to implement Nuclear Physics, and related experiments.
- Acquire basic skills to critically elaborate and interpret experimental data.

Reference Book

1. B. Sc. Practical Physics, C. L. Arora, S Chand and Company Limited.

Core Course-XII

PHY-3.1.2: SOLID STATE PHYSICS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objectives: To study some of the basic properties of the condensed phase of matter especially solids. This paper enables the students to understand about crystal structure, Lattice vibration, Free electron theory, magnetic properties of matter, Band theory of solids, electrical properties, semiconductors and superconductivity phenomenon.

Section A

Crystal Structure: Amorphous and Crystalline Solids, Lattice, Basis, Crystal Structure, Translation Vectors, Unit Cell, Miller Indices. Reciprocal Lattice, Types of Lattices, Brillouin Zones. Diffraction of X-rays by Crystals, Bragg's Law, Experimental diffraction Methods, Atomic and Geometrical Factor.

Elementary Lattice Dynamics and Free Electron theory: Dynamics of Monoatomic and Diatomic Linear Chains. Acoustical and Optical Phonons. Dulong and Petit's Law, Particle in one dimensional and three-dimensional box, density of states (one & Three dimensions), Einstein and Debye theories of specific heat of solids.

Section B

Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials, Classical Langevin Theory of dia– and Paramagnetic Domains, Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.

Elementary band theory: Kronig Penny model, Band Gap, Conductor, Semiconductor, (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect.

Superconductivity: Experimental Results, Critical Temperature, Critical magnetic field, Meissner effect, Type I and type II Superconductors, London's Equation and Penetration Depth, Isotope effect, Idea of BCS theory (No derivation)**.**

Course Outcomes: After the completion of the course, students will be able to

- Understand the physics behind structural, magnetic and electrical behaviour of the solids.
- Tailor the properties of the solids with proper understanding.
- Understand the physical process underlying many solid-state devices.
- Understand the concept of superconductors.
- Pursue the research work in the field of material science.

Text Books:

1. Introduction to Solid State Physics, Charles Kittel, 8th Edition, Wiley India Pvt. Ltd.
2. Solid State Physics, S.O. Pillai, 6th Edition, New Age International Publication

Reference Books

- Elements of Solid State Physics, J.P. Srivastava, 4th Edition, 2015, PHl of India
- Condensed Matter Physics, Ashok Sharma, Modern Publishers
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill

- Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
- Solid State Physics, Rita John, 2014, McGraw Hill
- Elementary Solid State Physics, M. Ali Omar, 1999, Pearson India
- Solid State Physics, A.J. Dekker, 2nd Edition, McMillan India Ltd

Core Course-XII Practical

PHY-3.1.2P: SOLID STATE PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40% (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

Course Objectives: The course introduces the students into basic experimental methods in Solid State Physics.

Experiments:

1. Measurement mass susceptibility
   (i) $FeCl_3 6H_2O$
   (ii) Anhydrous $FeCl_3$
   (iii) Molecular (or molar) susceptibility by Quinck`s Method.
2. To study Frank Hertz experiment for quantization of Bohr's model of an atom.
3. To find the curie temperature of a given substance.
4. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
5. Study of solar cell and its characteristics.
6. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.
7. Measurement of magneto-resistance of a semi-conducting sample.
8. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150^{o}C) and to determine its band gap.
9. To determine the Hall coefficient of a semiconductor sample.
10. Determination of velocity of Ultrasonic waves in liquids.
11. To demonstrate dia-para-ferro magnetism in an inhomogeneous magnetic field.

Course Outcomes: On satisfying the requirements of this course, students will have the knowledge to:

- Design a complete experimental apparatus able to implement solid state physics experiments.
- Acquires basic skills to critically elaborate and interpret experimental data.
- Achieve advanced capabilities in equipment handling and experimental problem solving.

Text Book

1. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House.
- Advanced level Practical Physics, Michael Nelkon and Jon M. Ogborn, 4th Edition, Heinemann Educational Publishers.

Discipline Specific Elective Papers

(Choose any two papers)

APPROVED
Board of Studies Meeting held on 1st August, 2022

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3A or PHY-3.1.4A: EXPERIMENTAL TECHNIQUES

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Instructional delivery strategy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

Measurements: Accuracy and precision. Significant figures. Error and uncertainty analysis. Types of errors: Gross error, systematic error, random error. Statistical analysis of data (Arithmetic mean, deviation from mean, average deviation, standard deviation, chi-square) and curve fitting. Guassian distribution.

Signals and Systems: Periodic and aperiodic signals. Impulse response, transfer function and frequency response of first and second order systems. Fluctuations and Noise in measurement system. S/N ratio and Noise figure. Noise in frequency domain. Sources of Noise: Inherent fluctuations, Thermal noise, Shot noise, 1/f noise.

Shielding and Grounding: Methods of safety grounding. Energy coupling. Grounding. Shielding: Electrostatic shielding. Electromagnetic Interference.

Digital Multimeter: Comparison of analog and digital instruments. Block diagram of digital multimeter, principle of measurement of I, V, C. Accuracy and resolution of measurement.

Section B

Transducers & industrial instrumentation (working principle, efficiency, applications): Static and dynamic characteristics of measurement Systems. Generalized performance of systems, Zero order first order, second order and higher order systems. Electrical, Thermal and Mechanical systems. Calibration. Transducers and sensors. Characteristics of Transducers. Transducers as electrical element and their signal conditioning. Temperature transducers: RTD, Thermistor, Thermocouples, Semiconductor type temperature sensors (AD590, LM35, LM75) and signal conditioning. Linear Position transducer: Strain gauge, Piezoelectric. Inductance change transducer: Linear variable differential transformer (LVDT), Capacitance change transducers. Radiation Sensors: Principle of Gas filled detector, ionization chamber, scintillation detector.

Impedance Bridges and Q-meter: Block diagram and working principles of RLC bridge. Q-meter and its working operation. Digital LCR Bridge.

Vacuum Systems: Characteristics of vacuum: Gas law, Mean free path. Application of vacuum. Vacuum system- Chamber, Mechanical pumps, Diffusion pump & Turbo Modular pump, Pumping speed, Pressure gauges (Pirani, Penning, ionization).

Reference Books

1. Measurement, Instrumentation and Experiment Design in Physics and Engineering,
2. M. Sayer and A. Man singh, PHI Learning Pvt. Ltd. Experimental Methods for Engineers, J.P. Holman, McGraw Hill
3. Introduction to Measurements and Instrumentation, A.K. Ghosh, 3rd Edition, PHI
4. Learning Pvt. Ltd. Transducers and Instrumentation, D.V.S. Murty, 2nd Edition, PHI Learning Pvt. Ltd.
5. Instrumentation Devices and Systems, C.S. Rangan, G.R. Sarma, V.S.V. Mani, Tata
6. McGraw Hill Principles of Electronic Instrumentation, D. Patranabis, PHI Learning Pvt. Ltd.
7. Electronic circuits: Handbook of design & applications, U. Tietze, Ch. Schenk, Springer.

(BOS Chairman) (VC Nominee) (Academic Council Nominees) (Industry Expert) (Student Alumni) (Members)

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3AP or PHY-3.1.4AP: EXPERIMENTAL TECHNIQUES PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40% (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Practical:

1. Determine output characteristics of a LVDT & measure displacement using LVDT
2. Measurement of Strain using Strain Gauge.
3. Measurement of level using capacitive transducer.
4. To study the characteristics of a Thermostat and determine its parameters.
5. Study of distance measurement using ultrasonic transducer.
6. Calibrate Semiconductor type temperature sensor (AD590, LM35, or LM75)
7. To measure the change in temperature of ambient using Resistance Temperature Device (RTD).
8. Create vacuum in a small chamber using a mechanical (rotary) pump and measure the chamber pressure using a pressure gauge.
9. Comparison of pickup of noise in cables of different types (co-axial, single shielded, double shielded, without shielding) of 2m length, understanding of importance of grounding using function generator of mV level & an oscilloscope.
10. To design and study the Sample and Hold Circuit.
11. Design and analyze the Clippers and Clampers circuits using junction diode
12. To plot the frequency response of a microphone.
13. To measure Q of a coil and influence of frequency, using a Q-meter.

Reference Books

1. Electronic circuits: Handbook of design and applications, U. Tietze and C. Schenk,2008, Springer
2. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1990,Mc-Graw Hill
3. Measurement, Instrumentation and Experiment Design in Physics & Engineering, M. Sayer and A. Mansingh, 2005, PHI Learning.

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3B or PHY-3.1.4B: PHYSICS OF DEVICES AND INSTRUMENTS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Instructional delivery strategy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

Devices: Characteristic and small signal equivalent circuits of UJT and JFET. Metal semiconductor Junction. Metal oxide semiconductor (MOS) device. Ideal MOS and Flat Band voltage. SiO2-Si based MOS. MOSFET– their frequency limits. Enhancement and Depletion Mode MOSFETS, CMOS. Charge coupled devices. Tunnel diode.

Power supply and Filters: Block Diagram of a Power Supply, Qualitative idea of C and L Filters. IC Regulators, Line and load regulation, Short circuit protection.

Active and Passive Filters, Low Pass, High Pass, Band Pass and band Reject Filters.

Multivibrators: Astable and Monostable Multivibrators using transistors.

Phase Locked Loop(PLL): Basic Principles, Phase detector (XOR & edge triggered), Voltage Controlled Oscillator (Basics, varactor). Loop Filter– Function, Loop Filter Circuits, transient response, lock and capture. Basic idea of PLL IC (565 or 4046).

Section B

Processing of Devices: Basic process flow for IC fabrication, Electronic grade silicon. Crystal plane and orientation. Defects in the lattice. Oxide layer. Oxidation Technique for Si. Metallization technique. Positive and Negative Masks. Optical lithography. Electron lithography. Feature size control and wet anisotropic etching. Lift off Technique. Diffusion and implantation.

Digital Data Communication Standards: Serial Communications: RS232, Handshaking, implementation of RS232 on PC.

Universal Serial Bus (USB): USB standards, Types and elements of USB transfers. Devices (Basic idea of UART).

Parallel Communications: General Purpose Interface Bus (GPIB), GPIB signals and lines, Handshaking and interface management, Implementation of a GPIB on a PC. Basic idea of sending data through a COM port.

Introduction to communication systems: Block diagram of electronic communication system, Need for modulation. Amplitude modulation. Modulation Index. Analysis of Amplitude Modulated wave. sideband frequencies in AM wave. CE Amplitude Modulator. Demodulation of AM wave using Diode Detector. basic idea of Frequency, Phase, Pulse and Digital Modulation including ASK, PSK, FSK.

Reference Books

1. Physics of Semiconductor Devices, S.M. Sze & K.K. Ng, 3rd Ed.2008, John Wiley & Sons
2. Electronic devices and integrated circuits, A.K. Singh, 2011, PHI Learning Pvt. Ltd.
3. Op-Amps & Linear Integrated Circuits, R. A. Gayakwad,4 Ed. 2000, PHI Learning Pvt. Ltd
4. Electronic Devices and Circuits, A. Mottershead, 1998, PHI Learning Pvt. Ltd.
5. Electronic Communication systems, G. Kennedy, 1999, Tata McGraw Hill.
6. Introduction to Measurements & Instrumentation, A.K. Ghosh, 2009, PHI Learning Pvt. Ltd.
7. Semiconductor Physics and Devices, D.A. Neamen, 2011, 4th Edition, McGraw Hill
8. PC based instrumentation; Concepts & Practice, N. Mathivanan, 2007, Prentice-Hall of India

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3BP or PHY-3.1.4BP: PHYSICS OF DEVICES AND INSTRUMENTS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Practical:

Section A

1. To design a power supply using bridge rectifier and study effect of C-filter.
2. To design the active Low pass and High pass filters of given specification.
3. To design the active filter (wide band pass and band reject) of given specification.
4. To study the output and transfer characteristics of a JFET.
5. To design a common source JFET Amplifier and study its frequency response.
6. To study the output characteristics of a MOSFET.
7. To study the characteristics of a UJT and design a simple Relaxation Oscillator.
8. To design an Amplitude Modulator using Transistor.
9. To design PWM, PPM, PAM and Pulse code modulation using ICs.
10. To design an Astable multivibrator of given specifications using transistor.
11. To study a PLL IC (Lock and capture range).
12. To study envelope detector for demodulation of AM signal.
13. Study of ASK and FSK modulator.
14. Glow an LED via USB port of PC.
15. Sense the input voltage at a pin of USB port and subsequently glow the LED connected with another pin of USB port.

Section B

SPICE/MULTISIM simulations for electrical networks and electronic circuits

1. To verify the Thevenin and Norton Theorems.
2. Design and analyze the series and parallel LCR circuits
3. Design the inverting and non-inverting amplifier using an Op-Amp of given gain
4. Design and Verification of op-amp as integrator and differentiator
5. Design the 1st order active low pass and high pass filters of given cutoff frequency
6. Design a Wein`s Bridge oscillator of given frequency.
7. Design clocked SR and JK Flip-Flop`s using NAND Gates
8. Design 4-bit asynchronous counter using Flip-Flop ICs
9. Design the CE amplifier of a given gain and its frequency response.
10. Design an Astable multivibrator using IC555 of given duty cycle.

Reference Books

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller,1994, Mc-Graw Hill
2. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
3. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
4. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn., 2000, Prentice Hall.
5. Introduction to PSPICE using ORCAD for circuits & Electronics, M.H. Rashid, PHI Learning.
6. PC based instrumentation; Concepts & Practice, N. Mathivanan, 2007, Prentice-Hall of India

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3C or PHY-3.1.4C: CLASSICAL DYNAMICS

Maximum Marks: 150 **Teaching Hours: 90 (5 Th.+1 Tu. Credits)**
External Examination: 100 (Pass Marks: 40) **Pass Percentage: 40 %**
Internal Assessment: 50 (Pass Marks: 20) **Time Allowed: 3 Hours**

50 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 15 marks and each question of section C will carry 4 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 15 marks and Section C carries 40 marks. **Use of scientific calculator is allowed.**

Course Objective: The purpose of the course is to train the students in the Newtonian Mechanics and Special Theory of Relativity formalisms to an extent that they can use these in the modern branches of Physics.

Instructional delivery strategy/Pedagogy: Many of the present student-centered strategies used in physics instruction can intentionally be integrated with the most prominent teacher-centered strategies like direct instruction, lecturing, lecturing with demonstration, or problem-solving with teacher guidance.

Section A

Classical Mechanics of Point Particles: Generalized coordinates, Generalized displacement and velocities, Hamilton's principle, D' Albert Principle, Lagrangian and the Euler-Lagrange equations, Canonical momenta & Hamiltonian. Hamilton's equations of motion, Hamiltonian for a harmonic oscillator. Poisson brackets. Canonical transformations.

Problems: Linear Harmonic Oscillator, Simple Pendulum, Atwood's Machine.

Small Amplitude Oscillations: Potential Energy and Equilibrium: One Dimensional Oscillator, Eigen value Equation. Frequencies of free vibrations and normal modes. Lagrange's equation of motion for small oscillations.

Problems: Normal mode frequencies and Eigen vectors of diatomic and triatomic molecules.

Section B

Four Dimensional Formulation: Minkowski space (Qualitative). The invariant interval, World point and World line. Simultaneity and Twin paradox. Space-Time intervals: space-like, time-like and light-like. Four vectors: Four-velocity and acceleration. Four-momentum and energy-momentum relation. Concept of four-force. Conservation of four-momentum- Applications of Four vectors. Covariant Formulation of Lagrangian and Hamiltonian. Relativistic kinematics.

Problems: Problems and questions 1 to 5 from chapter 14, Text Book 1.

Covariant Formulation of Electrodynamics: D'Alemertian operator and Invariance of D'Alemertian operator (Introduction Only). Maxwell's Field Equations, The Electromagnetic Field Tensor and its transformation under Lorentz transformation, Covariant form of Maxwell's field Equations in term of Electromagnetic Field Tensor, Stress Energy Tensor and conservation laws.

Course learning outcome: On successful completion of this course, students will be able to:

- Understand the Hamilton's principle and D' Alembert Principle.
- Understand the concept of Hamilton's equations of motion.
- Acknowledge the concept of Poisson brackets and Canonical transformations.
- Solve Lagrange's equations of motion for small oscillations.
- Understand the concept of Special Theory of Relativity and basics of Space-Time intervals, Four vectors, concept of four-force and four-momentum etc.
- Explain the Covariant form of Maxwell's field Equations in term of Electromagnetic Field Tensor.

Text Books

1. Classical Mechanics, J.C. Upadhyaya, Revised Edition, Himalaya Publishing Company.
2. Classical Mechanics, Gupta Kumar Sharma, Pragati Prakashan

Reference Books

- Classical Mechanics, H. Goldstein, C.P. Poole, J.L. Safko, 3rd Ed. 2002, Pearson Education.
- Classical Electrodynamics, J.D. Jackson, 3rd Ed., 1998, Wiley.
- The Classical Theory of Fields, L.D Landau, E.M Lifshitz, 4th Ed., 2003, Elsevier.
- Introduction to Electrodynamics, D.J. Griffiths, 2012, Pearson Education.
- Classical Mechanics: An introduction, Dieter Strauch, 2009, Springer.

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3D or PHY-3.1.4D: ATMOSPHERIC PHYSICS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Instructional delivery strategy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

General features of Earth's atmosphere: Thermal structure of the Earth's Atmosphere, Ionosphere, Composition of atmosphere, Hydrostatic equation, Potential temperature, Atmospheric Thermodynamics, Greenhouse effect and effective temperature of Earth, Local winds, monsoons, fogs, clouds, precipitation, Atmospheric boundary layer, Sea breeze and land breeze. Instruments for meteorological observations, including RS/RW, meteorological processes and different systems, fronts, Cyclones and anticyclones, thunderstorms.

Atmospheric Dynamics: Scale analysis, Fundamental forces, Basic conservation laws, The Vectorial form of the momentum equation in rotating coordinate system, scale analysis of equation of motion, Applications of the basic equations, Circulations and vorticity, Atmospheric oscillations, Quasi biennial oscillation, annual and semiannual oscillations, Mesoscale circulations, The general circulations, Tropical dynamics.

Section B

Atmospheric Waves: Surface water waves, wave dispersion, acoustic waves, buoyancy waves, propagation of atmospheric gravity waves (AGWs) in a nonhomogeneous medium, Lamb wave, Rossby waves and its propagation in three dimensions and in sheared flow, wave absorption, non-linear consideration.

Atmospheric Radar and Lidar: Radar equation and return signal, Signal processing and detection, Various type of atmospheric radars, Application of radars to study atmospheric phenomena, Lidar and its applications, Application of Lidar to study atmospheric phenomenon. Data analysis tools and techniques.

Atmospheric Aerosols: Spectral distribution of the solar radiation, Classification and properties of aerosols, Production and removal mechanisms, Concentrations and size distribution, Radiative and health effects, Observational techniques for aerosols, Absorption and scattering of solar radiation, Rayleigh scattering and Mie scattering, Bouguert-Lambert law, Principles of radiometry, Optical phenomena in atmosphere, Aerosol studies using Lidars.

Reference Books:

1. Fundamental of Atmospheric Physics – Murry L Salby; Academic Press, Vol 61, 1996
2. The Physics of Atmosphere – John T. Houghton; Cambridge University press; 3rd edn. 2002.
3. An Introduction to dynamic meteorology – James R Holton; Academic Press, 2004
4. Radar for meteorological and atmospheric observations – S Fukao and K Hamazu, Springer Japan, 2014

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3DP or PHY-3.1.4DP: ATMOSPHERIC PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40% (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four programs on the question paper and the examiner will allot one of these four programs to be executed. The distribution of marks is given below:

1. One full program requiring the student to write algorithm and execution. (30)
2. Viva-Voce (10)
3. Record (Practical File) (10)

Scilab/C++ based simulations experiments based on Atmospheric Physics problems like:

1. Numerical Simulation for atmospheric waves using dispersion relations
   (a) Atmospheric gravity waves (AGW)
   (b) Kelvin waves
   (c) Rossby waves, and mountain waves
2. Offline and online processing of radar data
   (a) VHF radar,
   (b) X-band radar, and
   (c) UHF radar
3. Offline and online processing of LIDAR data
4. Radiosonde data and its interpretation in terms of atmospheric parameters using vertical profiles in different regions of the globe.
5. Handling of satellite data and plotting of atmospheric parameters using radio occultation technique
6. Time series analysis of temperature using long term data over metropolitan cities in India – an approach to understand the climate change

Reference Books

1. Fundamental of Atmospheric Physics – Murry L Salby; Academic Press, Vol 61, 1996
2. The Physics of Atmosphere – J.T. Houghton; Cambridge Univ. Press; 3rd edn. 2002.
3. An Introduction to dynamic meteorology – James R Holton; Academic Press, 2004
4. Radar for meteorological and atmospheric observations – S Fukao and K Hamazu, Springer Japan, 2014

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3E or PHY-3.1.4E: NANO MATERIALS AND APPLICATIONS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Instructional delivery strategy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

NANOSCALE 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 anoscale, 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, 1D nanostructures and its consequences.

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.

CHARACTERIZATION: X-Ray Diffraction. Optical Microscopy. Scanning Electron Microscopy. Transmission Electron Microscopy. Atomic Force Microscopy. Scanning Tunneling Microscopy.

Section B

OPTICAL PROPERTIES: 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. Radiative processes: General formalization-absorption, emission and luminescence. Optical properties of heterostrctures and nanostructures.

ELECTRON TRANSPORT: Carrier transport in nanostrcutures. Coulomb blockade effect, thermionic emission, tunneling and hoping conductivity. Defects and impurities: Deep level and surface defects.

APPLICATIONS: 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. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).
5. M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama, Nanoparticle Technology Handbook (Elsevier)
6. Introduction to Nanoelectronics, V.V. Mitin, V.A. Kochelap and M.A. Stroscio, 2011, Cambridge University Press.
7. Bharat Bhushan, Springer Handbook of Nanotechnology (Springer-Verlag, Berlin, 2004).

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3EP or PHY-3.1.4EP: NANO MATERIALS AND APPLICATIONS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40% (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Practical:

1. Synthesis of metal nanoparticles by chemical route.
2. Synthesis of semiconductor nanoparticles.
3. Surface Plasmon study of metal nanoparticles by UV-Visible spectrophotometer.
4. XRD pattern of nanomaterials and estimation of particle size.
5. To study the effect of size on color of nanomaterials.
6. To prepare composite of CNTs with other materials.
7. Growth of quantum dots by thermal evaporation.
8. Prepare a disc of ceramic of a compound using ball milling, pressing and sintering, and study its XRD.
9. Fabricate a thin film of nanoparticles by spin coating (or chemical route) and study transmittance spectra in UV-Visible region.
10. Prepare a thin film capacitor and measure capacitance as a function of temperature or frequency.
11. Fabricate a PN diode by diffusing Al over the surface of N-type Si and study its V-I characteristic.

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 & Technology (PHI Learning Private Limited).
4. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3F or PHY-3.1.4F: MEDICAL PHYSICS

Maximum Marks: 150 **Teaching Hours: 90 (5 Th.+1 Tu. Credits)**
External Examination: 100 (Pass Marks: 40) **Pass Percentage: 40 %**
Internal Assessment: 50 (Pass Marks: 20) **Time Allowed: 3 Hours**

50 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 15 marks and each question of section C will carry 4 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 15 marks and Section C carries 40 marks. **Use of scientific calculator is allowed.**

Course Objective:

- Focus on the application of Physics to clinical medicine.
- Gain a broad and fundamental understanding of Physics while developing particular expertise in medical applications.
- Learn about the human body, its anatomy, physiology and Bio-Physics, exploring its performance as a physical machine. Other topics include the Physics of the senses.
- He / She will study diagnostic and therapeutic applications like the ECG, radiation Physics, X-ray technology, ultrasound and magnetic resonance imaging.
- Gain knowledge with reference to working of various diagnostic tools, medical imaging techniques, how ionizing radiation interacts with matter, how it affects living organisms and how it is used as a therapeutic technique and radiation safety practices
- Imparts functional knowledge regarding need for radiological protection and the sources of an approximate level of radiation exposure for treatment purposes.
- In the laboratory course, the student will be exposed to the workings of various medical devices. He / she gets familiarized with various detectors used in medical imaging, medical diagnostics.

Instructional delivery strategy/Pedagogy: The course will be taught using lectures followed up by homework assignments and regular class-tests and classroom discussions. Discussions of the course topics using problem-solving approach during the lecture delivery are encouraged.

Section A

Physics of the Body: Basic Anatomical Terminology, Motion in Human machine, The Standard Human, Scaling relationships, Familiarity with terms like- Superior, Inferior, Anterior, Posterior, Medial, Lateral, Proximal and Distal. Statics in the Body: The Lower Arm, Hip, Statics of Other Synovial, Lower Back, Three-Force Rule, Multisegment Modeling. Material components of body: Bone, Ligaments and Tendons, Cartilage. Skeletal Muscles in the Body. Energy Content of Body Fuel. Energy Storage Molecules. Physics of the Circulation System: Properties of Blood, Blood Pressure and Flow in Vessels, Capillaries and Osmotic Pressure, Blood Flow Rates and Speeds, Consequences of Clogged Arteries, Work Done by the Heart, and the Metabolic Needs of the Heart.

Physics of Diagnostic and Therapeutic Systems: X-RAYS: Electromagnetic spectrum, production of x-rays, x-ray spectra, Brehmsstrahlung, Characteristic x-ray. X-ray tubes & types: Coolidge tube, x-ray tube design, tube cooling stationary mode, Rotating anode x-ray tube, Tube rating, quality and intensity of x-ray. X-ray generator circuits, half wave and full wave rectification, filament circuit, kilo voltage circuit. Single and three phase electric supply. Power ratings. Types of X-Ray Generator, high frequency generator, exposure timers and switches, HT cables.

Section B

Imaging Physics: Ultrasound Instrumentation: Machine Controls, Frequency of Transducers, Types of Transducers, Extended Field of View, Clinical Applications of Fusion Imaging. Computer Tomography: Basic Workflow of CT scanner, Determinants of an Optimal Image, Advances in Hardware, Special

Computed Tomography. Magnetic Resonance Instrumentation: The Magnet, Prepolarized MRI, Magnet Geometry, Tesla and Higher Magnet Strengths, Multichannel RF Coils and Parallel Imaging, Advanced MR Applications and Hardware. Basic Physics of Digital Mammography. Applications of Digital Mammography.

Radiotherapy: Photons: Geometrical factors, Specification of dose ratios, The effects of scattered radiation. Field size and backscatter, Dependence of fractional depth dose on TAR. TPR and BSF, Filters, compensators and shields, Orthovoltage glass tube (up to 300 keV X-rays, Linac-based MeV X-rays, Depth-dose distributions, Photon energy spectrum, Neutron contamination of X-ray beams. Electrons: Determination of electron energy at depth in the phantom, Bremsstrahlung contamination of electron beams. Heavy Particles: Protons, Neutrons, Negative pions, Heavy ions. Brachytherap: Interstitial and intracavity brachytherapy, the principles of the Paris system, Experimental HDR brachytherapy dose distribution measurements, Interstitial radiosurgery.

Course learning outcomes: Students will have achieved the ability to:

- Explain about the human body, its anatomy, physiology and Bio-Physics, exploring its performance as a physical machine.
- Explain various diagnostic tools, medical imaging techniques, how ionizing radiation interacts with matter, how it affects living organisms and how it is used as a therapeutic technique and radiation safety practices
- Know about need for radiological protection and the sources of an approximate level of radiation exposure for treatment purposes.

Text Books

1. Physics of the human body, Irving P. Herman, Springer (2007).
2. Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry - Lippincot Williams and Wilkins (1990)
3. Diagnostic Radiology_ Recent Advances and Applied Physics in Imaging byArun Kumar Gupta (2013, Jp Medical Ltd)
4. A primer in applied radiation physics by F A Smith, World Scientific

Reference Books

- Faiz M. Khan - The Physics of Radiation Therapy (2003, Lippincott Williams & Wilkins
- Harold Elford Johns, John Robert Cunningham - Physics of Radiology, Fourth Edition (1983, Charles C Thomas Pub Ltd).
- Jerrold T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt Jr., John M. Boone - The Essential Physics of Medical Imaging-LIPPINCOTT WILLIAMS & WILKINS (2011).
- Noble J.V - Physics of the human body (2003)

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3G or PHY-3.1.4G: LASER PHYSICS

Maximum Marks: 100 | **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) | **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) | **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objectives: The aim of this course is not just to impart theoretical knowledge of lasers, its structure, design and properties but also to provide the students a basic knowledge of its various applications in different areas like holography, fibre optics and non-linearoptics. The practical related to its lab will provide a hands-on training related to these applications.

Section A

Introduction: Introduction, three processes, Active material, Population inversion, Metastable states, Relationship between Einstein's A and B coefficients, Main components of a laser and possibility of light amplification, Threshold condition, Pumping, Electrical and optical pumping (Qualitative), Various level laser system.

Laser Properties: Directionality, Coherence, Spatial coherence, Temporal coherence, Monochromaticity, Relation between coherence &monochromaticity, Brightness &intensity, Focusability

Dynamics of the Laser Processes: Rate equations for two, three and four level systems, production of a giant pulse – Q switching, Techniques of Q-switching, Mode-locking (Definition only), Techniques of mode locking.

Section B

Types of Lasers: Solid state lasers, Basic structure & requirements, Ruby laser, Nd-Glass laser, Gas Lasers, Basic structure & requirements, He-Ne laser, CO_2laser, Liquid lasers, Basic structure & requirements, dye lasers, Semiconductor lasers, Basic structure & requirements, intrinsic semiconductor lasers, doped semiconductors laser, injection lasers.

Application to Fiber Optics: General optical fiber communication system and its advantages**,** Basic principle, Propagation of light in optical fiber, Acceptance angle, Numerical aperture, Relation between numerical aperture and fractional refractive index change, Normalized frequency, Types of optical fiber, Applications of optical fibers.

Some Other Applications: Holography: Principle of recording and reconstruction, Application of holography, Non-linear optics: harmonic generation, second harmonic generation.

Course Learning Outcomes: Within the course structure offered, students will gain a good understanding of the building blocks of lasers, its applications to fiber optics communication, holography and non-linear optics. In particular, they will be able to:

- Understand the basic interaction phenomenon
- Find the interrelations between Einstein coefficients
- Understand the concept of line broadening
- Predict fundamental characteristics of laser systems
- Understand the basic holography and optical fiber communication
- Solve the rate equations in steady state for a laser
- Describe the major examples of laser systems
- Understand the basics of optical fiber

- Understand basics of its different applications viz. holography & non-linear optics

Text Books

1. Laser Theory and Applications by A. Ghatak, Macmillan.
2. Optical Fiber Communications, 3rd Edition by John M Senior, 2009, PHI.
3. Lasers and Non-linear Optics by B.B. Laud, 1991, Wiley Eastern.

Reference Books

- Principles of Lasers: O. Svelto,(3rd Ed.), Plenum Press.
- Optical Electronics A.K. Ghatak and K. Thyagrajan, Cambridge Univ Press.
- Optical Fiber Communications, 3rd Edition.by Gerd Keiser Mc Graw-Hill.
- Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3GP or PHY-3.1.4GP: LASER PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40% (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

Course Objectives: The course introduces the students into basic experimental methods in Laser Physics.

List of Experiments:

1. To calculate the wavelength of Laser light by Double Slit
2. To determine the wavelength of laser light with a transmission grating
3. To measure the wavelength of He-Ne laser by Fresnel's Bi-prism
4. To measure the angle of the wedge of a transparent plate using He-Ne laser
5. To determine grating element of a given diffraction grating
6. Construction of some simple intensity modulated fiber optic sensors for measurement of pressure
7. Measurement of guided near field of a multimode fiber and to measure its Refractive Index Profile (RIP)
8. Characterization of a single mode fiber from a measurement of its far field distribution
9. Determination of the grating radial spacing of the Compact Disc (CD) byreflection using, He-Ne or solid-state laser
10. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid-state laser
11. To find the polarization angle of laser light using polarizer and analyser
12. Thermal expansion of quartz using laser.
13. To determine number of lines in a transmission diffraction grating by using a laser light with known wavelength
14. To measure the divergence of a given laser source**.**
15. To calculate the wavelength of Laser light by single Slit.

Course Outcomes: On satisfying the requirements of this course, students will have the knowledge to:

- Design a complete experimental apparatus able to implement Laser Physics and fibre optics experiments.
- Acquires basic skills to critically elaborate and interpret experimental data.
- Apply key analysis techniques to typical problems encountered in the field
- Achieve advanced capabilities in equipment handling and experimental problem solving.

Reference Books

1. A course of Experiments with He-Ne Laser R S Sirohi, New Age International.
2. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.

Discipline Specific Elective-1 or Discipline Specific Elective-2

PHY-3.1.3H or PHY-3.1.4H: PARTICLE PHYSICS AND ACCELERATORS

Maximum Marks: 150 **Teaching Hours: 90 (5 Th.+1 Tu. Credits)**
External Examination: 100 (Pass Marks: 40) **Pass Percentage: 40 %**
Internal Assessment: 50 (Pass Marks: 20) **Time Allowed: 3 Hours**

50 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 15 marks and each question of section C will carry 4 marks.
Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 15 marks and Section C carries 40 marks. **Use of scientific calculator is allowed.**
Course Objectives: To impart knowledge about basic Particle Physics and various Accelerators.
Instructional delivery strategy/Pedagogy: Many of the present student-centered strategies used in physics instruction can intentionally be integrated with the most prominent teacher-centered strategies like direct instruction, lecturing, lecturing with demonstration, or problem-solving with teacher guidance.

Section A

Elementary Particles: Historical introduction, fermions and bosons, particles and antiparticles, Classification of particles, types of interactions, electromagnetic, weak, strong interactions, gravitational interactions, Quantum numbers and conservation laws, isospin, charge conjugation, Yukawa theory, Introduction to quarks and qualitative discussion of the quark model, high energy physics units.
Problems: Problems 1 to 10 from Chapter 4 of Book 2.

Particle Properties and their reactions: Properties and life time of muon, pions: Determination of mass, spin and parity. Lifetime of neutral pion and isotopic spin. Strange particles: V particles, charged K-mesons, mass and life time for charged K-mesons. Observations of different strange particles, strange particle production and decay. Strangeness and Hypercharge.

Section B

Particle Accelerators: Ion sources, Heavy Ion sources, Polarized Ion Sources, Electrostatic Accelerators (Cockcroft-Walton Generator, Van de Graff generator and Pelletron), linear accelerators, Low Energy Circular Accelerators: Cyclotron, Betatron, electron and proton synchrotron, Heavy Ion Accelerators. Colliding beam machines, Fermilab Tevatron, Large Hadron Collider (LHC). Indian Accelerators.
Problems: Problems 1 to 7 from Chapter 3 of Text Book 1.

Course learning outcomes: Students will have achieved the ability to:

- Basic knowledge of the various particle accelerators.
- Basic knowledge nuclear and particle physics. Knowledge and understanding of the elementary particle interactions. Capability of relating the theory predictions and measurements.
- Understanding of various particle interactions and their interrelation. Relation of basic laws of particle physics and macroscopic physics phenomena. Usage of basic laws in determination of particle properties and properties of processes in the subatomic world.

Text Books:

1. Introductory Particle Physics by K.S. Thind, M. Singh, V. Kumar, L. Gerward (Vishal Pub. Co.)
2. Introductory Nuclear Physics, D. C. Tayal, Himalaya Publishers

Reference Books:

- Nuclear Physics by I. Kaplan (Addision-Wiley Pub. Co. Inc.)
- An Introduction to Nuclear Physics by M.R. Bhiday and V.A. Joshi (Orient Longman)
- Concepts of Nuclear Physics by B.L. Cohen (TMI Ed.)

Core Course-XIII

PHY-3.2.1: ELECTROMAGNETIC THEORY

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objectives: The students are exposed to Maxwell's equations, propagation of electromagnetic (EM) waves in different homogeneous-isotropic as well as anisotropic unbounded and bounded media, production and detection of different types of polarized EM waves, general information as waveguides.

Instructional delivery strategy/Pedagogy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

Maxwell Equations: Review of Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density.

EM Wave Propagation in Unbounded Media: Plane EM waves through isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth.

EM Wave in Bounded Media: Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric Media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases. Brewster's law. Reflection & Transmission coefficients. Total internal reflection, evanescent waves. Metallic reflection (normal Incidence).

Section B

Polarization of Electromagnetic Waves: Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media. Symmetric Nature of Dielectric Tensor. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates.

Wave Guides: Planar optical wave guides. Planar dielectric wave guide. Condition of continuity at interface. Phase shift on total reflection. Eigenvalue equations. Phase and group velocity of guided waves. Field energy and Power transmission.

Course learning outcome:

- Students will be able to understand Maxwell equations in different media.
- Students will understand the concept of polarization of EM waves and its propagation.
- Students will understand the concept of wave guides and process of energy transmission.

Text Books:

1. Classical Electrodynamics, S.P Puri, 3rd Ed., 2017, Narosa Publishing House Pvt. Ltd.
2. Optics, Ajoy Ghatak, 7th Ed, Mc Graw Hill Education Pvt. Ltd.
3. Introduction to Electrodynamics, D.J. Griffiths, 3rd Ed., 1998, Benjamin Cummings.

Reference Books:

- Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.

- Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning.
- Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGraw Hill.
- Electromagnetic field Theory, R.S. Kshetrimayun, 2012, Cengage Learning.
- Engineering Electromagnetic, Willian H. Hayt, 8th Edition, 2012, McGraw Hill.
- Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer.

Core Course-XIII Practical

PHY-3.2.1P: ELECTROMAGNETIC THEORY PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

Objective: The laboratory content compliments the theoretical knowledge of Electromagnetic Theory and gives hands-on experience. Also, it provides the observational understanding of the subject. It enhances the qualitative and quantitative skills of the students.

List of Experiments:

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of sugar solution using Polari meter.
3. To determine the Brewster angle and refractive index of glass.
4. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the diffraction through ultrasonic grating.
5. To study the magnetic field produced by a current carrying solenoid using a search coil and to find value of permeability of air.
6. To determine the ultrasonic velocity in a liquid and measure its adiabatic compressibility.
7. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
8. To verify the Stefan`s law of radiation and to determine Stefan's constant.
9. To determine the Boltzmann constant using V-I characteristics of PN junction diode.
10. To study reflection, refraction of microwaves.
11. To observe the neon spectral bands formation in Frank-Hertz tube.
12. To record the Frank-Hertz characteristics curve for neon.
13. To study the effect of filament voltage and anode plate voltage on the characteristic curve (Frank Hertz)

Reference Books:

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

Core Course-XIV

PHY-3.2.2: STATISTICAL MECHANICS

Maximum Marks: 150 **Teaching Hours: 90 (5 Th.+1 Pr. Credits)**
External Examination: 100 (Pass Marks: 40) **Pass Percentage: 40 %**
Internal Assessment: 50 (Pass Marks: 20) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 15 marks and each question of section C will carry 4 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 15 marks and Section C carries 40 marks. **Use of scientific calculator is allowed.**

Course Objective: The Statistical Mechanics deals with the derivation of the macroscopic parameters (internal energy, pressure, specific heat etc.) of a physical system consisting of large number of particles (solid, liquid or gas) from knowledge of the underlying microscopic behavior of atoms and molecules that comprises it. The main objective of this course work is to introduce the techniques of Statistical Mechanics which has applications in various fields including Astrophysics, Semiconductors, Plasma Physics, Bio-Physics, chemistry and in many other directions.

Instructional delivery strategy/Pedagogy: Many of the present student-centered strategies used in physics instruction can intentionally be integrated with the most prominent teacher-centered strategies like direct instruction, lecturing, lecturing with demonstration, or problem-solving with teacher guidance.

Section A

Basic ideas of statistical physics: Scope of statistical physics, Basic ideas about probability, Concept of macro states, microstates, thermodynamic probability, distribution of four distinguishable particles in two compartment of equal size, Effects of constraints on the system, Distribution of n particles in two compartments, Deviation from the state of maximum probability, equilibrium state of dynamic system, Distribution of distinguishable n particles in k compartments of unequal sizes.

Phase space and its division into elementary cells, three kinds of statistics. The basic approach in the three statistics.

Classical Statistics: Maxwell-Boltzmann Statistics applied to an ideal gas in equilibrium, Maxwell-Boltzmann's law of molecular energies, Zartmann and Ko experiment, Graphical depiction of Maxwell-Boltzmann Speed distribution.

Problems: Problems and questions 1 to 10 from chapter 1, Text Book 1.
Problems and questions 1 to 10 from chapter 2, Text Book 1.

Section B

Bose-Einstein Statistics: B-E distribution law, Application of B-E statistics to photon gas, Black Body Radiation, Spectral Distribution of Black Body Radiation. Planck's Law of Blackbody Radiation: Experimental Verification., Deduction from Plank's law (1) Wien's Displacement Law, (2) Rayleigh-Jeans Law and Wien's law of radiation as a special case of Plank's law, (3) Stefan-Boltzmann Law, (4) pressure exerted by radiation, (5) Equation of state of a photon gas, (6) Adiabatic expansion of photon gas. Radiation pressure and stability of massive stars.

Fermi-Dirac Statistics: Fermi-Dirac Distribution Law, Application of F-D statistics to free electrons inside conductors, Behavior of electron gas at absolute zero temperature, equation of state of degenerate Fermi gas. White Dwarf Stars, Neutron Star and Black holes. Relativistic Fermi gas and Chandrasekhar Limit. Comparison of M-B, B-E and F-D statistics.

Problems: Problems and questions 1 to 10 from chapter 3, Text Book 1.

Course learning outcome:

- Understand the concepts of phase space and thermodynamic probability.

- Three different distribution laws e.g. Maxwell-Boltzmann distribution, Bose-Einstein distribution and Fermi-Dirac distribution laws of particles and their derivation.
- Comprehend and articulate the connection as well as dichotomy between classical statistical mechanics and quantum statistical mechanics.
- Understand the application of F-D statistical distribution law to derive thermodynamic functions of a degenerate Fermi gas, electron gas in metals and their properties.
- Calculate electron degeneracy pressure and ability to understand the Chandrasekhar mass limit, stability of white dwarfs against gravitational collapse.
- Regular assignments related to problems given by the course instructor.

Text Books:

1. Statistical Physics, Thermodynamics & Kinetic Theory, V.S. Bhatia, Vishal Publishing Co.

Reference Books:

- Statistical and Thermal Physics, S. Lokanathan and R.S. Gambhir. 1991, Prentice Hall
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer
- An Introduction to Statistical Mechanics & Thermodynamics, R.H. Swendsen,2012, Oxford Univ. Press
- Statistical Physics and Thermodynamics, A.K. Sikri (Pardeep Publication, Jalandhar)
- A Treatise on Heat, M.N. Saha & B.N. Srivastava, (The Indian Press Pvt. Ltd., Allahabad) 1965.
- Statistical Mechanics: An Introductory Text, Bhattacharjee, J.K. (Allied Pub., Delhi) 2000.
- Statistical Physics, Bhattacharjee, J.K. (Allied Pub., Delhi) 2000.
- Statistical Mechanics, B.B. Laud (Macmillan India Ltd), 1981.

Discipline Specific Elective Papers

(Choose any two papers other than already chosen in previous semester)

APPROVED
Board of Studies Meeting held on 1st August, 2022

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3A or PHY-3.2.4A: EXPERIMENTAL TECHNIQUES

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Instructional delivery strategy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

Measurements: Accuracy and precision. Significant figures. Error and uncertainty analysis. Types of errors: Gross error, systematic error, random error. Statistical analysis of data (Arithmetic mean, deviation from mean, average deviation, standard deviation, chi-square) and curve fitting. Guassian distribution.

Signals and Systems: Periodic and aperiodic signals. Impulse response, transfer function and frequency response of first and second order systems. Fluctuations and Noise in measurement system. S/N ratio and Noise figure. Noise in frequency domain. Sources of Noise: Inherent fluctuations, Thermal noise, Shot noise, 1/f noise.

Shielding and Grounding: Methods of safety grounding. Energy coupling. Grounding. Shielding: Electrostatic shielding. Electromagnetic Interference.

Digital Multimeter: Comparison of analog and digital instruments. Block diagram of digital multimeter, principle of measurement of I, V, C. Accuracy and resolution of measurement.

Section B

Transducers & industrial instrumentation (working principle, efficiency, applications): Static and dynamic characteristics of measurement Systems. Generalized performance of systems, Zero order first order, second order and higher order systems. Electrical, Thermal and Mechanical systems. Calibration. Transducers and sensors. Characteristics of Transducers. Transducers as electrical element and their signal conditioning. Temperature transducers: RTD, Thermistor, Thermocouples, Semiconductor type temperature sensors (AD590, LM35, LM75) and signal conditioning. Linear Position transducer: Strain gauge, Piezoelectric. Inductance change transducer: Linear variable differential transformer (LVDT), Capacitance change transducers. Radiation Sensors: Principle of Gas filled detector, ionization chamber, scintillation detector.

Impedance Bridges and Q-meter: Block diagram and working principles of RLC bridge. Q-meter and its working operation. Digital LCR Bridge.

Vacuum Systems: Characteristics of vacuum: Gas law, Mean free path. Application of vacuum. Vacuum system- Chamber, Mechanical pumps, Diffusion pump & Turbo Modular pump, Pumping speed, Pressure gauges (Pirani, Penning, ionization).

Reference Books

1. Measurement, Instrumentation and Experiment Design in Physics and Engineering,
2. M. Sayer and A. Man singh, PHI Learning Pvt. Ltd. Experimental Methods for Engineers, J.P. Holman, McGraw Hill
3. Introduction to Measurements and Instrumentation, A.K. Ghosh, 3rd Edition, PHI
4. Learning Pvt. Ltd. Transducers and Instrumentation, D.V.S. Murty, 2nd Edition, PHI Pvt. Ltd.
5. Instrumentation Devices and Systems, C.S. Rangan, G.R. Sarma, V.S.V. Mani, Tata
6. McGraw Hill Principles of Electronic Instrumentation, D. Patranabis, PHI Learning Pvt. Ltd.
7. Electronic circuits: Handbook of design & applications, U. Tietze, Ch. Schenk, Springer.

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3AP or PHY-3.2.4AP: EXPERIMENTAL TECHNIQUES PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Practical:

1. Determine output characteristics of a LVDT & measure displacement using LVDT
2. Measurement of Strain using Strain Gauge.
3. Measurement of level using capacitive transducer.
4. To study the characteristics of a Thermostat and determine its parameters.
5. Study of distance measurement using ultrasonic transducer.
6. Calibrate Semiconductor type temperature sensor (AD590, LM35, or LM75)
7. To measure the change in temperature of ambient using Resistance Temperature Device (RTD).
8. Create vacuum in a small chamber using a mechanical (rotary) pump and measure the chamber pressure using a pressure gauge.
9. Comparison of pickup of noise in cables of different types (co-axial, single shielded, double shielded, without shielding) of 2m length, understanding of importance of grounding using function generator of mV level & an oscilloscope.
10. To design and study the Sample and Hold Circuit.
11. Design and analyze the Clippers and Clampers circuits using junction diode
12. To plot the frequency response of a microphone.
13. To measure Q of a coil and influence of frequency, using a Q-meter.

Reference Books

1. Electronic circuits: Handbook of design and applications, U. Tietze and C. Schenk,2008, Springer
2. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1990, Mc-Graw Hill
3. Measurement, Instrumentation and Experiment Design in Physics & Engineering, M. Sayer and A. Mansingh, 2005, PHI Learning.

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3B or PHY-3.2.4B: PHYSICS OF DEVICES AND INSTRUMENTS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Instructional delivery strategy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

Devices: Characteristic and small signal equivalent circuits of UJT and JFET. Metal semiconductor Junction. Metal oxide semiconductor (MOS) device. Ideal MOS and Flat Band voltage. SiO2-Si based MOS. MOSFET– their frequency limits. Enhancement and Depletion Mode MOSFETS, CMOS. Charge coupled devices. Tunnel diode.

Power supply and Filters: Block Diagram of a Power Supply, Qualitative idea of C and L Filters. IC Regulators, Line and load regulation, Short circuit protection.

Active and Passive Filters, Low Pass, High Pass, Band Pass and band Reject Filters.

Multivibrators: Astable and Monostable Multivibrators using transistors.

Phase Locked Loop(PLL): Basic Principles, Phase detector (XOR & edge triggered), Voltage Controlled Oscillator (Basics, varactor). Loop Filter– Function, Loop Filter Circuits, transient response, lock and capture. Basic idea of PLL IC (565 or 4046).

Section B

Processing of Devices: Basic process flow for IC fabrication, Electronic grade silicon. Crystal plane and orientation. Defects in the lattice. Oxide layer. Oxidation Technique for Si. Metallization technique. Positive and Negative Masks. Optical lithography. Electron lithography. Feature size control and wet anisotropic etching. Lift off Technique. Diffusion and implantation.

Digital Data Communication Standards: Serial Communications: RS232, Handshaking, implementation of RS232 on PC.

Universal Serial Bus (USB): USB standards, Types and elements of USB transfers. Devices (Basic idea of UART).

Parallel Communications: General Purpose Interface Bus (GPIB), GPIB signals and lines, Handshaking and interface management, Implementation of a GPIB on a PC. Basic idea of sending data through a COM port.

Introduction to communication systems: Block diagram of electronic communication system, Need for modulation. Amplitude modulation. Modulation Index. Analysis of Amplitude Modulated wave. sideband frequencies in AM wave. CE Amplitude Modulator. Demodulation of AM wave using Diode Detector. basic idea of Frequency, Phase, Pulse and Digital Modulation including ASK, PSK, FSK.

Reference Books

1. Physics of Semiconductor Devices, S.M. Sze & K.K. Ng, 3rd Ed.2008, John Wiley & Sons
2. Electronic devices and integrated circuits, A.K. Singh, 2011, PHI Learning Pvt. Ltd.
3. Op-Amps & Linear Integrated Circuits, R. A. Gayakwad,4 Ed. 2000, PHI Learning Pvt. Ltd
4. Electronic Devices and Circuits, A. Mottershead, 1998, PHI Learning Pvt. Ltd.
5. Electronic Communication systems, G. Kennedy, 1999, Tata McGraw Hill.
6. Introduction to Measurements & Instrumentation, A.K. Ghosh, 3rd Ed., 2009, PHI Learning.
7. Semiconductor Physics and Devices, D.A. Neamen, 2011, 4th Edition, McGraw Hill
8. PC based instrumentation; Concepts & Practice, N. Mathivanan, 2007, Prentice-Hall of India

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3BP or PHY-3.2.4BP: PHYSICS OF DEVICES AND INSTRUMENTS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Practicals:

Section A

1. To design a power supply using bridge rectifier and study effect of C-filter.
2. To design the active Low pass and High pass filters of given specification.
3. To design the active filter (wide band pass and band reject) of given specification.
4. To study the output and transfer characteristics of a JFET.
5. To design a common source JFET Amplifier and study its frequency response.
6. To study the output characteristics of a MOSFET.
7. To study the characteristics of a UJT and design a simple Relaxation Oscillator.
8. To design an Amplitude Modulator using Transistor.
9. To design PWM, PPM, PAM and Pulse code modulation using ICs.
10. To design an Astable multivibrator of given specifications using transistor.
11. To study a PLL IC (Lock and capture range).
12. To study envelope detector for demodulation of AM signal.
13. Study of ASK and FSK modulator.
14. Glow an LED via USB port of PC.
15. Sense the input voltage at a pin of USB port and subsequently glow the LED connected with another pin of USB port.

Section B

SPICE/MULTISIM simulations for electrical networks and electronic circuits

1. To verify the Thevenin and Norton Theorems.
2. Design and analyze the series and parallel LCR circuits
3. Design the inverting and non-inverting amplifier using an Op-Amp of given gain
4. Design and Verification of op-amp as integrator and differentiator
5. Design the 1st order active low pass and high pass filters of given cutoff frequency
6. Design a Wein`s Bridge oscillator of given frequency.
7. Design clocked SR and JK Flip-Flop`s using NAND Gates
8. Design 4-bit asynchronous counter using Flip-Flop ICs
9. Design the CE amplifier of a given gain and its frequency response.
10. Design an Astable multivibrator using IC555 of given duty cycle.

Reference Books

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller,1994, Mc-Graw Hill
2. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
3. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
4. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn., 2000, Prentice Hall.
5. Introduction to PSPICE using ORCAD for circuits & Electronics, M.H. Rashid, 2003, PHI Learning.
6. PC based instrumentation; Concepts & Practice, N. Mathivanan, 2007, Prentice-Hall of India

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3C or PHY-3.2.4C: CLASSICAL DYNAMICS

Maximum Marks: 150 **Teaching Hours: 90 (5 Th.+1 Tu. Credits)**
External Examination: 100 (Pass Marks: 40) **Pass Percentage: 40 %**
Internal Assessment: 50 (Pass Marks: 20) **Time Allowed: 3 Hours**

50 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 15 marks and each question of section C will carry 4 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 15 marks and Section C carries 40 marks. **Use of scientific calculator is allowed.**

Course Objective: The purpose of the course is to train the students in the Newtonian Mechanics and Special Theory of Relativity formalisms to an extent that they can use these in the modern branches of Physics.

Instructional delivery strategy/Pedagogy: Many of the present student-centered strategies used in physics instruction can intentionally be integrated with the most prominent teacher-centered strategies like direct instruction, lecturing, lecturing with demonstration, or problem-solving with teacher guidance.

Section A

Classical Mechanics of Point Particles: Generalized coordinates, Generalized displacement and velocities, Hamilton's principle, D' Albert Principle, Lagrangian and the Euler-Lagrange equations, Canonical momenta & Hamiltonian. Hamilton's equations of motion, Hamiltonian for a harmonic oscillator. Poisson brackets. Canonical transformations.

Problems: Linear Harmonic Oscillator, Simple Pendulum, Atwood's Machine.

Small Amplitude Oscillations: Potential Energy and Equilibrium: One Dimensional Oscillator, Eigen value Equation. Frequencies of free vibrations and normal modes. Lagrange's equation of motion for small oscillations.

Problems: Normal mode frequencies and Eigen vectors of diatomic and triatomic molecules.

Section B

Four Dimensional Formulation: Minkowski space (Qualitative). The invariant interval, World point and World line. Simultaneity and Twin paradox. Space-Time intervals: space-like, time-like and light-like. Four vectors: Four-velocity and acceleration. Four-momentum and energy-momentum relation. Concept of four-force. Conservation of four-momentum- Applications of Four vectors. Covariant Formulation of Lagrangian and Hamiltonian. Relativistic kinematics.

Problems: Problems and questions 1 to 5 from chapter 14, Text Book 1.

Covariant Formulation of Electrodynamics: D'Alemertian operator and Invariance of D'Alemertian operator (Introduction Only). Maxwell's Field Equations, The Electromagnetic Field Tensor and its transformation under Lorentz transformation, Covariant form of Maxwell's field Equations in term of Electromagnetic Field Tensor, Stress Energy Tensor and conservation laws.

Course learning outcome: On successful completion of this course, students will be able to:

- Understand the Hamilton's principle and D' Alembert Principle.
- Understand the concept of Hamilton's equations of motion.
- Acknowledge the concept of Poisson brackets and Canonical transformations.
- Solve Lagrange's equations of motion for small oscillations.
- Understand the concept of Special Theory of Relativity and basics of Space-Time intervals, Four vectors, concept of four-force and four-momentum etc.
- Explain the Covariant form of Maxwell's field Equations in term of Electromagnetic Field Tensor.

Text Books

1. Classical Mechanics, J.C. Upadhyaya, Revised Edition, Himalaya Publishing Company.
2. Classical Mechanics, Gupta Kumar Sharma, Pragati Prakashan

Reference Books

1. Classical Mechanics, H. Goldstein, C.P. Poole, J.L. Safko, 3rd Ed. 2002, Pearson Education.
2. Classical Electrodynamics, J.D. Jackson, 3rd Ed., 1998, Wiley.
3. The Classical Theory of Fields, L.D Landau, E.M Lifshitz, 4th Ed., 2003, Elsevier.
4. Introduction to Electrodynamics, D.J. Griffiths, 2012, Pearson Education.
5. Classical Mechanics: An introduction, Dieter Strauch, 2009, Springer.

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3D or PHY-3.2.4D: ATMOSPHERIC PHYSICS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Instructional delivery strategy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

General features of Earth's atmosphere: Thermal structure of the Earth's Atmosphere, Ionosphere, Composition of atmosphere, Hydrostatic equation, Potential temperature, Atmospheric Thermodynamics, Greenhouse effect and effective temperature of Earth, Local winds, monsoons, fogs, clouds, precipitation, Atmospheric boundary layer, Sea breeze and land breeze. Instruments for meteorological observations, including RS/RW, meteorological processes and different systems, fronts, Cyclones and anticyclones, thunderstorms.

Atmospheric Dynamics: Scale analysis, Fundamental forces, Basic conservation laws, The Vectorial form of the momentum equation in rotating coordinate system, scale analysis of equation of motion, Applications of the basic equations, Circulations and vorticity, Atmospheric oscillations, Quasi biennial oscillation, annual and semiannual oscillations, Mesoscale circulations, The general circulations, Tropical dynamics.

Section B

Atmospheric Waves: Surface water waves, wave dispersion, acoustic waves, buoyancy waves, propagation of atmospheric gravity waves (AGWs) in a nonhomogeneous medium, Lamb wave, Rossby waves and its propagation in three dimensions and in sheared flow, wave absorption, non-linear consideration.

Atmospheric Radar and Lidar: Radar equation and return signal, Signal processing and detection, Various type of atmospheric radars, Application of radars to study atmospheric phenomena, Lidar and its applications, Application of Lidar to study atmospheric phenomenon. Data analysis tools and techniques.

Atmospheric Aerosols: Spectral distribution of the solar radiation, Classification and properties of aerosols, Production and removal mechanisms, Concentrations and size distribution, Radiative and health effects, Observational techniques for aerosols, Absorption and scattering of solar radiation, Rayleigh scattering and Mie scattering, Bouguert-Lambert law, Principles of radiometry, Optical phenomena in atmosphere, Aerosol studies using Lidars.

Reference Books

1. Fundamental of Atmospheric Physics – Murry L Salby; Academic Press, Vol 61, 1996
2. The Physics of Atmosphere – John T. Houghton; Cambridge University press; 3rd edn. 2002.
3. An Introduction to dynamic meteorology – James R Holton; Academic Press, 2004
4. Radar for meteorological and atmospheric observations – S Fukao and K Hamazu, Springer Japan, 2014

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3DP or PHY-3.2.4DP: ATMOSPHERIC PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40% (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four programs on the question paper and the examiner will allot one of these four programs to be executed. The distribution of marks is given below:

1. One full program requiring the student to write algorithm and execution. (30)
2. Viva-Voce (10)
3. Record (Practical File) (10)

Scilab/C++ based simulations experiments based on Atmospheric Physics problems like:

1. Numerical Simulation for atmospheric waves using dispersion relations
    a. Atmospheric gravity waves (AGW)
    b. Kelvin waves
    c. Rossby waves, and mountain waves
2. Offline and online processing of radar data
    a. VHF radar,
    b. X-band radar, and
    c. UHF radar
3. Offline and online processing of LIDAR data
4. Radiosonde data and its interpretation in terms of atmospheric parameters using vertical profiles in different regions of the globe.
5. Handling of satellite data and plotting of atmospheric parameters using radio occultation technique
6. Time series analysis of temperature using long term data over metropolitan cities in India – an approach to understand the climate change

Reference Books

1. Fundamental of Atmospheric Physics – Murry L Salby; Academic Press, Vol 61, 1996
2. The Physics of Atmosphere – J.T. Houghton; Cambridge Univ. Press; 3rd edn. 2002.
3. An Introduction to Dynamic Meteorology – James R Holton; Academic Press, 2004
4. Radar for Meteorological and Atmospheric Observations-S Fukao and K Hamazu, Springer Japan, 2014

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3E or PHY-3.2.4E: NANO MATERIALS AND APPLICATIONS

Maximum Marks: 100 | **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) | **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) | **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Instructional delivery strategy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

NANOSCALE 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 anoscale, 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, 1D nanostructures and its consequences.

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.

CHARACTERIZATION: X-Ray Diffraction. Optical Microscopy. Scanning Electron Microscopy. Transmission Electron Microscopy. Atomic Force Microscopy. Scanning Tunneling Microscopy.

Section B

OPTICAL PROPERTIES: 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. Radiative processes: General formalization-absorption, emission and luminescence. Optical properties of heterostrctures and nanostructures.

ELECTRON TRANSPORT: Carrier transport in nanostrcutures. Coulomb blockade effect, thermionic emission, tunneling and hoping conductivity. Defects and impurities: Deep level and surface defects.

APPLICATIONS: 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 Ltd).
4. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).
5. M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama, Nanoparticle Technology Handbook (Elsevier).
6. Introduction to Nanoelectronics, V.V. Mitin, V.A. Kochelap and M.A. Stroscio, 2011, Cambridge University Press.
7. Bharat Bhushan, Springer Handbook of Nanotechnology (Springer-Verlag, Berlin, 2004).

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3EP or PHY-3.2.4EP: NANO MATERIALS AND APPLICATIONS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40% (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Practical:

1. Synthesis of metal nanoparticles by chemical route.
2. Synthesis of semiconductor nanoparticles.
3. Surface Plasmon study of metal nanoparticles by UV-Visible spectrophotometer.
4. XRD pattern of nanomaterials and estimation of particle size.
5. To study the effect of size on color of nanomaterials.
6. To prepare composite of CNTs with other materials.
7. Growth of quantum dots by thermal evaporation.
8. Prepare a disc of ceramic of a compound using ball milling, pressing and sintering, and study its XRD.
9. Fabricate a thin film of nanoparticles by spin coating (or chemical route) and study transmittance spectra in UV-Visible region.
10. Prepare a thin film capacitor and measure capacitance as a function of temperature or frequency.
11. Fabricate a PN diode by diffusing Al over the surface of N-type Si and study its V-I characteristic.

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 & Technology (PHI Learning Private Limited).
4. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3F or PHY-3.2.4F: MEDICAL PHYSICS

Maximum Marks: 150 **Teaching Hours: 90 (5 Th.+1 Tu. Credits)**
External Examination: 100 (Pass Marks: 40) **Pass Percentage: 40 %**
Internal Assessment: 50 (Pass Marks: 20) **Time Allowed: 3 Hours**

50 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 15 marks and each question of section C will carry 4 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 15 marks and Section C carries 40 marks. **Use of scientific calculator is allowed.**

Course Objective:

- Focus on the application of Physics to clinical medicine.
- Gain a broad and fundamental understanding of Physics while developing particular expertise in medical applications.
- Learn about the human body, its anatomy, physiology and Bio-Physics, exploring its performance as a physical machine. Other topics include the Physics of the senses.
- He / She will study diagnostic and therapeutic applications like the ECG, radiation Physics, X-ray technology, ultrasound and magnetic resonance imaging.
- Gain knowledge with reference to working of various diagnostic tools, medical imaging techniques, how ionizing radiation interacts with matter, how it affects living organisms and how it is used as a therapeutic technique and radiation safety practices
- Imparts functional knowledge regarding need for radiological protection and the sources of an approximate level of radiation exposure for treatment purposes.

Instructional delivery strategy/Pedagogy: The course will be taught using lectures followed up by homework assignments and regular class-tests and classroom discussions. Discussions of the course topics using problem-solving approach during the lecture delivery are encouraged.

Section A

Physics of the Body: Basic Anatomical Terminology, Motion in Human machine, The Standard Human, Scaling relationships, Familiarity with terms like- Superior, Inferior, Anterior, Posterior, Medial, Lateral, Proximal and Distal. Statics in the Body: The Lower Arm, Hip, Statics of Other Synovial, Lower Back, Three-Force Rule, Multi-segment Modeling. Material components of body: Bone, Ligaments and Tendons, Cartilage. Skeletal Muscles in the Body. Energy Content of Body Fuel. Energy Storage Molecules. Physics of the Circulation System: Properties of Blood, Blood Pressure and Flow in Vessels, Capillaries and Osmotic Pressure, Blood Flow Rates and Speeds, Consequences of Clogged Arteries, Work Done by the Heart, and the Metabolic Needs of the Heart.

Physics of Diagnostic and Therapeutic Systems: X-RAYS: Electromagnetic spectrum, production of x-rays, x-ray spectra, Bremsstrahlung, Characteristic x-ray. X-ray tubes & types: Coolidge tube, x-ray tube design, tube cooling stationary mode, Rotating anode x-ray tube, Tube rating, quality and intensity of x-ray. X-ray generator circuits, half wave and full wave rectification, filament circuit, kilo voltage circuit. Single and three phase electric supply. Power ratings. Types of X-Ray Generator, high frequency generator, exposure timers and switches, HT cables.

Section B

Imaging Physics: Ultrasound Instrumentation: Machine Controls, Frequency of Transducers, Types of Transducers, Extended Field of View, Clinical Applications of Fusion Imaging. Computer Tomography: Basic Workflow of CT scanner, Determinants of an Optimal Image, Advances in Hardware, Special Computed Tomography. Magnetic Resonance Instrumentation: The Magnet, Prepolarized MRI, Magnet Geometry, Tesla and Higher Magnet Strengths, Multichannel RF Coils and Parallel Imaging, Advanced

MR Applications and Hardware. Basic Physics of Digital Mammography. Applications of Digital Mammography.

Radiotherapy: Photons: Geometrical factors, Specification of dose ratios, The effects of scattered radiation. Field size and backscatter, Dependence of fractional depth dose on TAR. TPR and BSF, Filters, compensators and shields, Orthovoltage glass tube (up to 300 keV X-rays, Linac-based MeV X-rays, Depth-dose distributions, Photon energy spectrum, Neutron contamination of X-ray beams. Electrons: Determination of electron energy at depth in the phantom, Bremsstrahlung contamination of electron beams. Heavy Particles: Protons, Neutrons, Negative pions, Heavy ions. Brachytherap: Interstitial and intracavity brachytherapy, the principles of the Paris system, Experimental HDR brachytherapy dose distribution measurements, Interstitial radiosurgery.

Course learning outcomes: Students will have achieved the ability to:

- Explain about the human body, its anatomy, physiology and Bio-Physics, exploring its performance as a physical machine.
- Explain various diagnostic tools, medical imaging techniques, how ionizing radiation interacts with matter, how it affects living organisms and how it is used as a therapeutic technique and radiation safety practices
- Know about need for radiological protection and the sources of an approximate level of radiation exposure for treatment purposes.

Text Books

1. Physics of the human body, Irving P. Herman, Springer (2007).
2. Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry - Lippincot Williams and Wilkins (1990)
3. Diagnostic Radiology_ Recent Advances and Applied Physics in Imaging byArun Kumar Gupta (2013, Jp Medical Ltd)
4. A primer in applied radiation physics by F A Smith, World Scientific

Reference Books

- Faiz M. Khan - The Physics of Radiation Therapy (2003, Lippincott Williams & Wilkins
- Harold Elford Johns, John Robert Cunningham - Physics of Radiology, Fourth Edition (1983, Charles C Thomas Pub Ltd).
- Jerrold T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt Jr., John M. Boone - The Essential Physics of Medical Imaging-LIPPINCOTT WILLIAMS & WILKINS (2011).
- Noble J.V - Physics of the human body (2003)

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3G or PHY-3.2.4G: LASER PHYSICS

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 10 marks and each question of section C will carry 3 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 10 marks and Section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objectives: The aim of this course is not just to impart theoretical knowledge of lasers, its structure, design and properties but also to provide the students a basic knowledge of its various applications in different areas like holography, fibre optics and non-linearoptics. The practical related to its lab will provide a hands-on training related to these applications.

Section A

Introduction: Introduction, three processes, Active material, Population inversion, Metastable states, Relationship between Einstein's A and B coefficients, Main components of a laser and possibility of light amplification, Threshold condition, Pumping, Electrical and optical pumping (Qualitative), Various level laser system.

Laser Properties: Directionality, Coherence, Spatial coherence, Temporal coherence, Monochromaticity, Relation between coherence &monochromaticity, Brightness &intensity, Focusability

Dynamics of the Laser Processes: Rate equations for two, three and four level systems, production of a giant pulse – Q switching, Techniques of Q-switching, Mode-locking (Definition only), Techniques of mode locking.

Section B

Types of Lasers: Solid state lasers, Basic structure & requirements, Ruby laser, Nd-Glass laser, Gas Lasers, Basic structure & requirements, He-Ne laser, CO_2laser, Liquid lasers, Basic structure & requirements, dye lasers, Semiconductor lasers, Basic structure & requirements, intrinsic semiconductor lasers, doped semiconductors laser, injection lasers.

Application to Fiber Optics: General optical fiber communication system and its advantages**,** Basic principle, Propagation of light in optical fiber, Acceptance angle, Numerical aperture, Relation between numerical aperture and fractional refractive index change, Normalized frequency, Types of optical fiber, Applications of optical fibers.

Some Other Applications: Holography: Principle of recording and reconstruction, Application of holography, Non-linear optics: harmonic generation, second harmonic generation.

Course Learning Outcomes: Within the course structure offered, students will gain a good understanding of the building blocks of lasers, its applications to fiber optics communication, holography and non-linear optics. In particular, they will be able to:

- Understand the basic interaction phenomenon
- Find the interrelations between Einstein coefficients
- Understand the concept of line broadening
- Predict fundamental characteristics of laser systems
- Understand the basic holography and optical fiber communication
- Solve the rate equations in steady state for a laser
- Describe the major examples of laser systems
- Understand the basics of optical fiber

- Understand basics of its different applications viz. holography & non-linear optics

Text Books

1. Laser Theory and Applications: A. Ghatak, Macmillan.
2. Optical Fiber Communications, 3rd Edition by John M Senior, 2009, PHI.
3. Lasers and Non-linear Optics: B.B. Laud. (Wiley Eastern), 1991.

Reference Books

- Principles of Lasers: O. Svelto, (3rd Ed.), Plenum Press.
- Optical Electronics A.K. Ghatak and K. Thyagrajan, Cambridge Univ Press.
- Optical Fiber Communications, 3rd Edition.by Gerd Keiser Mc Graw-Hill.
- Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3GP or PHY-3.2.4GP: LASER PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (2 Credits)**
Pass Marks: 40% (20 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

Course Objectives: The course introduces the students to basic experimental methods in Laser Physics.

List of Experiments:

1. To calculate the wavelength of Laser light by Double Slit
2. To determine the wavelength of laser light with a transmission grating
3. To measure the wavelength of He-Ne laser by Fresnel's Bi-prism
4. To measure the angle of the wedge of a transparent plate using He-Ne laser
5. To determine grating element of a given diffraction grating
6. Construction of some simple intensity modulated fiber optic sensors for measurement of pressure
7. Measurement of guided near field of a multimode fiber and to measure its Refractive Index Profile (RIP)
8. Characterization of a single mode fiber from a measurement of its far field distribution
9. Determination of the grating radial spacing of the Compact Disc (CD) by reflection using, He-Ne or solid-state laser
10. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid-state laser
11. To find the polarization angle of laser light using polarizer and analyser
12. Thermal expansion of quartz using laser.
13. To determine number of lines in a transmission diffraction grating by using a laser light with known wavelength
14. To measure the divergence of a given laser source**.**
15. To calculate the wavelength of Laser light by single Slit.

Course Outcomes: On satisfying the requirements of this course, students will have the knowledge to:

- Design a complete experimental apparatus able to implement Laser Physics and fibre optics experiments.
- Acquires basic skills to critically elaborate and interpret experimental data.
- Apply key analysis techniques to typical problems encountered in the field
- Achieve advanced capabilities in equipment handling and experimental problem solving.

Reference Books:

1. A course of Experiments with He-Ne Laser R. S. Sirohi, New Age International.
2. Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.

(BOS Chairman) (VC Nominee) (Academic Council Nominees) (Industry Expert) (Student Alumni) (Members)

Discipline Specific Elective-3 or Discipline Specific Elective-4

PHY-3.2.3H or PHY-3.2.4H: PARTICLE PHYSICS AND ACCELERATORS

Maximum Marks: 150 **Teaching Hours: 90 (5 Th.+1 Tu. Credits)**
External Examination: 100 (Pass Marks: 40) **Pass Percentage: 40 %**
Internal Assessment: 50 (Pass Marks: 20) **Time Allowed: 3 Hours**

50 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of Sections A and B will carry 15 marks and each question of section C will carry 4 marks.
Instruction for the candidates: The candidates are required to attempt any two questions out of four from each Section A and B and the entire Section C of the question paper. Each question of sections A and B carries 15 marks and Section C carries 40 marks. **Use of scientific calculator is allowed.**
Course Objectives: To impart knowledge about basic Particle Physics and various Accelerators.
Instructional delivery strategy/Pedagogy: Many of the present student-centered strategies used in physics instruction can intentionally be integrated with the most prominent teacher-centered strategies like direct instruction, lecturing, lecturing with demonstration, or problem-solving with teacher guidance.

Section A

Elementary Particles: Historical introduction, fermions and bosons, particles and antiparticles, Classification of particles, types of interactions, electromagnetic, weak, strong interactions, gravitational interactions, Quantum numbers and conservation laws, isospin, charge conjugation, Yukawa theory, Introduction to quarks and qualitative discussion of the quark model, high energy physics units. Problems: Problems 1 to 10 from Chapter 4 of Book 2.
Particle Properties and their reactions: Properties and life time of muon, pions:Determination of mass, spin and parity. Lifetime of neutral pion and isotopic spin. Strange particles: V particles, charged K-mesons, mass and life time for charged K-mesons. Observations of different strange particles, strange particle production and decay. Strangeness and Hypercharge.

Section B

Particle Accelerators: Ion sources, Heavy Ion sources, Polarized Ion Sources, Electrostatic Accelerators (Cockcroft-Walton Generator, Van de Graff generator and Pelletron), linear accelerators, Low Energy Circular Accelerators: Cyclotron, Betatron, electron and proton synchrotron, Heavy Ion Accelerators. Colliding beam machines, Fermilab Tevatron, Large Hadron Collider (LHC). Indian Accelerators.
Problems: Problems 1 to 7 from Chapter 3 of Text Book 1.

Course learning outcomes: Students will have achieved the ability to:

- Basic knowledge of the various particle accelerators.
- Basic knowledge nuclear and particle physics. Knowledge and understanding of the elementary particle interactions. Capability of relating the theory predictions and measurements.
- Understanding of various particle interactions and their interrelation. Relation of basic laws of particle physics and macroscopic physics phenomena. Usage of basic laws in determination of particle properties and properties of processes in the subatomic world.

Text Books:

1. Introductory Particle Physics, K. S. Thind, M. Singh, V. Kumar, L. Gerward, Vishal Pub. Co.
2. Introductory Nuclear Physics, D. C. Tayal, Himalaya Publishers

Reference Books:

- Nuclear Physics by I. Kaplan (Addision-Wiley Pub. Co. Inc.)
- An Introduction to Nuclear Physics by M. R. Bhiday and V.A. Joshi (Orient Longman)
- Concepts of Nuclear Physics by B. L. (Cohen (TMI Ed.)

PHYSICS DEPARTMENT

Syllabus

Generic Elective Paper

PHYSICS

Interdisciplinary Paper for

B.Sc. (Honors) CHEMISTRY
B.Sc. (Honors) MATHEMATICS

2022-23, 2023-24 and 2024-25

Sri Guru Teg Bahadur Khalsa College
Sri Anandpur Sahib-140118, Punjab

*An Autonomous College, Affiliated to Punjabi University Patiala
*NAAC Accredited 'A' Grade
*College with Potential for Excellence Status by UGC
*STAR College Status by Department of Biotechnology, Govt. of India
*Department of Science & Technology FIST Scheme, Govt. of India

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Website: www.sgtbcollege.org.in
Email: physicsdepartment321@gmail.com
Phone: 01887-232037

APPROVED
Board of Studies Meeting held on 1st August, 2022

Generic Elective-1

BASIC PHYSICS-I

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 10 marks and section C will carry 30 marks.
Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 10 marks and section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objective: The purpose of the course is to train the students in the Newtonian Mechanics and Special Theory of Relativity formalisms to an extent that they can use these in the modern branches of Physics.
Instructional delivery strategy/Pedagogy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

Central Forces: Various forces in Nature (brief introduction), Centre of mass, Equivalent one body problem, Central forces, Equation of motion under central force, Kepler's laws and their derivation.
Inertial and Non Inertial Frames: Frames of reference. Galilean transformation and Invariance, Invariance of Newton's law of motion, Invariance of law of conservation of linear momentum and energy, concept of stationary universal frame of reference and ether. Non-Inertial frames.
Special Theory of Relativity: Postulates of special theory of relativity, Lorentz transformations, Relativity Length and Time, Relativistic addition of Velocities, Relativistic Doppler effect, Relativistic mass variation formula, Mass-Energy Equivalence.

Section B

Basics of Nuclear Physics: Basic concept of atomic structure; The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, Radioactivity, Units of radioactivity, Properties of Alpha, Beta and Gamma radiations, law of radioactive decay, Mean-life and Half-life, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, fusion, fission.
Interaction of Photons – Photoelectric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients, Half Value Thickness (HVT) and Tenth Value Thickness (TVT)**.**

Learning outcomes: At the end of this course, **s**tudents will be able to articulate and describe:

- Relative motion. Inertial and non-inertial reference frames.
- Kepler's law and their derivation
- Study of the interaction of forces between solids in mechanical systems.
- Centre of mass and inertia tensor of mechanical systems.
- Introduction to analytical mechanics as a systematic tool for problem solving.

- Basic Concept of Atomic Structure
- Types of Radiation and Interaction of Photons

Text Books

1. Analytical Mechanics: Satish K. Gupta, Modern Publications
2. Nuclear and Particle Physics: Ashok Sharma, A.S Vasudea, Modern Publishers
3. Nuclear Physics by Kulwant S. Thind, Vishal Publishing Co.

Reference Books:

- Mechanics Berkeley Physics, v.1: Charles Kittel, et. al. 2007, Tata McGraw-Hill. Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
- Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
- W.E. Burcham and M. Jobes – Nuclear and Particle Physics – Longman (1995)

Generic Elective-1 Practical

BASIC PHYSICS-I PRACTICAL

Maximum Marks:	**50**	**Teaching Hours:**	**60**
Pass Marks:	**40 % (20 Marks)**	**Time Allowed:**	**3 Hours**
Credits:	**2**		

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

9. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
10. Brief theory (05)
11. Viva-Voce (10)
12. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. To measure the volume of a given cylinder using Vernier caliper.
2. To measure the diameter of a wire by using a screw gauge.
3. To measure the distance between two edges of a slit by using a travelling microscope.
4. To determine the value of ‘g’ by using simple pendulum.
5. To determine the value of ‘g’ by using Kater’s Pendulum.
6. To determine the spring constant using a helical spring.
7. To establish relationship between torque and angular acceleration using flywheel.
8. To determine the height of a building using a Sextant.
9. Determination of Poisson's ratio for rubber.
10. Study the dependence of moment of inertia on distribution of mass using objects of different geometrical shapes but of same mass. (by noting time periods of oscillations)
11. To determine the Young's modulus by bending of beam using traveling microscope.
12. To study one dimensional collision using two hanging spheres of different materials.
13. Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source).
14. Study of counting statistics using background radiation using GM counter.

Reference Books:

1. B.Sc. Practical Physics, By C.L. Arora, S. Chand& Co.
2. A Laboratory Manual of Physics for undergraduate classes by D.P. Khandelwal
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Generic Elective-2

BASIC PHYSICS-II

Maximum Marks: 100 **Teaching Hours: 60 (4 Credits)**
External Examination: 70 (Pass Marks: 28) **Pass Percentage: 40 %**
Internal Assessment: 30 (Pass Marks: 12) **Time Allowed: 3 Hours**

30 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 10 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 10 marks and section C will carry 30 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 10 marks and section C carries 30 marks. **Use of scientific calculator is allowed.**

Course Objective: The course covers the basic ideas about probability, Macrostate and Microstate, Phase space, concept of thermodynamical probability and Crystal Structure. It also covers the Interference, diffraction and polarization of light and Lasers.

Instructional delivery strategy/Pedagogy: The course will be taught using lectures followed up by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged.

Section A

Interference: Concept of coherence, Spatial and temporal coherence. Conditions for sustained interference pattern, Young's double slit experiment, Interference in thin films due to reflected light, Newton Rings (Theory Only).

Diffraction: Huygens-Fresnel theory, half-period zones, Zone plates, Distinction between Fresnel and Fraunhofer diffraction, resolving power of telescope.

Polarization: Concept and analytical treatment of un-polarized, plane polarized and elliptically polarized light. Double refraction, Nicol prism, Polaroid and its applications.

Laser Fundamentals: Concept of stimulated emission and population inversion. Threshold condition, Introduction of three level and four level laser schemes, Ruby and He-Ne lasers.

Section B

Statistical Mechanics: Scope of statistical Physics, basic ideas about probability, Macrostate and Microstate, Phase space, concept of thermodynamical probability, Distribution of n particles in two compartments, sterling formula, deviation from the state of maximum probability, equilibrium state of a dynamic system, Difference between three kind of statistics (MB, BE and FD).

Crystal Structure: Symmetry operations for a two dimensional crystal. Two dimensional Bravais lattices, three dimensional Bravais lattices. Basic primitive cells. Crystal planes and Miller indices. Diamond and NaCI structure. Packing fraction for Cubic and hexagonal closed packed structure.

Learning Outcomes: Students will be able to articulate and describe:

- The concept of interference with many experiments associated with it.
- Differentiate between Fraunhofer and Fresnel diffraction
- Apply skill to find the wavelength of spectral lines using Plane diffraction grating
- Distinguish the methods of polarisation
- Describe the different types of lasers, its principle, properties of laser beam

- Explain Macrostate and Microstate, Phase space and Three kinds of Statics
- Explain about the Crystal Structure.

Text Books

1. Optics and Laser, Ashok Sharma, Modern Publishers
2. Solid State Physics, S. O. Pillai, New Age International, 2006
3. Statistical Physics and Thermodynamics: B.S. Satyal, K.K. Sharma, Kalyani Publishers

Reference Books:

- Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
- Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications.
- Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
- Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa

Generic Elective-2 Practical

BASIC PHYSICS-II PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60**
Pass Marks: 40 % (20 Marks) **Time Allowed: 3 Hours**
Credits: 2

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. To determine the angle of prism using spectrometer.
2. To determine refractive index of the material of a prism using sodium source.
3. To determine refractive index of the liquid using sodium source.
4. To determine wavelength of sodium light using Newton's rings
5. To determine resolving power of a telescope.
6. Study of rotation of plane of polarization with a polarimeter.
7. Study of variation of light intensity using photovoltaic cell/inverse square law.
8. To determine the Plank's constant using photovoltaic cell.
9. To determine the divergence and wave length of a given Laser source using double slit.
10. To study the diffraction pattern of He-Ne Laser by using single slit and determine the wavelength.
11. To study the probability distribution using coloured dice and coins.

Reference Books:

1. B.Sc. Practical Physics, by C.L. Arora, S. Chand & Company
2. A Laboratory Manual of Physics for undergraduate classes by D.P. Khandelwal
3. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.