K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

SCHOOL OF BASIC AND APPLIED SCIENCES

Bachelor of Science (Honours) Physics

B.Sc. (Hons.) Physics

Programme Code: 09

2021-2024

Approved in the 26th Meeting of Academic Council Held on 11 August 2021

Registrar
K.R. Mangalam University
Sohna Road, Gurugram, (Haryana)

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Preamble

The objective of any programme at Higher Education Institute is to prepare their students for the society at large. The K. R. Mangalam University visualizes all its programmes in the best interest of their students and in this endeavor; it offers a new vision to all its Under-Graduate courses. It imbibes a Learning Outcome-based Curriculum Framework (LOCF) for all its Under Graduate programmes. The LOCF approach is envisioned to provide a focused, outcome-based syllabus at the undergraduate level with an agenda to structure the teaching-learning experiences in a more student-centric manner. The LOCF approach has been adopted to strengthen students' experiences as they engage themselves in the programme of their choice. The Under-Graduate Programmes will prepare the students for both, academia and employability. The programmes also state the attributes that it offers to inculcate at the graduation level. The graduate attributes encompass values related to emotional stability, well-being, critical thinking and also skills for employability.

The School acknowledges all the faculty members for their valuable contributions in preparing the curriculum.

Dr. Diwakar Padalia Dr. Pawan Kumar Dr. Dilraj Preet Kaur

Dr. Nidhi Gaur Dr. Ruby Jindal Dr. Rajni Gautam

1. Introduction: About University

K.R. Mangalam University located on Sohna Road, Gurugram, is one of the fastest growing and most promising upcoming universities in India. It is a State Private University established in 2013 by an act of the legislature of the Haryana Government under Haryana Private Universities Act (Amendment) 8 of 2013.It is recognized by the UGC under Section 2f of the UGC Act, 1956. The primary aim of the University is to promote excellence in basic and professional education while upholding moral values.

KRMU offers various Undergraduate, Postgraduate and Doctoral Degree programs across different disciplines. The group of educational units in the University promote education in the areas of Engineering& Technology, Legal Studies, Basic and Applied Sciences, Management Sciences, Commerce, Journalism and Mass Communication, Hotel Management and Catering Technology, Medical and Allied Sciences, Architecture and Planning, Agriculture, Fashion Designing, Humanities and Education. All the disciplines follow a well-defined curriculum design keeping in view the guidelines of UGC/AICTE and appropriate regulatory bodies like Council of Architecture (COA), Bar Council of India (BCI), Pharmacy Council of India (PCI), National Council for Teachers Education (NCTE) etc., wherever applicable. All courses are semester and credit based.

Objectives

i. To impart undergraduate, post-graduate and Doctoral education in identified areas of higher education.
ii. To undertake research programs with industrial interface.
iii. To integrate its growth with the global needs and expectations of the major stake holders through teaching, research, exchange & collaborative programs with foreign, Indian Universities/Institutions and MNCs.
iv. To act as a nodal center for transfer of technology to the industry.
v. To provide job oriented professional education to the student community with particular focus on Haryana.

2. About School: SBAS

The SBAS imparts both teaching and research through its three Departments of Physics, Chemistry & Mathematics.

SBAS imparts students disciplinary knowledge, enhances their skills and ability, motivating them to think ingeniously, helping them to act independently and take decisions accordingly in all their scientific pursuits and other endeavors. It strives to empower its students and faculty members to contribute for the development of society and Nation.

The faculty is in constant touch with various experts in the relevant fields and is willing to experiment with latest ideas in teaching and research.

VISION

School of Basic and Applied Sciences intends for continuum growth as centre of advanced learning, research and innovation by disseminating analytical and scientific knowledge in the areas of basic and applied sciences by promoting interdisciplinary research and scientific acumen.

MISSION

M1: Enable students to be scientists/ academicians /entrepreneurs by accomplishing fundamental and advanced research in diverse areas of basic and applied sciences.

M2: Build strong associations with academic organizations/industries for knowledge creation, advancement, and application of scientific fervor.

M3: Create conducive environment for lifelong learning.

M4: Empower students to be socially responsible and ethically strong individuals through value-based science education.

3. Programme offered by School

School offers undergraduate B.Sc. (Hons) Programmes, postgraduate M.Sc. Programmes, and Doctoral Programmes. All these programmes are designed to impart scientific knowledge to the students and are aimed to provide theoretical as well as practical training in their respective fields.

3.1 B.Sc. (Hons.) Physics

The undergraduate programme, B.Sc. (Hons.) Physics of the SBAS is intended for students with a keen interest in either the theoretical or experimental aspects of frontline physics. This research-orientated program builds on the courses in physics, which aims to give students a deeper level of knowledge and understanding of the scientific methods and principles. The goals and objectives of this program are to widen student's horizon in understanding fundamental concepts and applications of physics, supporting their specialization in the field, and helping them expand their skills.

3.2 Graduate Attributes

GA1: To demonstrate competence in discipline specific theoretical and practical Knowledge
GA2: To develop creativity and innovation
GA3: To enhance communication and interpersonal skills
GA4: To enable critical & logical thinking and investigative research attitude amongst students
GA5: To develop ethical values, teamwork and lifelong learning approach

3.3 Programme Educational Objectives (PEO)

PEO1: To equip students to apply the basic principles of Physics to the events occurring around us and also in the world.

PEO2: To ignite the interest for research in students.

PEO3: To employ logical reasoning, analytical, numerical ability and theoretical skills to model real-world problems and solve them.

PEO4: To develop critical thinking, creative thinking, and self-confidence for eventual success in career.

PEO5: To endow the students with creative and analytical skills; this will equip them to become entrepreneurs.

PEO6: To acquire rewarding career/placement in educational institutions, engineering and industrial firms.

3.4 Program Outcomes (POs):

The B.Sc. (H) graduates should be able to:

PO1: Acquire fundamental understanding and conceptual knowledge of physics.

PO2: Understand application of basic concepts of physics.

PO3: Link Physics with related disciplines.

PO4: Acquire procedural knowledge for professional subjects.

PO5: Develop skills in related field of specialization.

PO6: Develop investigative skills and problem solving approach

PO7: Develop skills in Mathematical modeling.

PO8: Develop skills in performing analysis and interpretation of data.

PO9: Develop Technical Communication and ICT skills.

PO10: Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self –reading etc.

3.5 Eligibility Criteria: - The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board in Science stream with an aggregate of 50% or more.

3.6 Course Outline: - Mathematical Physics / Mechanics / Electricity & Magnetism/Waves & Optics / Thermal Physics / Digital Systems & Applications/Elements of Modern Physics/Analog Systems & Applications/Quantum Mechanics & Applications / Electromagnetic Theory / Statistical Mechanics/ Solid State physics / Elementary Nuclear Physics/ Elementary Particle Physics/Applied Optics.

3.7 Career Options: - Opportunities exist in academics, research laboratories and administration besides all the opportunities applicable to any other graduate like UPSC examination's, defense services and other govt. jobs.

3.8 Program Specific Outcomes (PSOs)

The student graduating with the degree B.Sc. (H) Physics should be able to:
PSO1: Acquire a fundamental, systematic or coherent understanding of the academic field of Physics.
PSO2: Acquire procedural knowledge that creates different types of professional related to the disciplinary area of Physics.
PSO3: Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.
PSO4: Demonstrate the ability to use skills in Physics and its related areas of technology.

4. Programs Duration

The minimum period required for the B.Sc. (Hons.) Physics offered by the department of physics shall extend over a period of three Academic Years.
The maximum period for the completion of the B.Sc. (Hons) Physics offered by the department of physics shall be five years.

5. Class Timings

The classes will be held from Monday to Friday from 09:10 am to 04:30 pm.

6. Scheme of Studies

Scheme of Studies as per Choice-Based Credit System and Learning Outcome-Based Curriculum Framework

ODD SEMESTER								
YEAR	S.No.	COURSE CODE	COURSE TYPE	COURSE TITLE	L	T	P	C
FIRST (Ist Sem)	1	BSPH101A	CC-1	MATHEMATICAL PHYSICS-I	4	0	0	4
	2	BSPH151A	CC-1 LAB	MATHEMATICAL PHYSICS-I LAB	0	0	4	2
	3	BSPH103A	CC-2	MECHANICS	4	0	0	4
	4	BSPH153A	CC-2 LAB	MECHANICS LAB	0	0	4	2
	5	BSPH105A	SEC-1	PHYSICS WORKSHOP SKILL	2	2	0	4
	6	UCES125A	AECC-1	ENVIRONMENTAL STUDIES	3	0	0	3
	7	*	GEC-1	**	4	0	0	4
	TOTAL				17	2	8	23

EVEN SEMESTER								
YEAR	S.No.	COURSE CODE	COURSE TYPE	COURSE TITLE	L	T	P	C
FIRST (2nd Sem)	1	BSPH102A	CC-3	ELECTRICITY AND MAGNETISM	4	0	0	4
	2	BSPH152A	CC-3 LAB	ELECTRICITY AND MAGNETISM LAB	0	0	4	2
	3	BSPH104A	CC-4	WAVES AND OPTICS	4	0	0	4
	4	BSPH154A	CC-4 LAB	WAVES AND OPTICS LAB	0	0	4	2
	5	BSPH106A	SEC-2	ELECTRICAL CIRCUITS AND NETWORK SKILLS	2	2	0	4
	6	UCCS155A	AECC-2	COMMUNICATION SKILLS	4	0	0	4
	7	ETCS104A	EMP	INTRODUCTION TO COMPUTER SCIENCE AND PROGRAMMING IN PYTHON	3	1	0	4
	8	ETCS150A	EMP	INTRODUCTION TO COMPUTER SCIENCE AND PROGRAMMING IN PYTHON LAB	0	0	2	1
	9	*	GEC-2	**	4	0	0	4
	TOTAL				18	2	8	29

ODD SEMESTER								
YEAR	S.No.	COURSE CODE	COURSE TYPE	COURSE TITLE	L	T	P	C
SECOND (3rd Sem)	1	BSPH201A	CC-5	MATHEMATICAL PHYSICS-II	4	0	0	4
	2	BSPH251A	CC-5 LAB	MATHEMATICAL PHYSICS-II LAB	0	0	4	2
	3	BSPH203A	CC-6	THERMAL PHYSICS	4	0	0	4
	4	BSPH253A	CC-6 LAB	THERMAL PHYSICS LAB	0	0	4	2
	5	BSPH205A	CC-7	DIGITAL SYSTEMS AND APPLICATIONS	4	0	0	4
	6	BSPH255A	CC-7 LAB	DIGITAL SYSTEMS AND APPLICATIONS LAB	0	0	4	2
	7	UCDM301A	AECC-3	DISASTER MANAGEMENT	3	0	0	3
	8	ETCS109A	EMP	DATA ANALYSIS AND VISUALIZATION	2	0	0	2
	9	ETCS159A	EMP	DATA ANALYSIS AND VISUALIZATION LAB	0	0	2	1
	10			MOOC (Online course)				2
	TOTAL				19	0	16	26

EVEN SEMESTER								
YEAR	S.No.	COURSE CODE	COURSE TYPE	COURSE TITLE	L	T	P	C
SECOND (IVth	1	BSPH202A	CC-8	MATHEMATICAL PHYSICS-III	4	0	0	4
sem)	2	BSPH252A	CC-8 LAB	MATHEMATICAL PHYSICS-III LAB	0	0	4	2
	3	BSPH204A	CC-9	ELEMENTS OF MODERN PHYSICS	4	0	0	4
	4	BSPH254A	CC-9 LAB	ELEMENTS OF MODERN PHYSICS LAB	0	0	4	2
	5	BSPH206A	CC-10	ANALOG SYSTEMS AND APPLICATIONS	4	0	0	4
	6	BSPH256A	CC-10 LAB	ANALOG SYSTEMS AND APPLICATIONS LAB	0	0	4	2
	7	BSMA274A	SEC-3	INTRODUCTION TO LATEX	0	0	2	1
	8			VALUE ADDED COURSE				
	9	BSPH218A		INTERNSHIP IN PHYSICS	0	0	0	2
	TOTAL				16	0	16	21

ODD SEMESTER								
YEAR	S.No.	COURSE CODE	COURSE TYPE	COURSE TITLE	L	T	P	C
THIRD (Vth SEm)	1	BSPH301A	CC-11	QUANTUM MECHANICS AND APPLICATIONS	4	0	0	4
	2	BSPH351A	CC-11 LAB	QUANTUM MECHANICS AND APPLICATIONS LAB	0	0	4	2
	3	BSPH303A	CC-12	SOLID STATE PHYSICS	4	0	0	4
	4	BSPH353A	CC-12 LAB	SOLID STATE PHYSICS LAB	0	0	4	2
	5	BSPH305A	SEC-3	BASIC INSTRUMENTATION SKILLS	2	2		4
	6	BSPH307A	DSE-1	CLASSICAL DYNAMICS	5	1	0	6
	7	BSPH309A	DSE-2	NUCLEAR AND PARTICLE PHYSICS	5	1	0	6
	8			Value added course				
	TOTAL				20	4	8	28

EVEN SEMESTER								
YEAR	S.No.	COURSE CODE	COURSE TYPE	COURSE TITLE	L	T	P	C
THIRD (VIth Sem)	1	BSPH302A	CC-13	ELECTROMAGNETIC THEORY	4	0	0	4
	2	BSPH352A	CC-13 LAB	ELECTROMAGNETIC THEORY LAB	0	0	4	2
	3	BSPH304A	CC-14	STATISTICAL MECHANICS	4	0	0	4
	4	BSPH354A	CC-14 LAB	STATISTICAL MECHANICS LAB	0	0	4	2
	5	BSPH306A	SEC-4	APPLIED OPTICS	2	2	0	4
	6	BSPH308A	DSE-3	PHYSICS OF EARTH	5	1	0	6
	7	BSPH356A	DSE-4	DISSERTATION	0	0	0	6
	TOTAL				15	3	8	28

7. Syllabus of B.Sc. (Hons.) Physics

BSPH101A	Mathematical Physics-I	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Calculus				
Co-requisites					

Course Objectives

To make them learn about the calculus and its applications.

To enable them to use vector calculus for different applications.

To give knowledge of vector differentiation, integration.

To impart knowledge about orthogonal curvilinear coordinate, probability and Dirac delta function and its properties.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Apply concepts of calculus in solving problems of interest to physicists.

CO2. Better understand vector calculus and its applications.

CO3. Understand use of vector differentiation and integration.

CO4. Solve equations encountered in Physics and Engineering.

Catalog Description

This course aims to demonstrate the use of mathematical techniques in solving problems in Physics and to provide a deeper understanding of the mathematics underpinning theoretical physics. The course is intended to develop the concepts of vector calculus and its applications. Emphasis will be on illustrative examples from Physics and Engineering.

Course Content

UNIT-I **15 Lecture Hours**

Calculus:

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

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

UNIT-II **15 Lecture Hours**

Vector Calculus:

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

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

UNIT-III **15Lecture Hours**

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

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

UNIT-IV **15 Lecture Hours**

Orthogonal Curvilinear Coordinates:

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

Introduction to probability:

Probability distribution functions; binomial, Gaussian, and Poisson, with examples. Mean and variance.

Reference Books:

Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning
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
Mathematical Physics, Goswami, 1st edition, Cengage Learning
Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford University Press
Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
Essential Mathematical Methods, K.F.Riley & M.P.Hobson, 2011, Cambridge Univ. Press.
Mathematical Physics, H.K. Dass and R. Verma, S. Chand & Company.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	Quiz	Presentation OR Assignments/ etc.	Mid Term Exam	Attendance	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Apply concepts of calculus in solving problems of interest to physicists.	PO7
CO2	Better understand vector calculus and its applications.	PO7
CO3	Understand use of vector differentiation and integration.	PO3, PO8
CO4	Solve equations encountered in Physics and Engineering.	PO8

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-101A	Mathematical Physics-I			3				3	3						3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
CO1							3							3	
CO2							3							3	
CO3			3					3							3
CO4								3							3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH151A	Mathematical Physics-I Lab	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

Highlights the use of computational methods to solve physical problems

Evaluation done not on the programming but on the basis of formulating the problem

Aim at teaching students to construct the computational problem to be solved

Students can use any one operating system Linux or Microsoft Windows

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire knowledge about the computer architecture and organization.

CO2. To use the computational methods to solve physical problems.

CO3. Understand errors and errors analysis.

CO4. Use concepts to solve differential equations and other problems in physics and engineering.

Catalog Description

The aim of this Lab is not just to teach computer programming and numerical analysis but to

emphasize its role in solving problems in Physics. Highlights the use of computational methods to solve physical problems. The course will consist of lectures (both theory and practical) in the Lab. Evaluation done not on the programming but on the basis of formulating the problem. Aim at teaching students to construct computational problems to be solved. Students can use any one operating system Linux or Microsoft Windows.

Course Content

Topics	Description with Applications
Introduction and Overview	Computer architecture and organization, memory and Input/output devices
Basics of scientific computing	Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow &overflow-emphasize the importance of making equations in terms of dimensionless variables, Iterative methods
Errors and error Analysis	Truncation and round off errors, Absolute and relative errors, Floating point computations.
Review of C & C++ Programming fundamentals	Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (If-statement. If-else Statement. Nested if Structure. Else-if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops), Arrays (1D & 2D) and strings, user defined functions, Structures and Unions, Idea of classes and objects
Programs:	Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search
Random number generation	Area of circle, area of square, volume of sphere, value of pi (π)

Solution of Algebraic and Transcendental equations by Bisection, Newton Raphsonand Secant methods	Solution of linear and quadratic equation,
Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation	Evaluation of trigonometric functions
Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method	Given Position with equidistant time data to calculate velocity and acceleration and vice versa. Find the area of B-H Hysteresis loop
Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods	First order differential equation . Radioactive decay . Current in RC, LC circuits with DC source . Newton's law of cooling . Classical equations of motion.

Referred Books:

Introduction to Numerical Analysis, S.S. Sastry, 5th Edn. , 2012, PHI Learning Pvt. Ltd.

Schaum's Outline of Programming with C++. J. Hubbard, 2000, McGraw-Hill Pub.

Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal, 3rd

Edn. , 2007, Cambridge University Press.

A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHI Learning.

Elementary Numerical Analysis, K.E. Atkinson, 3 r d E d n . , 2 0 0 7 , Wiley India Edition.

Numerical Methods for Scientists & Engineers, R.W. Hamming, 1973, Courier Dover Pub.

An Introduction to computational Physics, T.Pang, 2nd Edn. , 2006,Cambridge Univ. Press

Computational Physics, Darren Walker, 1st Edn., 2015, Scientific International Pvt. Ltd.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Conduct of Experiment**	**Lab Record/Viva Voce**	**Attendance**	**End Term Examination**
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Acquire knowledge about the computer architecture and organization.**	PO1
CO2	**To use the computational methods to solve physical problems.**	PO4
CO3	**Understand errors and errors analysis.**	PO5
CO4	**Use concepts to solve differential equations and other problems in physics and engineering.**	PO2

		Acquire fundamental understanding and conceptual o knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-151A	Mathematical Physics-I Lab			3				3	3						3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3													3	
CO2				3										3	
CO3					3										3
CO4		3													3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH204A	ELEMENTS OF MODERN PHYSICS	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Quantum Mechanics				
Co-requisites	--				

Couse Objectives

Understand the structure of the atom

Explore the particle properties of waves

Examine the wave properties of particles.

Study nuclear transformations

Course Outcomes:

CO1: Understand the fundamental structure and behavior of atoms

CO2: Comprehend the dual nature of particles

CO3: Analyze structure and properties of nucleus

CO4: Apply knowledge to nuclear transformations and reactions

UNIT-I

Origin of Quantum Mechanics: 15 Lectures

Photo-electric effect, Laws of Phoelectric emission, Planck's quantum, Planck's constant and light as a collection of photons, Compton scattering. Dual nature of electromagnetic Waves, De Broglie wavelength, Matter waves, De Broglie wavelength associated with electron Davisson Germer experiment.

Unit -II 15 Lectures

Wave Particle Duality and Uncertainty Principle:

Wave nature of the particle, Free particle, Relation between momentum and propagation constant, Phase velocity, Group velocity , relation between group velocity and phase velocity, Heisenberg uncertainty principle, Applications of uncertainty principle, Minimum energy of harmonic oscillator, Energy of hydrogen atom.

UNIT-III **15 Lectures**

ATOMS AND NUCLEI

Size and structure of atomic nucleus and its relation with atomic weight; Rutherford nuclear atom model, Impossibility of an electron being in the nucleus,Nature of Nuclear Forces, stability of the nucleus; Nuclear Model: Liquid Drop model, semi empirical mass formula and binding energy, Nuclear Shell Model and magicnumbers

UNIT-IV **15 Lectures**

Nuclear Transformations

Law of radioactive decay; Mean life and half-life; modes of radio active decays, Laws of radio active decays Alpha decay; Beta decay, Gamma ray emission, Half life time, positron emission and electron capture, radioactive series, Nuclear Fission; Energy Released in Fission

Textbooks

Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
Modern Physics (17th Ed.), 2013, S. Chand & Company Pvt. Ltd.
Reference Books/Materials
Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
Textbook of engineering Physics, M.N Avadhanulu, P.G.Kshirsagar.
Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.
Physics for scientists and Engineers with Modern Physics, Jewett and Serway, 2010, Cengage Learning.
Modern Physics, G.Kaur and G.R. Pickrell, 2014, McGraw Hill
Quantum Mechanics: Theory & Applications, A.K.Ghatak & S.Lokanathan, 2004, Macmillan 2002.

Open Educational Resources (OER)
https://www.youtube.com/live/uFF_ptEDN0o?feature=share
https://youtu.be/3It49x562b0
https://youtu.be/UyWXOIK0uSg
https://youtu.be/QpXIPPln3Ig
https://youtu.be/Hpn5G1FiuCs
https://youtu.be/Lhxx2jQmLH4
https://youtu.be/PNBk5LjweEk

Assessment & Evaluation

Components	Assignment	Mid Term Examination	Attendance	End Term Examination
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	**Understand the fundamental structure and behavior of atoms**	PO1, PO2, PO6, PO10 & PSOI
CO2	**Comprehend the dual nature of particles.**	PO1, PO2, PO6, PO10 & PSOI
CO3	**Analyze structure and properties of nucleus**	PO1, PO2, PO3, PO6, PO10 & PSOI
CO4	**Apply knowledge to nuclear transformations and reactions.**	PO1, PO2, PO6, PO10 & PSOI

		Acquire fundamental understanding and conceptual o knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH204A	ELEMENTS OF MODER Physics	3	2	2			3				3	3			3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme And Course Mapping

Course Code and Title	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH204A Elements of Modern Physics	CO1	3	2	-	-	-	3	-	-	-	3	3	-	-	-
	CO2	3	2	-	-	-	3	-	-	-	3	3	-	-	-
	CO3	3	-	2	-	-	3	-	-	-	2	3	-	-	-
	CO4	3	2	-	-	-	3	-	-	-	2	3	-	-	-

BSPH254A	ELEMENTS OF MODERN PHYSICS LAB	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Quantum Mechanics				
Co-requisites	--				

Course Objectives:

1. Develop a foundational understanding of quantum mechanics, emphasizing Planck's constant and the photoelectric effect through hands-on experiments.

2. Hone experimental skills to investigate the photoelectric effect, analyzing relationships between photo current, intensity, wavelength, and energy of photoelectrons.

3. Gain practical insight into electronic properties by determining the work function of a directly heated vacuum diode filament.

4. Develop competency in quantum measurements, calculating Planck's constant using LEDs of various colors and determining wavelengths in laser diffraction experiments.

Course Outcomes:

CO1: Demonstrate applied mastery of quantum principles, showcasing proficiency in understanding and utilizing foundational concepts.

CO2: Showcase proficiency in analytically interpreting experimental outcomes related to the photoelectric effect and its parameters.

CO3: Acquire a deeper understanding of electronic structures by practically determining the work function of a directly heated vacuum diode filament.

CO4: Demonstrate expertise in conducting quantum experiments, showcasing the ability to measure Planck's constant and wavelengths using diverse experimental setups.

Course Content

1. Measurement of Planck's constant using black body radiation and photo-detector

2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light

3. To determine work function of material of filament of directly heated vacuum diode.

4. To determine the Planck's constant using LEDs of at least 4 different colours.

5. To determine the wavelength of H-alpha emission line of Hydrogen atom.

6. To determine the ionization potential of mercury.

7. To determine the absorption lines in the rotational spectrum of Iodine vapour.

8. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.

9. To setup the Millikan oil drop apparatus and determine the charge of an electron.

10. To show the tunneling effect in tunnel diode using I-V characteristics.

11. To determine the wavelength of laser source using diffraction of single slit.

12. To determine the wavelength of laser source using diffraction of double slits.

13. To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating

Reference Books

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

Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

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

Assessment & Evaluation

Components	Conduct of Experiment	Lab Record/Viva Voce	Attendance	End Term Examination
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Demonstrate applied mastery of quantum principles, showcasing proficiency in understanding and utilizing foundational concepts.	PO1, PO2, PO3, PO6, PO8 & PSO1
CO2	Showcase proficiency in analytically interpreting experimental outcomes related to the photoelectric effect and its parameters.	PO1, PO2, PO3, PO6, PO8 & PSO1
CO3	Acquire a deeper understanding of electronic structures by practically determining the work function of a directly heated vacuum diode filament.	PO1, PO2, PO3, PO6, PO8 & PSO1
CO4	Demonstrate expertise in conducting quantum experiments, showcasing the ability to measure Planck's constant and wavelengths using diverse experimental setups.	PO1, PO2, PO3, PO6, PO8 & PSO1

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-254A	Elements of Modern Physics Lab	2	2	3			2		3			2			

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3			2		3				2			
CO2	2	2	3			2		3				2			
CO3	2	2	2			2		2				2			
CO4	2	2	3			2		3				1			
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSMA274A	INTRODUCTION TO LaTeX	L	T	P	C
Version 1.0		0	0	2	1
Total Contact Hours	15				
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of the course is

To learn about a document preparation system for high-quality typesetting

To learn typesetting of complex mathematical formulas

Course Outcomes

On completion of this course, the students will be able to

CO1. Typesetting journal articles, technical reports, books, and slide presentations.

CO2. Control over large documents containing sectioning, cross-references.

CO3. Automatic generation of bibliographies and indexes

Catalog Description

The course aims to introduce students to LaTeX - a high quality open-source typesetting software. LaTeX is most used for medium to large technical or scientific documents but can be used for almost any type of publication. The course will, therefore, enable students to type a report, article, or mathematical document.

Course Content

Introduction to LaTeX, Benefits and comparison with word processor, Installing LaTeX, Formatting lines and paragraph, typesetting a simple document, Text alignment, Installing packages.

Creating Lists, Typing Math Formulas, Environments – equations, arrays, matrices, Footnotes, Fonts, Title and headers, Sectioning, Listing references, Math styles – cases, braces, math symbols

Graphics in LaTeX, Inserting Tables and Figures, Simple pictures using PSTricks, Sample article and report, Beamer presentation, Sample presentation, Using online resources

Textbooks

David F. Griffiths, Desmond J. Higham, Learning LaTeX, Society for Industrial and Applied Mathematics(SIAM), 2016.

Stefan Kottwitz , LaTeX Beginner's Guide. Packt Publishing, Birmingham, UK, 2011.

Lamport, Leslie, LaTeX: A Document Preparation System, User's Guide and Reference Manual (2nd ed.). Addison-Wesley, 1994.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Conduct of Experiment**	**Attendance**	**Lab Record/ Quizzes/ Viva-Voice**	**End Term Practical Exam**
Weightage (%)	20	10	20	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Typesetting journal articles, technical reports, books, and slide presentations.	PO9, PO10
CO2	Control over large documents containing sectioning, cross-references	PO5
CO3	Automatic generation of bibliographies and indexes	PO9, PO10

		Apply information on scientific facts to face day to day requirements	Apply moral principles and responsibilities of a science graduate to serve the society	Create innovative ideas by using scientific knowledge for analysis and interpretation of data.	Ability to work independently as well as in collaboration with other individuals /institutions.	Knowledge regarding advancement in various branches of mathematics	Inculcate moral/ethical values and environmental consciousness	Enhance employability/ entrepreneurship skills	Ability to communicate various concepts of mathematics effectively.	Capable to use appropriate software's to solve mathematical equations.	Develop the protocols as per laboratory standards to accomplish the objectives	To gain a strong foundation in various branches of mathematics to investigate and solve the real-life problem	Acquire jobs in government and public sector undertakings, banks, central government institutes and pursuing higher studies at country wide.	Analyze the local and global impacts of understanding of values, ideas, and outcomes in a specific subject area.	To develop entrepreneurial skills to become empowered and self-reliant	Understand the basic concepts of statistics, algebra, and differential equations	Apply the mathematical modeling and reasoning to solve basic problems.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
BSMA 274A 274A	INTRODUCTION TO LaTeX					2				3	3			2			

1=weakly mapped

2=moderately mapped

3=strongly mapped

Programme and Course Mapping																	
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1									3	3		3	2	1	1	2	2
CO2					2							3	2	1	1	2	2
CO3									3	3		3	2	1	1	2	2
1=lightly mapped 2= moderately mapped 3=strongly mapped																	

BSPH103A	MECHANICS	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Basic Physics and Mathematics				
Co-requisites					

Course Objectives

1. To acquire the knowledge of fundamentals of motion of objects, work, energy and collisions

2. To understand the concepts of rotational dynamics, elasticity and fluid motion.

3. To gain insight to the theory of gravitation and oscillations.

4. To have an insight about non-inertial systems and Special Theory of Relativity.

Course Outcomes

On completion of this course, the students will be able to

CO1. Better understand the laws of physics governing the motion of physical objects and relationship between force, work and energy.

CO 2. Comprehend the concept of rotational motion of objects, elastic properties of the materials and motion of fluids.

CO 3. Have an understanding of motion under gravitational force of attraction and simple harmonic motion.

CO 4. Gain deeper understanding of Special Theory of Relativity, Lorentz Transformation, Mass energy transformations.

Catalog Description

This course is intended to introduce the basic concepts of physics related to the motion of objects. It discusses the logic behind many events that we observe around us in day-to-day life. It emphasizes the relationship between force, matter, and motion under different circumstances. This course is a bridge between the basic and advanced concepts of physics.

Course Content

UNIT-I **20 Lecture Hours**

Fundamentals of Dynamics: Reference frames. Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Momentum of variable-mass system: motion of rocket. Motion of a projectile in Uniform gravitational field Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse.

Work and Energy: Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by nonconservative forces. Law of conservation of Energy.

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

UNIT-II **15 Lecture Hours**

Rotational Dynamics: Angular momentum of a particle and system of particles.Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involves both translation and rotation. Elasticity: Relation between Elastic constants. Twisting torque on a Cylinder or Wire.

Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube.

Gravitation and Central Force Motion: Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere.

Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).

UNIT-III **15 Lecture Hours**

Oscillations: SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor.

Non-Inertial Systems: Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems.

UNIT-IV **10 Lecture Hours**

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

Textbooks:

1. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000

Reference book(s) [RB]:

1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.

2. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.

3. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.

4. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning

5. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education

6. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.

7. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Better understand the laws of physics governing the motion of physical objects and relationship between force, work and energy.	PO1, PO2, PO3 & PO6
CO2	Comprehend the concept of rotational motion of objects, elastic properties of the materials and motion of fluids.	PO1, PO2, PO3 & PO6
CO3	Have an understanding of motion under gravitational force of attraction and simple harmonic motion.	PO1, PO2, PO3 & PO6
CO4	Gain deeper understanding of Special Theory of Relativity, Lorentz Transformation, Mass energy transformations.	PO1, PO2, PO3 & PO6

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand and application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH103A	Mechanics	3	3	3			3					3		2	2

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2			2						3			
CO2	3	3	2			2									
CO3	3	3	2			2									
CO4	3	3	2			2									
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH153A	MECHANICS LAB	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Mechanics				
Co-requisites	--				

Course Objectives

Demonstration cum laboratory sessions on the concepts of mechanics such as moment of inertia, determination of 'g' and elastic constants of materials.

Sessions on the review of scientific laboratory report writing, and on experimental data analysis.

Expand and exercise the students' physical intuition and thinking process through the experiments.

Interpretation of experimental data.

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of laboratory instruments and their uses.

CO2. Better insight about data collection techniques.

CO3. Better understanding of data interpretation and error analysis.

CO4. Acquire knowledge about the techniques related data analysis and curve fitting.

Catalog Description

This course involves the experimental verification of concepts of mechanics. The course is design to give knowledge how to use basic instruments in laboratory and laboratory experiment protocols. The main focus is on data collection techniques and the data interpretation. For this purpose a series of experiments have been set. The difficulty level of experiments is set easy to moderate level due to introductory physics.

Course Content

At least 08 experiments from the following:

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

References for Laboratory Work:

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

Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

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

Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt.Ltd.

Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Conduct of Experiment**	**Lab Record/Viva Voce**	**Attendance**	**End Term Examination**
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire fundamental knowledge of laboratory instruments and their uses.	PO1& PO2
CO2	Better insight about data collection techniques.	PO6
CO3	Better understanding of data interpretation and error analysis.	PO6
CO4	Acquire knowledge about the techniques related data analysis and curve fitting	PO7 & PO8

		Acquire fundamental understanding and conceptual knowledge of physics.	Understand and application of basic concepts of physics.	Link Physics with related disciplines.	Acquire procedural knowledge for professional subjects.	Develop skills in related field of specialization.	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling.	Develop skills in performing analysis and interpretation of data.	Develop Technical Communication and ICT skills.	Demonstrate professional behaviour with respect to attributes like objectivity, ethical values, self – reading etc.	: Acquire a fundamental, systematic or coherent understanding of the academic field of Physics.	Acquire procedural knowledge that creates different types of professional related to the disciplinary area of Physics.	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH153A	MECAHNICS LAB	3	3				3	3	3			3	1		3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3												3	
CO2						3								3	
CO3						3									3
CO4							3	3							3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH105A	Physics Workshop Skill	L	T	P	C
Version 1.0		2	2	0	4
Total Contact Hours	60				
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

To make them learn about the different measuring instruments.

To enable them to use mechanical skill for development of new tools.

To give knowledge of soldering process.

To impart knowledge about gear systems, lever and pulley.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Apply concepts of measuring tools in solving problems of interest to physicists.

CO2. Better understand mechanical skill and its applications.

CO3. Understand use of electrical and electronics skill.

CO4. Solve equations encountered in Physics and Engineering.

Catalog Description

The aim of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode. To make them learn about the different measuring instruments. To enable them to use mechanical skill for development of new tools. To give knowledge of soldering process. To impart knowledge about gear systems, lever and pulley.

Course Content

UNIT-I **20 Lecture Hours**

Introduction: Measuring units. conversion to SI and CGS. Familiarization with meterscale,Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

UNIT-II **20 Lecture Hours**

Mechanical Skill: Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothening of cutting edge of sheet using file. Drilling of holes of different diameter in metal sheet and wooden block. Use of bench vice and tools for fitting. Make funnel using metal sheet.

UNIT-III **10 Lecture Hours**

Electrical and Electronic Skill: Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

UNIT-IV **10 Lecture Hours**

Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, Lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.

Reference Books:

A text book in Electrical Technology - B L Theraja – S. Chand and Company.

Performance and design of AC machines – M.G. Say, ELBS Edn.

Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.

Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]

New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply concepts of measuring tools in solving problems of interest to physicists.	PO1
CO2	Better understand mechanical skill and its applications.	PO4
CO3	Understand use of electrical and electronics skill.	PO5
CO4	Solve equations encountered in Physics and Engineering.	PO2

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand and application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-105A	Physics Workshop Skill			3				3	3						3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3													3	
CO2				3										3	
CO3					3										3
CO4		3													3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

UCES125A	Environmental Studies	L	T	P	C
Version 2.0		3	0	0	3
Total Contact Hours	45				
Pre-requisites/Exposure	Basics of Environment				
Co-requisites	--				

Course Objectives

To aware the students about the environment.

To learn the students concepts and methods from ecological and physical sciences and their application in environmental problem solving.

To think across and beyond existing disciplinary boundaries, mindful of the diverse forms of knowledge and experience that arise from human interactions with the world around them.

communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate forms.

Course Outcomes

On completion of this course, the students will be able to

CO1. To comprehend and become responsive regarding environmental issues.

CO2. Acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.

CO3. Enable the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.

CO4. To know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.

CO5. Become consciousness about healthy and safe environment.

Catalog Description

This course imparts the basic concepts of environment which enable them to solve basic problems related to their surroundings. This course helps them to get an idea adverse effect of industrialization, population and degradation of natural resources on the environment. The course introduces the concepts of renewable and non-renewable resources.

Course Content

UNIT I **10 Lectures**

Environment and Natural Resources:

Multidisciplinary nature of environmental sciences; Scope and importance; Need for public awareness.

Land resources; 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 & inter-state). Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Carbon Footprints

UNIT II **10 Lectures**

Ecosystems and Biodiversity:

Ecosystem: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.

Case studies of the following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots ; India as a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT III **10 Lectures**

Environmental Pollution and Environmental Policies:

Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.

Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context. Fundamentals and Application of ESG (Environment Social Governance).

UNIT IV **15 Lectures**

Human Communities and the Environment and Field work:

Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnoi's of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, Recent Case studies related to earthquakes, Foods, Famine, Water Crisis/Scarcity, Smog, Water contamination at National and International Level.

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.

Visit to a 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.

Textbooks

Kaushik and Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

Reference Books/Materials

A.K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.

S.E. Manahan, Environmental Chemistry, CRC Press.

S.S Dara and D.D. Mishra, Environmental Chemistry and Pollution Control, S.Chand & Company Ltd, New Delhi.

R. Gadi, S. Rattan, S. Mohapatra, Environmental Studies Kataria Publishers, New Delhi.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	The learners will be able to comprehend and become responsive regarding environmental issues.	PO6
CO2	Students will acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.	PO10
CO3	It enables the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.	PO8
CO4	Students come to know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.	PO9
CO5	Students become consciousness about healthy and safe environment.	PO2

		Enhancement in Advanced Scientific knowledge about chemistry	Development of critical, logical and innovative thinking	Demonstrate interdisciplinary approach	Learning of fundamental concepts and instrumentation techniques	Orientation towards research and development	Acquiring capability to work independently as well as a member of the diverse team	Understanding of impact of chemicals on the environment	Fostering communication skills	Ethical awareness and digital literacy	Capability to deal with professional responsibilities	Systematic and coherent understanding of theoretical and practical concepts	Appreciate the techniques for the qualitative and quantitative analysis	Learn problem solving approach	Apply principles of chemistry to address societal problems
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSCH125A	Environmental Studies		2				3		3	3	2			3	

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1						3									
CO2										3					
CO3								3							
CO4									3						
CO5		3													
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH102A	Electricity and Magnetism	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Basics of Physics				
Co-requisites	--				

Course Objectives

The abstraction from forces to fields using the examples of the electric and magnetic fields, with some applications.

To learn how charges behave through electric circuits.

Consolidate the understanding of fundamental concepts in Electricity and Magnetism more rigorously as needed for further studies in physics, engineering and technology. Expand and exercise the students' physical intuition and thinking process through the understanding of the theory and application of this knowledge to the solution of practical problems

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of electrostatic interaction using Gauss Law and able to apply it on physical systems.

CO2. Better insight about magnetic and dielectric behaviour of materials.

CO3. Better understanding of electrical circuits/theorems which enhances problem solving approach.

CO4. Develop the ability to correlates the daily life phenomenon to physics using mathematical tools.

Catalog Description

This course imparts the basic concepts of Physics. The course is design to point to a plausible physical origin of simple electromagnetic phenomena in nature, based on what the candidate has learned in the course about fundamental laws and concepts in electricity and magnetism. The course of Electricity and Magnetism help organizing the data in variety of ways to solve the problem efficiently. The course is focused on theoretical discussions of Electricity and Magnetism and applications of discussed phenomenon. It also discusses about daily life physics like magnetism, current etc.

Course Content

Unit I: **10 Lecture hours**

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to chargedistributions with spherical, cylindrical and planar symmetry.

Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole.

Unit II: **15 Lecture hours**

Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to: (1) Plane Infinite Sheet and (2) Sphere.

Dielectric Properties of Matter: Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D. Relations between E, P and D. Gauss' Law in dielectrics.

Unit III: **15 Lecture hours**

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

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

Unit IV: **20 Lecture hours**

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.

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

Network theorems: Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits.

Ballistic Galvanometer: Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping. CDR.

Textbooks

1. Physics for Scientists and Engineers (6th Ed.), Raymond A. Serway and John W. Jewett, Thomson Brooks (2004).

2. Engineering Physics Theory and Practical, A. K. Katiyar and C. K. Pandey, Wiley (2015)

Reference Books/Materials

1. Introduction to Electrodynamics (3rd Indian reprint), D.J. Griffiths,., Pearson Education (2003).

2. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire fundamental knowledge of electrostatic interaction using Gauss Law and able to apply on physical systems.	PO1& PO2
CO2	Better insight about magnetic and dielectric behaviour of materials.	PO4
CO3	Better understanding of electrical circuits/theorems which enhances problem solving approach.	PO6
CO4	Develop the ability to correlates the daily life phenomenon to physics using mathematical tools.	PO7 & PO8

		Acquire fundamental understanding and conceptual knowledge of physics.	Understand application of basic concepts of physics.	Link Physics with related disciplines.	Acquire procedural knowledge for professional subjects.	Develop skills in related field of specialization.	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling.	Develop skills in performing analysis and interpretation of data.	Develop Technical Communication and ICT skills.	Demonstrate professional behaviour with respect to attributes like objectivity, ethical values, self – reading etc.	: Acquire a fundamental, systematic or coherent understanding of the academic field of Physics.	Acquire procedural knowledge that creates different types of professional related to the disciplinary area of Physics.	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH102A	Electricity and Magnetism	3	3		3		3	3	3			3	1		3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3										3			
CO2				3											
CO3						3									
CO4							3	3							

1=lightly mapped 2= moderately mapped 3=strongly mapped

BSPH152A	Electricity and Magnetism Lab	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Basics of Physics				
Co-requisites	--				

Course Objectives

Dedicated demonstration cum laboratory sessions on the construction, functioning and uses of different electrical bridge circuits, and electrical devices like the ballistic galvanometer. To learn how charges behave through electric circuits.

Sessions on the review of scientific laboratory report writing, and on experimental data analysis.

Expand and exercise the students' physical intuition and thinking process through the experiments.

Interpretation of experimental data

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of laboratory instruments and their uses.

CO2. Better insight about data collection techniques.

CO3. Better understanding of data interpretation and error analysis..

CO4. Acquire knowledge about the techniques related data analysis and curve fitting.

Catalog Description

This course imparts the basic concepts of experimental physics. The course is design to give knowledge how to use basic instruments in laboratory and laboratory experiment protocols. The main focus is on data collection techniques and data interpretation. For this purpose a series of experiments have been set. The difficulty level of experiments is set easy to moderate level due to introductory physics.

Course Content

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.

2. To study the characteristics of a series RC Circuit.

3. To determine an unknown Low Resistance using Potentiometer.

4. To determine an unknown Low Resistance using Carey Foster's Bridge.

5. To compare capacitances using De'Sauty's bridge.

6. Measurement of field strength B and its variation in a solenoid (determine dB/dx)

7. To verify the Thevenin and Norton theorems.

8. To verify the Superposition, and Maximum power transfer theorems.

9. To determine self inductance of a coil by Anderson's bridge.

10. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.

11. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant

frequency and (b) Quality factor Q.

12. Measurement of charge and current sensitivity and CDR of Ballistic Galvanometer

13. Determine a high resistance by leakage method using Ballistic Galvanometer.

14. To determine self-inductance of a coil by Rayleigh's method.

15. To determine the mutual inductance of two coils by Absolute method.

Textbooks

1. Physics for Scientists and Engineers (6th Ed.), Raymond A. Serway and John W. Jewett, Thomson Brooks (2004).

2. Engineering Physics Theory and Practical, A. K. Katiyar and C. K. Pandey, Wiley (2015)

Reference Books/Materials

1. Introduction to Electrodynamics (3rd Indian reprint), D.J. Griffiths,., Pearson Education (2003).

2. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Conduct of Experiment**	**Lab Record/Viva Voce**	**Attendance**	**End Term Examination**
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire fundamental knowledge of laboratory instruments and their uses.	PO1& PO2
CO2	Better insight about data collection techniques.	PO6
CO3	Better understanding of data interpretation and error analysis.	PO6
CO4	Acquire knowledge about the techniques related data analysis and curve fitting	PO7 & PO8

		Acquire fundamental understanding and conceptual knowledge of physics.	Understand application of basic concepts of physics.	Link Physics with related disciplines.	Acquire procedural knowledge for professional subjects.	Develop skills in related field of specialization.	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling.	Develop skills in performing analysis and interpretation of data.	Develop Technical Communication and ICT skills.	Demonstrate professional behaviour with respect to attributes like objectivity, ethical values, self – reading etc.	: Acquire a fundamental, systematic or coherent understanding of the academic field of Physics.	Acquire procedural knowledge that creates different types of professional related to the disciplinary area of Physics.	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH152A	Electricity and Magnetism Lab	3	3				3	3	3			3	1		3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3										3		3	
CO2						3								3	
CO3						3									3
CO4							3	3							3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH104A	Waves and Optics	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Electromagnetic Theory				
Co-requisites	Electrostatics and Electromagnetism				

Course Objectives

To learn about the Simple Harmonic Oscillation and its solution

To understand the different wave's phenomenon

To understand the behaviour and properties of light

To acquire knowledge of interference diffraction, polarisation and Holography

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the characteristics of Simple Harmonic Motion.

CO2. Understand the role of the wave equation and appreciate the universal nature of wave motion in a range of physical systems.

CO3. Make them understand dual nature of light, light as a wave and its properties.

CO4. Acquire knowledge of various wave optics phenomena such as Interference, Diffraction, Polarisation and Holography.

Catalog Description

This course builds on the ideas of harmonic motion to cover in depth the concept of waves in physics with particular emphasis on light waves as an example. Emphasis will be on the optical phenomena associated with Wave Optics for example Interference, Diffraction and Polarisation.

Course Content

UNIT-I **15 Lecture Hours**

Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences. (5 Lectures)

Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. (2 Lectures)

Wave Motion: Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves. (4 Lectures)

UNIT-II **15 Lecture Hours**

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. (6 Lectures)

Superposition of Two Harmonic Waves: Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N Harmonic Waves. (7 Lectures)

UNIT-III **15 Lecture Hours**

Wave Optics: Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence. (3 Lectures)

Interference: Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index. (9 Lectures)

Interferometer: Michelson Interferometer-(1) Idea of form of fringes (No theoryrequired), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer. (4 Lectures).

UNIT-IV **15 Lecture Hours**

Diffraction: Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula. (Qualitative discussion only) (2 Lectures)

Fraunhofer diffraction: Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating. (8 Lectures)

Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire. (7 Lectures)

Holography: Principle of Holography. Recording and Reconstruction Method. Theory of Holography as Interference between two Plane Waves. Point source holograms. (3 Lectures)

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.
The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
Fundamental of Optics, A. Kumar, H.R. Gulati and D.R. Khanna, 2011, R. Chand Publications.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	Quiz	Presentation OR Assignments/ etc.	Mid Term Exam	Attendance	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the characteristics of Simple Harmonic Motion	PO1, PO2
CO2	Understand the role of the wave equation and appreciate the universal nature of wave motion in a range of physical systems.	PO2
CO3	Make them understand dual nature of light, light as a wave and its properties.	PO2
CO4	Acquire knowledge of various wave optics phenomena such as Interference, Diffraction, Polarisation and Holography.	PO2, PO6

		Acquire fundamental understanding and conceptual o knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-104A	Waves and Optics	3	3				2							2	2

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3													
CO2		3													
CO3		3													
CO4		3				3						3			

1=lightly mapped 2= moderately mapped 3=strongly mapped

BSPH154A	Waves and Optics Lab	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Waves and Optics				
Co-requisites	Electromagnetic Theory				

Course Objectives

To learn about the experimental set ups related to various optical phenomena.

To learn the wave equation an its solution.

To understand the behaviour and properties of light.

To acquire knowledge of interference, diffraction, polarisation and Holography

Course Outcomes

On completion of this course, the students will be able to

CO1. Get familiar with the laboratory instruments and their uses.

CO2. Understand the role of the wave equation and appreciate the universal nature of wave motion in a range of physical systems.

CO 3. Expand and exercise the students' physical intuition and thinking process through the experiments.

CO4. Develop deep knowledge of optical phenomena i.e. Interference, Diffraction and Polarisation using hands on experiments.

Catalog Description

This course intends to provide deep knowledge of waves and optical phenomena associated with wave optics through lab experiments. This course fills the gap between the theory and practical knowledge of Wave Optics using hands on experiments.

Course Content

To determine the frequency of an electric tuning fork by Melde's experiment and verify λ2 –T law.

To investigate the motion of coupled oscillators.

To study Lissajous Figures.

Familiarization with: Schuster`s focusing; determination of angle of prism.

To determine refractive index of the Material of a prism using sodium source.

To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.

To determine the wavelength of sodium source using Michelson's interferometer.

To determine wavelength of sodium light using Fresnel Biprism.

To determine wavelength of sodium light using Newton's Rings.

To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.

To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.

To determine dispersive power and resolving power of a plane diffraction grating.

Reference Books:

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

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

A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Conduct of Experiment**	**Lab Record/Viva Voce**	**Attendance**	**End Term Examination**
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Get familiar with the laboratory instruments and their uses.	PO6, PO8
CO2	Understand the role of the wave equation and appreciate the universal nature of wave motion in a range of physical systems.	PO1, PO2
CO3	Expand and exercise the students' physical intuition and thinking process through the experiments.	PO8
CO4	Develop deep knowledge of optical phenomena i.e. Interference, Diffraction and Polarisation using hands on experiments.	PO2, PO6

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand and application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH154A	Waves and Optics Lab	3	3				3		3					2	2

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1						3		3						3	
CO2	3	3												3	
CO3								3							3
CO4		3				3									3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH106A	Electrical Circuits and Network Skills	L	T	P	C
Version 1.0		2	2	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Electromagnetic Theory				
Co-requisites	Electrostatics and Electromagnetism				

Course Objectives

To make them learn the basics of electricity, DC and AC Circuits.

To solve DC and AC circuits by KVL and KCL.

To make them understand the behaviour of RL, RC and RLC circuits.

To familiarise them with the working of Voltmeter, Ammeter and Multimeter.

To give knowledge of Electrical Machines such as Transformer, DC and AC Generator, DC Motor, Induction Motor, Synchronous Motor.

To enable them to recognise Electrical drawing symbols and to read an electrical drawing blueprint and ladder diagrams.

To give knowledge of electrical wiring, connectors and cables.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the difference between DC and AC circuits, Actice and Passive Components, Single and Three Phase Supply.

CO 2. Learn the behavior of Main electric circuit elements and their combination i.e. RL, RC and RLC circuits.

CO 3. Understand the basic construction and working mechanism of various electrical machines i.e. Transformer, Generators and Motors.

CO 4. Read an electrical drawing and ladder diagram blueprint.

CO 5. Troubleshoot any fault in an electrical circuit using Multimeter and other tools.

Catalog Description

This course intends to cover Fundamentals of Ohm's law, Kirchhoff's current and voltage laws and its practical implementation, Demonstration of the utility of Voltmeter, Ammeter and Multimeter in measurement of voltage, current, power and impedance of any circuit and familiarization with the working of electrical machines such as Transformer, Generator and Motors etc. The aim of this course is to enable the students to design and trouble shoots the electrical circuits and networks.

Course Content

UNIT-I **15 Lecture Hours**

Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter.

Understanding Electrical Circuits: Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.

UNIT-II **15 Lecture Hours**

Electrical Drawing and Symbols: Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. Generators and Transformers: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers.

Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor.)

UNIT-III **15 Lecture Hours**

Solid-State Devices: Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources

Electrical Protection: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device)

UNIT-IV **15 Lecture Hours**

Electrical Wiring: Different types of conductors and cables. Basics of wiring-Star anddelta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board.

Textbooks

A text book in Electrical Technology - B L Theraja - S Chand & Co.

A text book of Electrical Technology - A K Theraja

Reference Books/Materials

Performance and design of AC machines - M G Say ELBS Edn.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the difference between DC and AC circuits, Actice and Passive Components, Single and Three Phase Supply	PO2
CO2	Learn the behavior of Main electric circuit elements and their combination i.e. RL, RC and RLC circuits	PO3
CO3	Understand the basic construction and working mechanism of various electrical machines i.e. Transformer, Generators and Motors.	PO4
CO4	Read an electrical drawing and ladder diagram blueprint.	PO5
CO5	Troubleshoot any fault in an electrical circuit using Multimeter and other tools.	PO6

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-106A	Electrical Circuits and Network Skills		3	3	3	3	3							3	3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1		3												3	
CO2			3											3	
CO3				3											3
CO4					3										3
CO5						3									3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

UCCS155A	Communication Skills	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

Understand the basics of Grammar to improve written and oral communication skills.

Understand the correct form of English with proficiency

Improve student's personality and enhance their self-confidence.

Improve professional communication.

Enhance academic writing skills.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the basics of Grammar to improve written and oral communication skills

CO2. Understand the correct form of English with proficiency

CO3. Improve student's personality and enhance their self-confidence

CO4. Improve professional communication

CO5. Enhance academic writing skills

Catalog Description

This learning program with its practice-based learning tasks will facilitate the learners to enhance their communication skills in a modern and globalized context, enhance their linguistic and communicative competence and hone their interpersonal skills.

Course Content

UNIT I **10 lecture hours**

Introduction to Communication: Importance of Communication Skills, Meaning, Forms & Types of Communication; Process of Communication; Principles of Effective Communication/7Cs, Barriers in Communication (Interpersonal, Intrapersonal and Organizational).

UNIT II **15 lecture hours**

Academic Writing: Précis (Summary – Abstract – Synopsis – Paraphrase – Précis: Methods), Letter & Résumé (Letter Structure & Elements – Types of letter: Application & Cover - Acknowledgement – Recommendation – Appreciation – Acceptance – Apology – Complaint –Inquiry).Writing a proposal and synopsis. Structure of a research paper. Citations and plagiarism.

UNIT III **11 lecture hours**

Technology-Enabled Communication: Using technology in communication tasks, E-mails, tools for constructing messages, Computer tools for gathering and collecting information; Different virtual medium of communication.

UNIT IV **12 lecture hours**

Building Vocabulary: Word Formation (by adding suffixes and prefixes); Common Errors; Words Often Confused; One word substitution, Homonyms and Homophones; Antonyms &Synonyms, Phrasal Verbs, Idioms & Proverbs (25 each); Commonly used foreign words(15 in number);

UNIT V **12 lecture hours**

Personality Development: Etiquettes& Manners; Attitude, Self-esteem & Self-reliance; Public Speaking; Work habits (punctuality, prioritizing work, bringing solution to problems), Body Language: Posture, Gesture, Eye Contact, Facial Expressions; Presentation Skills/ Techniques.

Textbook [TB]:

Kumar, Sanjay and Pushplata.Communication Skills.Oxford University Press, 2015.

Reference Books/Materials

Mitra, Barun K. Personality Development and Soft Skills. Oxford University Press, 2012.

Tickoo, M.L., A. E.Subramanian and P.R.Subramaniam.Intermediate Grammar, Usage and Composition. Orient Blackswan, 1976.

Bhaskar, W.W.S., AND Prabhu, NS., " English Through Reading", Publisher: MacMillan,1978

Business Correspondence and Report Writing" -Sharma, R.C. and Mohan K. Publisher: Tata McGraw Hill1994

Communications in Tourism & Hospitality- Lynn Van Der Wagen, Publisher: HospitalityPress

Business Communication-K.K.Sinha

Essentials of Business Communication By Marey Ellen Guffey, Publisher: ThompsonPress

How to win Friends and Influence People By Dale Carnegie, Publisher: Pocket Books

Basic Business Communication By Lesikar&Flatley, Publisher Tata McGraw Hills

Body Language By Allan Pease, Publisher SheldonPress

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the basics of Grammar to improve written and oral communication skills	PO1, PSO1
CO2	Understand the correct form of English with proficiency	PO9,PSO1
CO3	Improve student's personality and enhance their self-confidence	PO9
CO4	Improve professional communication.	PO9
CO5	Enhance academic writing skills	PO3,PSO1

		Comprehensive understanding of the theories and practical applications of their subject.	Acquire a sense of social responsibility and service to the greater good of humanity.	Foster scientific temper, creative ability and cross cultural sensitivity	Provide the students opportunities in terms of employment and research	Develop ability for advanced critical thinking and ability to formulate logical arguments.	Acquire the capability to work independently, as well as a member of the diverse team,	Develop awareness about the existing social and cultural constructs and develop strategies to contribute to the wellbeing of society.	Understand the scope of the discipline and be motivated to pursue the contemporary developments and happenings.	Competency in language and communication skills for interacting with diverse audiences in a variety of contexts and genres.	Ability to use digital sources to aid and augment their scholastic pursuits.	To develop competence in the structure, levels and discourse functions of the English language	To appreciate different literary texts with respect to its genre and history	To gain an understanding of the social and cultural connotations associated with a literary work.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
UCCS155A	Communication Skills	3		3						3		3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1							3								
CO2							3								
CO3			3					3							
CO4								3							
1=lightly mapped 2= moderately mapped 3=strongly mapped															

---ETCS104A	INTRODUCTION TO COMPUTERS AND PROGRAMMING IN PYTHON	L	T	P	C
Version 1.0		3	1	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Advanced of Computer communication				
Co-requisites	--				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.

2. Master the fundamentals of writing Python scripts.

3. Learn core Python scripting elements such as variables and flow control structures.

4. Discover how to work with lists and sequence data.

5. Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO1. Remember fundamental concepts in computer science, including programming languages, algorithms, and data structures.

CO2. Understand the purpose and functions of different software and hardware components in a computer system.

CO3. Apply programming concepts and techniques using Python to solve simple to moderate complexity problems.

CO4. Analyze and debug Python programs to identify and resolve errors or issues.

CO5. Evaluate the efficiency and effectiveness of algorithms and data structures used in Python programming.

CO6. Create and implement algorithms and data structures suitable for specific programming scenarios.

Catalog Description

Introduction to Computer and Programming in Python is intended for students with little or no programming experience. It aims to provide students with an understanding of the role computation can play in solving problems and to help students, regardless of their major, feel justifiably confident of their ability to write small programs that allow them to accomplish useful goals. The class will use the Python 3.5 programming language.

Course Content

UNIT I **20 LECTURES**

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm:Flowchart / Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT II **17 LECTURE**

Introduction to Python: The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration, String Manipulation, Guess and Check, Approximations, Bisection, Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files

UNIT III **12 LECTURE**

Classes and Object: Oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding, Handling Exceptions, Decorators

UNIT IV **11 LECTURE**

Simple Algorithms and Data structures: File Handling, Search Algorithms, Sorting, Algorithms, Hash Tables

TEXTBOOKS:

1. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India

Reference Books

1. R. Nageswara Rao, “Core Python Programming”, Dreamtech

2. Wesley J. Chun. “Core Python Programming, Second Edition”, Prentice Hall

3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, Wiley

4. Kenneth A. Lambert, “Fundamentals of Python,First Programs”, CENGAGE Publication

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz/Assignment**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Remember fundamental concepts in computer science, including programming languages, algorithms, and data structures.	PO4, PSO1
CO2	Understand the purpose and functions of different software and hardware components in a computer system.	PO3
CO3	Apply programming concepts and techniques using Python to solve simple to moderate complexity problems.	PO3, PSO3
CO4	Analyze and debug Python programs to identify and resolve errors or issues.	PO2
CO5	Evaluate the efficiency and effectiveness of algorithms and data structures used in Python programming.	PO4
CO6	Create and implement algorithms and data structures suitable for specific programming scenarios.	PO4

		Enhancement in Advanced Scientific knowledge about chemistry	Development of critical, logical and innovative thinking	Demonstrate interdisciplinary approach	Learning of fundamental concepts and instrumentation techniques	Orientation towards research and development	Acquiring capability to work independently as well as a member of the diverse team	Understanding of impact of chemicals on the environment	Fostering communication skills	Ethical awareness and digital literacy	Capability to deal with professional responsibilities	Systematic and coherent understanding of theoretical and practical concepts	Appreciate the techniques for the qualitative and quantitative analysis	Learn problem solving approach	Apply principles ofchemistry to address societal problems
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4

ETCS104A	INTRODUCTION TO COMPUTERS AND PROGRAMMING IN PYTHON	L	T	P	C
Version 1.0		3	1	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Advanced of Computer communication				
Co-requisites	--				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.

2. Master the fundamentals of writing Python scripts.

3. Learn core Python scripting elements such as variables and flow control structures.

4. Discover how to work with lists and sequence data.

5. Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO1. Remember fundamental concepts in computer science, including programming languages, algorithms, and data structures.

CO2. Understand the purpose and functions of different software and hardware components in a computer system.

CO3. Apply programming concepts and techniques using Python to solve simple to moderate complexity problems.

CO4. Analyze and debug Python programs to identify and resolve errors or issues.

CO5. Evaluate the efficiency and effectiveness of algorithms and data structures used in Python programming.

CO6. Create and implement algorithms and data structures suitable for specific programming scenarios.

Catalog Description

Introduction to Computer and Programming in Python is intended for students with little or no programming experience. It aims to provide students with an understanding of the role computation can play in solving problems and to help students, regardless of their major, feel justifiably confident of their ability to write small programs that allow them to accomplish useful goals. The class will use the Python 3.5 programming language.

Course Content

UNIT I 20 LECTURE

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm:Flowchart / Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT II 17 LECTURE

Introduction to Python: The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration, String Manipulation, Guess and Check, Approximations, Bisection, Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files

UNIT III 12 LECTURE

Classes and Object: Oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding, Handling Exceptions, Decorators

UNIT IV 11 LECTURE

Simple Algorithms and Data structures: File Handling, Search Algorithms, Sorting, Algorithms, Hash Tables

TEXT BOOKS:

1. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India

Reference Books

1. R. Nageswara Rao, “Core Python Programming”, Dreamtech

2. Wesley J. Chun. “Core Python Programming, Second Edition”, Prentice Hall

3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, Wiley

4. Kenneth A. Lambert, “Fundamentals of Python,First Programs”, CENGAGE Publication

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz/Assignment	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Remember fundamental concepts in computer science, including programming languages, algorithms, and data structures.	PO4, PSO1
CO2	Understand the purpose and functions of different software and hardware components in a computer system.	PO3
CO3	Apply programming concepts and techniques using Python to solve simple to moderate complexity problems.	PO3, PSO3
CO4	Analyze and debug Python programs to identify and resolve errors or issues.	PO2
CO5	Evaluate the efficiency and effectiveness of algorithms and data structures used in Python programming.	PO4
CO6	Create and implement algorithms and data structures suitable for specific programming scenarios.	PO4

		Enhancement in Advanced Scientific knowledge about chemistry	Development of critical, logical and innovative thinking	Demonstrate interdisciplinary approach	Learning of fundamental concepts and instrumentation techniques	Orientation towards research and development	Acquiring capability to work independently as well as a member of the diverse team	Understanding of impact of chemicals on the environment	Fostering communication skills	Ethical awareness and digital literacy	Capability to deal with professional responsibilities	Systematic and coherent understanding of theoretical and practical concepts	Appreciate the techniques for the qualitative and quantitative analysis	Learn problem solving approach	Apply principles ofchemistry to address societal problems
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
ETCS 104A	Introduction To Computers And Programming In Python		3	2, 3	5, 6							1		3	

1=weakly mapped; 2= moderately mapped; 3=strongly mapped

Programme and Course Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO1	PSO 2	PSO 3	PSO4
CO1				3							3			
CO2			3											
CO3			3										3	
CO4		3												
CO5				3										
CO6				3										
1=lightly mapped 2= moderately mapped 3=strongly mapped														

ETCS150A	INTRODUCTION TO COMPUTERS AND PROGRAMMING IN PYTHON LAB	L	T	P	C
Version 1.0		0	0	2	1
Total Contact Hours	15				
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

Master the fundamentals of writing Python scripts.

Learn core Python scripting elements such as variables and flow control structures.

Discover how to work with lists and sequence data.

Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO1. Remember fundamental concepts and principles of computer programming and software development.

CO2. Understand the purpose and functionality of different software tools and utilities used in Python programming.

CO3. Apply programming concepts and techniques in Python to solve practical problems and implement algorithms.

CO4. Analyze and debug Python programs to identify and resolve errors or issues.

CO5. Evaluate the correctness and functionality of Python programs based on given specifications and requirements.

CO6. Create and integrate various programming concepts and techniques to build comprehensive Python applications.

Course Content

List of Experiments

1	Develop programs to implement list	2 lab hours
2	Develop programs to implement Dictionary	2 lab hours
3	Develop programs to implement tuples	2 lab hours
4	Develop programs to understand the control structures of python	2 lab hours
5	Develop programs to implement function with stress on scoping	2 lab hours
6	Develop programs to implement classes and objects	2 lab hours
7	Develop programs to implement exception handling.	2 lab hours
8	Develop programs to implement linear search and binary search.	2 lab hours
9	Develop programs to implement insertion sort	2 lab hours
10	Develop programs to implement bubble sort.	2 lab hours
11	Develop programs to implement quick sort.	2 Labs
12	Develop programs to implement heap sort.	2 Labs

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Conduct of Experiment	Lab Record/Quizzes/ Viva-Voce	Attendance	End Term PracticalExamination
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Remember fundamental concepts and principles of computer programming and software development.	PO4, PSO1
CO2	Understand the purpose and functionality of different software tools and utilities used in Python programming.	PO3, PSO1
CO3	Apply programming concepts and techniques in Python to solve practical problems and implement algorithms.	PO4
CO4	Analyze and debug Python programs to identify and resolve errors or issues.	PO2
CO5	Evaluate the correctness and functionality of Python programs based on given specifications and requirements.	PSO2
CO6	Create and integrate various programming concepts and techniques to build comprehensive Python applications.	PO5

		Enhancement in Advanced Scientific knowledge about chemistry	Development of critical, logical and innovative thinking	Demonstrate interdisciplinary approach	Learning of fundamental concepts and instrumentation techniques	Orientation towards research and development	Acquiring capability to work independently as well as a member of the diverse team	Understanding of impact of chemicals on the environment	Fostering communication skills	Ethical awareness and digital literacy	Capability to deal with professional responsibilities	Systematic and coherent understanding of theoretical and practical concepts	Appreciate the techniques for the qualitative and quantitative analysis	Learn problem solving approach	Apply principles ofchemistry to address societal problems
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
ETCS 150A	Introduction To Computers And Programming In Python Lab		3	2	1,3	3						1, 2	2	3	

1=weakly mapped 2= moderately mapped 3=strongly mapped

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO1	PSO 2	PSO 3	PSO4
CO1				3							3			
CO2			3								3			
CO3				3										
CO4		3										3		
CO5												3		
CO6					3									3

1=lightly mapped 2= moderately mapped 3=strongly mapped

BSPH201A	Mathematical Physics-II	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Calculus				
Co-requisites	Mathematical Physics-I				

Course Objectives

1. To make them learn about the Fourier series expansion and its applications.

2. To enable them to use theory of errors on various types of data.

3. To give knowledge of special Functions such as Legendre, Bessel, Hermite and Laguerre and their properties.

4. To impart knowledge about various mathematical tools employed to study physics problems.

Course Outcomes

On completion of this course, the students will be able to

CO1. Apply Fourier series expansion in solving problems of interest to physicists.

CO2. Better understand data interpretation and error analysis.

CO3. Understand use of special functions such as Legendre, Bessel, Hermite and Laguerre.

CO4. Solve partial differential equations encountered in Physics and Engineering.

Catalog Description

This course aims to demonstrate the use of mathematical techniques in solving problems in Physics and to provide a deeper understanding of the mathematics underpinning theoretical physics. The course is intended to develop the theory of errors, Fourier series, special functions and partial differential equations. Emphasis will be on illustrative examples from Physics and Engineering.

Course Content

UNIT-I 20 Lecture Hours

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

UNIT-II 20 Lecture Hours

Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions (Jo(x) and J1(x)) and Orthogonality.

UNIT-III 10 Lecture Hours

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

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 andintercept of a fitted line.

UNIT-IV **10 Lecture Hours**

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

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.

Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.

Partial Differential Equations for Scientists & Engineers, S.J. Farlow, 1993, Dover Pub.

Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford University Press

Mathematical methods for Scientists & Engineers, D.A. McQuarrie, 2003, Viva Books

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply Fourier series expansion in solving problems of interest to physicists.	PO7
CO2	Better understand data interpretation and error analysis.	PO7
CO3	Understand use of special functions such as Legendre, Bessel, Hermite and Laguerre.	PO3, PO8
CO4	Solve partial differential equations encountered in Physics and Engineering.	PO8

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-201A	Mathematical Physics-II			3				3	3						3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
CO1	3											3			
CO2		3										3			
CO3			3					3							
CO4								3							
CO5						3	3								
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH251A	Mathematical Physics-II Lab	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Mathematical Physics-II				
Co-requisites	Calculus				

Course Objectives

1. To make them familiar with Scilab/Matlab Simulation Softwares.

2. To learn Scilab/Matlab programs for Fourier series expansion and solution of differential equations.

3. Generation of Special functions using User defined functions in Scilab/Matlab.

4. To give knowledge of techniques of curve fitting and error analysis.

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire knowledge about the techniques related to data analysis and curve fitting.

CO2. To use the computational methods to solve physical problems.

CO3. Understand Scilab/Matlab programming to generate Special functions such as Legendre, Bessel, Hermite and Laguerre.

CO4. Use Scilab/Matlab programs for Fourier series expansion and solution of differential equations.

Catalog Description

This course aims to demonstrate the use of mathematical techniques in solving problems in Physics. The course is design to give knowledge how to use Scilab/Matlab based simulations experiments to solve Mathematical Physics problems like Fourier series expansion, Differential equations, Special functions, curve fitting and error analysis.

Course Content

Topics	Description with Applications
Introduction to Numerical computation software Scilab	Introduction to Scilab, Advantages and disadvantages, Scilab environment, ommand window, Figure window, Edit window, Variables and arrays, Initialising variables in Scilab, Multidimensional arrays, Subarray, Special values, Displaying output data, data file, Scalar and array operations, Hierarchy of operations, Built in Scilab functions, Introduction to plotting, 2D and 3D plotting (2), Branching Statements and program design, Relational & logical operators, the while loop, for loop, details of loop operations, break & continue statements, nested loops, logical arrays and vectorization (2) User defined functions, Introduction to Scilab functions, Variable passing in Scilab, optional arguments, preserving data between calls to a function, Complex and Character data, string function, Multidimensional arrays (2) an introduction to Scilab file processing, file opening and closing, Binary I/o functions, comparing binary and formatted functions, Numerical methods and developing the skills of writing a program (2).
Curve fitting, Least square fit, Goodness of fit, standard deviation	Ohms law to calculate R, Hooke's law to calculate spring Constant
Solution of Linear system of equations by auss elimination method and Gauss Seidal method. Diagonalization of matrices, Inverse of a matrix, Eigen vectors, eigen values problems	Solution of mesh equations of electric circuits (3 meshes) Solution of coupled spring mass systems (3 masses)
Generation of Special functions using User defined functions in Scilab	Generating and plotting Legendre Polynomials Generating and plotting Bessel function

Solution of ODE First order Differential equation Euler, modified Euler and Runge-Kutta second order methods Second order differential equation Fixed difference method Partial differential equations	First order differential equation Radioactive decay Current in RC, LC circuits with DC source Newton's law of cooling Classical equations of motion Second order ifferential Equation Harmonic oscillator (no friction) Damped Harmonic oscillator Over damped Critical damped Oscillatory Forced Harmonic oscillator Transient and Steady state solution Partial Differential Equation: Wave equation Heat equation Poisson equation □ Laplace equation
Using Scicos / xcos	Generating square wave, sine wave, saw tooth wave Solution to harmonic oscillator Study of beat phenomenon Phase space plots

Reference Books/Materials

Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and

S. J. Bence, 3rd ed., 2006, Cambridge University Press

Complex Variables, A.S. Fokas & M.J. Ablowitz, 8th Ed., 2011, Cambridge Univ. Press

First course in complex analysis with applications, D.G. Zill and P.D. Shanahan,

1940, Jones & Bartlett

Computational Physics, D.Walker, 1st Edn., 2015, Scientific International Pvt. Ltd.

A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rd

Edn., Cambridge University Press

Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and

Engineering Applications: A.V. Wouwer, P. Saucez, C.V. Fernández. 2014 Springer

Scilab by example: M. Affouf 2012, ISBN: 978-1479203444

Scilab (A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand & Company

Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing

www.scilab.in/textbook_companion/generate_book/291

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	Conduct of Experiment	Lab Record/Viva Voce	Attendance	End Term Examination
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Acquire knowledge about the techniques related to data analysis and curve fitting.	PO6
CO2	To use the computational methods to solve physical problems.	PO7
CO3	Understand Scilab/Matlab programming to generate Special functions such as Legendre, Bessel, Hermite and Laguerre.	PO8
CO4	Use Scilab/Matlab programs for Fourier series expansion and solution of differential equations.	PO3, PO8

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-251A	Mathematical Physics-II Lab			3			3	3	3						3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
CO1						3								3	
CO2							3							3	
CO3								3							3
CO4			3					3							3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH203A	Thermal Physics	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Basic calculus skills				
Co-requisites					

Course Objectives

To acquire the knowledge of basic concepts of different laws of thermodynamics.

To understand the principles governing entropy and the associated theorems.

To comprehend the Maxwell thermodynamic relations.

To gain the insight of basic aspects of kinetic theory of gases, ideal gas and real gas behaviour and transport behaviour linked to ideal gases.

Course Outcomes

On completion of this course, the students will be able to

CO1. The students will be able to learn first, second laws of thermodynamics and their applications.

CO2. Enable students to know the significance of entropy and third law of thermodynamics and Carnot Cycle.

CO3. Understanding the thermodynamic potentials, their relations and their physical interpretations.

CO4. Understand the Maxwell-Boltzman distribution law, equipartition of energies, real gas equations, Van der Waal equation of state and the Joule-Thompson effect.

Catalog Description

This course imparts the understanding of basic concepts of laws of thermodynamics and insight of the different types of reversible and irreversible processes based on entropy laws.. It assesses the thermodynamical potentials, Maxwell relations and their applications. It also provides detailed study of behavior ideal and real gases, the distribution law of velocities, transport phenomenon, Joule –Thompson effect and equation of state for ideal and real gases.

Course Content

UNIT-I 10 Lecture Hours

Introduction to Thermodynamics

Zeroth and First Law of Thermodynamics: Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient.

UNIT-II 15 Lecture Hours

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

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

UNIT-III 20 Lecture Hours

Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy,Their Definitions, Surface Films and Variation of Surface Tension with Temperature, Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations.

Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of Cp-Cv, (3) TdS Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process.

UNIT-IV 15 Lecture Hours

Kinetic Theory of Gases

Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification, Mean, RMS and Most Probable Speeds, Degrees of Freedom, Law of Equipartition of Energy (No proof required), Specific heats of Gases.

Molecular Collisions: Mean Free Path, Collision Probability, Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance.

Real Gases: Behavior of Real Gases: Deviations from the Ideal Gas Equation, The Virial Equation, Boyle Temperature, Van der Waal's Equation of State for Real Gases. Values of Critical Constants, P-V Diagrams, Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas, Joule-Thomson Porous Plug Experiment, Joule-Thomson Effect for Real and Van der Waal Gases,Temperature of Inversion, Joule-Thomson Cooling.

Text Books

Thermal Physics, Agarwal and Prakash, Pragati Prakashan Educational Publishers.

Reference Books/Materials

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

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

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

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	Quiz	Presentation OR Assignments/ etc.	Mid Term Exam	Attendance	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	To learn first, second laws of thermodynamics and their applications	PO1
CO2	To know the significance of entropy and third law of thermodynamics and Carnot Cycle.	PO2
CO3	Understanding the thermodynamic potentials, their relations and their physical interpretations	PO6
CO4	Understand the Maxwell-Boltzman distribution law, equipartition of energies, real gas equations, Van der Waal equation of state and the Joule-Thompson effect.	PO3

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand and application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH 203A	Thermal Physics	3	2	3			3								

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3										3			
CO2						3									
CO3															
CO4			3												3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH253A	Thermal Physics Lab	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Basics of Physics				
Co-requisites					

Course Objectives

To acquire the skills of doing basic experiments in thermal physics with the right theoretical explanations of results.

To learn laboratory report writing.

To comprehend the experimental data analysis and interpretation of results.

To expand and exercise the students thinking process and team work through the experiments.

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of laboratory instruments and their uses.

CO2. Enable students to measure calculate and analyze various thermodynamical quantities.

CO3. Develop experimental skills.

CO4. To identify and quantify the errors involved.

Catalog Description

This course imparts the basic concepts of experimental physics for understanding the thermo dynamical laws. It is designed to provide hands on experience to use basic instruments in laboratory and laboratory experiment protocols. The main focus is on data collection and analysis. For this purpose a series of experiments have been set to enhance their skills in doing calculations in thermodynamics and right theoretical explanation of results.

Course Content

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.

2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.

3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.

4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.

5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).

6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.

7. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature.

Reference Books:

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

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

A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal,1985, Vani Pub.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	Conduct of Experiment	Lab Record/Viva Voce	Attendance	End Term Examination
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Acquire fundamental knowledge of laboratory instruments and their uses.	PO1
CO2	Enable students to measure calculate and analyze various thermodynamical quantities	PO2
CO3	Develop experimental skills.	PO6
CO4	To identify and quantify data and errors involved.	PO8

		Acquire fundamental understanding and conceptua lo knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH 253A	Thermal Physics	3	2				3		3						

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3													3	
CO2		3												3	
CO3						3									3
CO4								3							3
1=lightly mapped			2= moderately mapped					3=strongly mapped							

BSPH205A	Digital system and Applications	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Digital Electronics				
Co-requisites					

Course Objectives

To acquire knowledge of Number system

Understanding the integrated and digital circuits

Better understanding of Boolean algebra and Data processing circuits

Better understanding of Flip flops ,registers and counter.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the number system,which is the base of digital electronics.

CO2. Enhanc deep insight of Boolean mathematics and how to simplify logical expressions.

CO3. Get knowledge about cobinatinal logic circuits

CO4. Get Better understanding of sequential logic circuits which are beneficial in their day to day life.

Catalog Description

This course is intended to cover most of the basic topics of digital electronics including Number systems, Logic gates and logic families,Boolean Algebra and Simplification, Arithmetic circuits, Data Processing Circuits, various Flip - flops , Clocks And Timers and Shift registers & counters. This course gives the circuit knowledge to students and students will be even able start their startups. Course will also beneficial for students in day to day life.

Course Content

UNIT-I 15 Lecture Hours

Number systems - decimal, binary, octal and hexadecimal systems - conversion from one number system to another. Codes - BCD code - Excess 3 code, Gray code ,Binary arithmetic - Binary addition - subtraction , 1's and 2's complement - Binary multiplication and division.

UNIT-II 15 Lecture Hours

Boolean Algebra and Simplification Of Logic Circuits:

Laws and theorems of Boolean algebra - De Morgan's theorems and their circuit implications - Duality theorem, simplification of Boolean equations – sum of products method (SOP), product of sums methods (POS) Karnaugh map(K Map) - pairs, quads, octets - 2,3 and 4 variables ,Reduction of POS using K Map

UNIT-III 15 Lecture Hours

Combinational Logic Circuits : Arithmetic building blocks - Half adder - Full adder - parallel binary adder - Half subtractor - Full subtractor - The adder-subtractor - digital comparator - parity checker / generator , Multiplexers – Demultiplexers, Decoders

UNIT-IV 15 Lecture Hours

Sequential Logic Circuits

Flip - flops - RS Flip Flop - Clocked RS Flip-flop - D flip-flop - JK flip-flop - JK master slave flip-flop - T type flip-flop registers and counters: Types of registers - serial in serial out - serial in parallel out - parallel in serial out - parallel in parallel out - ring counter

Text Books

1. Malvino and Leech, Digital Principles and Application, 4th edition, Tata McGraw Hill, New Delhi

Reference Books/Materials

Millman and Halkias, Integrated Electronics, International edition, McGraw Hill, New Delhi

Thomas L. Floyd, Digital Fundamentals (Universal Book Stall, India).

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	Quiz	Presentation OR Assignments/ etc.	Mid Term Exam	Attendance	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Understand the number system, which is the base of digital electronics.	PO1
CO2	Enhance deep insight of Boolean mathematics and how to simplify logical expressions.	PO1
CO3	Get knowledge about cobinatinal logic circuits	PO5
CO4	Get Better understanding of sequential logic circuits which are beneficial in their day to day life	PO4

		Acquire fundamental understanding and conceptual knowledge of physics.	Understand application of basic concepts of physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling.	Develop skills in performing analysis and interpretation of data.	Develop Technical Communication and ICT skills	Demonstrate professional behaviour with respect to attributes like objectivity, ethical values, self – reading etc	: Acquire a fundamental, systematic or coherent understanding of the academic field of Physics.	Acquire procedural knowledge that creates different types of professional related to the disciplinary area of Physics.	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH205A	Digital system and Applications	2			3	3						3	1		3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3	PS O4
CO 1					3									3	
CO 2					3									3	
CO 3					3									3	
CO 4				3		3								3	
CO 5				3		3								3	
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH255A	DIGITAL SYSTEMS AND APPLICATIONS LAB	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Digital Electronics				
Co-requisites					

Course Objectives

To acquire knowledge of Number system

Understanding the integrated and digital circuits

Better understanding of Boolean algebra and Data processing circuits

Better understanding of Flip flops ,registers and counter.

Course Outcomes

On completion of this course, the students will be able to

CO1. Get the knowledge of designing the gates.

CO2. Enhance deep insight of Boolean mathematics and how to simplify logical expressions.

CO3. Get the experimental knowledge about combinational logic system

CO4. Get Better understanding of registers and counters. How they are beneficial in day to day life.

Catalog Description

This course is intended to cover most of the basic topics of digital electronics including Number systems, Logic gates and logic families,Boolean Algebra and Simplification, Arithmetic circuits, Data Processing Circuits, various Flip - flops , Clocks And Timers and Shift registers & counters. This course gives the experimental and circuit knowledge to students which will be beneficial for students in day to day life.

Course Content

To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO.

To test a Diode and Transistor using a Multimeter.

To design a switch (NOT gate) using a transistor.

To verify and design AND, OR, NOT and XOR gates using NAND gates.

To design a combinational logic system for a specified Truth Table.

To convert a Boolean expression into logic circuit and design it using logic gate ICs.

To minimize a given logic circuit.

Half Adder, Full Adder and 4-bit binary Adder.

Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C.

To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.

To build JK Master-slave flip-flop using Flip-Flop ICs

To build a 4-bit Counter using D-type/JK Flip-Flop ICs and study timing diagram.

To make a 4-bit Shift Register (serial and parallel) using D-type/JK Flip-Flop ICs.

Reference Books:

Modern Digital Electronics, R.P. Jain, 4th Edition, 2010, Tata McGraw Hill.

Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.

Microprocessor Architecture Programming and applications with 8085, R.S. Goankar, 2002, Prentice Hall.

Microprocessor 8085:Architecture, Programming and interfacing, A. Wadhwa, 2010, PHI

Learning.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	Conduct of Experiment	Lab Record/Viva Voce	Attendance	End Term Examination
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Get the knowledge of designing the gates.	PO1
CO2	Enhanc deep insight of Boolean mathematics and how to simplify logical expressions.	PO1
CO3	Get the experimental knowledge about combinational logic system	PO5
CO4	Get Better understanding of registers and counters. How they are beneficial in day to day life	PO4

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH255A	DIGITAL SYSTEMS AND APPLICATIONS LAB	2			3	3						3	1		3

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
CO1	3													3	
CO2	3													3	
CO3					3										3
CO4				3											3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

UCDM301A	DISASTER MANAGEMENT	L	T	P	C
Version 1.0		3	0	0	3
Total contact hours	45				
Pre-requisites/Exposure	Basics of disasters and control techniques				
Co-requisites	--				

Course Objectives

To create awareness about various types of disasters.

To educate the students about basic disaster management strategies and problem solving.

To examine disaster profile of our country and illustrates the role of governmental and non-governmental organizations in its effective management.

To acquaints students with the existing legal frame work for disaster management and understanding the appropriate rules and regulations.

Course Outcomes

On completion of this course, the students will be able to

CO1. To enable the students to know the difference between natural and man- made disaster

CO2. Acquire the knowledge related to disaster preparedness

CO3. To aware the student about recovery after disaster

CO4. To know the structure and functioning of disaster management framework of our country

CO5. To provide the knowledge about disaster management act

Catalog Description

This course imparts the basic concepts of environment which enable them to solve basic problems related to their surroundings. This course helps them to get an idea adverse effect of industrialization, population and degradation of natural resources on the environment. The course introduces the concepts of renewable and non-renewable resources.

Course Content

UNIT I 10 Lectures

Introduction to Disasters: 10 Lectures

Concept and definitions- Disaster, Hazard, vulnerability, resilience, risks.

Different Types of Disaster: Causes, effects and practical examples for all disasters. Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc. Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc.

UNIT- II 8 Lectures

Disaster Preparedness 10 Lectures

Concept and Nature, Disaster Preparedness Plan, Prediction, Early Warnings and Safety Measures of Disaster, Role of Information, Education, Communication, and Training, Role of Government, International and NGO Bodies, Role of IT in Disaster Preparedness, Role of Engineers on Disaster Management, Relief and Recovery, Medical Health Response to Different Disasters

UNIT III 10 Lectures

Rehabilitation, Reconstruction and Recovery 15 Lectures

Reconstruction and Rehabilitation as a Means of Development, Damage Assessment, Post Disaster effects and Remedial Measures, Creation of Long-term Job Opportunities and Livelihood Options, Disaster Resistant House Construction, Sanitation and Hygiene, Education and Awareness, Dealing with Victims' Psychology, Long-term Counter Disaster Planning, Role of Educational Institute.

UNIT IV 8 Lectures

Disaster Management in India 10 Lectures

Disaster Management Act, 2005: Disaster management framework in India before and after Disaster Management Act, 2005, National Level Nodal Agencies, National Disaster Management Authority

Liability for Mass Disaster : Statutory liability, Contractual liability, Tortious liability, Criminal liability, Measure of damages

Epidemics Diseases Act, 1897: Main provisions, loopholes. Applications of AI and ML in Disaster Management and risk predictions.

Text Books

Content building programme (CBP) book on Disaster Management, Forum AS.

Reference Books/Materials

Government of India, Department of Environment, Management of Hazardous Substances Control

Act and Structure and Functions of Authority Created Thereunder.

Indian Chemical Manufacturers' Association & Loss Prevention Society of India, Proceedings of the National Seminar on Safety in Road Transportation of Hazardous Materials: (1986).

Author Title Publication Dr. Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd.

Tushar Bhattacharya Disaster Science and Management McGraw Hill Education (India) Pvt. Ltd.

Jagbir Singh Disaster Management: Future Challenges and Opportunities K W Publishers Pvt. Ltd.

J. P. Singhal Disaster Management Laxmi Publications.

Shailesh Shukla, Shamna Hussain Biodiversity, Environment and Disaster Management Unique Publications

C. K. Rajan, Navale Pandharinath Earth and Atmospheric Disaster Management: Nature and Manmade B S Publication

Indian law Institute (Upendra Baxi and Thomas Paul (ed.), Mass Disasters and Multinational Liability: The Bhopal Case (1986)

Indian Law Institute, Upendra Baxi (ed.), Environment Protection Act: An Agenda for Implementation (1987)

Asian Regional Exchange for Prof. Baxi., Nothing to Lose But our Lives: Empowerment to Oppose

Industrial Hazards in a Transnational world (1989)

Gurudip Singh, Environmental Law: International and National Perspectives (1995), Lawman (India) Pvt. Ltd.

Leela Krishnan, P, The Environmental Law in India, Chapters VIII, IX and X (1999), Butterworths, New Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	To enable the students to know the difference between natural and man- made disaster	PO1
CO2	Acquire the knowledge related to disaster preparedness	PO4
CO3	To aware the student about recovery after disaster	PO2
CO4	To know the structure and functioning of disaster management framework of our country	PO6
CO5	To provide the knowledge about disaster management act	PO7

		Apply information on scientific facts to face day to day requirements	Apply moral principles and responsibilities of a science graduate to serve the society	Create innovative ideas by using scientific knowledge for analysis and interpretation of data.	Ability to work independently as well as in collaboration with other individuals /institutions.	Knowledge regarding advancement in various branches of mathematics	Inculcate moral/ethical values and environmental consciousness	Enhance employability/ entrepreneurship skills	Ability to communicate various concepts of mathematics effectively.	Capable to use appropriate software's to solve mathematical equations.	Develop the protocols as per laboratory standards to accomplish the objectives	To gain a strong foundation in various branches of mathematics to investigate and solve the real-life problem	Acquire jobs in government and public sector undertakings, banks, central government institutes and pursuing higher studies at countrywide.	Analyze the local and global impacts of understanding of values, ideas, and outcomes in a specific subject area.	To develop entrepreneurial skills to become empowered and self-reliant	Understand the basic concepts of statistics, algebra, and differential equations	Apply the mathematical modeling and reasoning to solve basic problems.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
-UCDM 301A	DISASTER MANAGEMENT	2	2		2		3	3							3		3

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1							3								
CO2							3								
CO3			3					3							
CO4								3							

1=lightly mapped 2= moderately mapped 3=strongly mapped

BSPH202A	Mathematical Physics-III	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Calculus				
Co-requisites	Mathematical Physics-I, II				

Course Objectives

1. To make them learn about the complex numbers and their properties, functions of complex numbers and their properties such as analyticity, poles and residues.

2. To enable them to use residue theorem and its applications in evaluating definite Integrals.

3. To give knowledge of Fourier transform, Laplace Transform and their applications in real world problems.

4. To impart knowledge about various mathematical tools employed to study physics problems.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand Complex numbers and their properties.

CO 2. Solve for singularities and residues of a complex function.

CO 3. Evaluate definite integrals applying residue theorem.

CO 4. Understand the use of Fourier transform in many applications for example Image processing.

CO 5. Apply Laplace transform to solve ODE, PDE and other problems related to Physics and Engineering.

Catalog Description

This course aims to demonstrate the use of mathematical techniques in solving problems in Physics and to provide a deeper understanding of the mathematics underpinning theoretical physics. The course is intended to develop the theory of: complex analysis and its applications, Fourier Transform and Laplace Transform, their properties and applications. Emphasis will be on illustrative examples from Physics and Engineering.

Course Content

UNIT-I **15 Lecture Hours**

Complex Analysis: Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts.

UNIT-II **15 Lecture Hours**

Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula. Simply and multiply connected region. Laurent and Taylor's expansion. Residues and Residue Theorem. Application in solving Definite Integrals.

Integrals Transforms: Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral.

UNIT-III **10 Lecture Hours**

Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.). Three dimensional Fourier transforms with examples. Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations.

UNIT-IV **20 Lecture Hours**

Laplace Transforms: Laplace Transform (LT) of Elementary functions. Properties ofLTs: Change of Scale Theorem, Shifting Theorem. LTs of 1st and 2nd order Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT. Application of Laplace Transforms to 2nd order Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits, Coupled differential equations of 1st order. Solution of heat flow along infinite bar using Laplace transform.

Text Books

Mathematical Physics, H.K. Dass and R. Verma, S. Chand & Company.

Reference Books/Materials

Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence,3rd ed., 2006, Cambridge University Press.
Mathematics for Physicists, P. Dennery and A.Krzywicki, 1967, Dover Publications.
Complex Variables, A.S.Fokas & M.J.Ablowitz, 8th Ed., 2011, Cambridge Univ. Press.
Complex Variables, A.K. Kapoor, 2014, Cambridge Univ. Press.
Complex Variables and Applications, J.W. Brown & R.V. Churchill, 7th Ed. 2003, Tata McGraw-Hill.
First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Understand Complex numbers and their properties.	PO7
CO2	Solve for singularities and residues of a complex function	PO7
CO3	Evaluate definite integrals applying residue theorem	PO7
CO4	Understand the use of Fourier transform in many applications for example Image processing.	PO8
CO5	Apply Laplace transform to solve ODE, PDE and other problems related to Physics and Engineering	PO3

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand and application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-202A	Mathematical Physics-III			3				3	3						3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
CO1			1	2		3	3	3				2	1		1
CO2			1	2		3	3	3				2	1		1
CO3			1	2		3	3	3				2	1		1
CO4			1	2		3	3	3				2	1		1
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH252A	Mathematical Physics-III Lab	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Mathematical Physics-III				
Co-requisites	Calculus				

Course Objectives

1. To make them familiar with Scilab/Matlab Simulation Softwares.

2. To learn Matlab programs for Fourier transform, the inverse Fourier transform and their applications in real world problems.

3. To learn Matlab programs for Laplace transform, the inverse Laplace transforms and their applications in solving problems related to Physics and Engineering.

4. To give knowledge of techniques of curve fitting and error analysis.

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire knowledge about the techniques related to data analysis and curve fitting.

CO2. Better understand data interpretation and error analysis.

CO 3. To use the computational methods to solve physical problems.

CO4. Use Matlab programs to calculate Fourier transform of various functions and implementation of complex numbers.

CO5. Apply Laplace transform using Matlab to solve ODE, PDE and other problems related to Physics and Engineering.

Catalog Description

This course aims to demonstrate the use of mathematical techniques in solving problems in Physics. The course is design to give knowledge how to use Scilab/C++ based simulations experiments to solve Mathematical Physics problems like Fourier Transform, Laplace Transform, Differential equations, Complex Numbers, curve fitting and error analysis.

Course Content

Scilab/C++ based simulations experiments based on Mathematical Physics problems like

Solve differential equations:

dy/dx = e-x with y = 0 for x = 0

dy/dx + e-xy = x2

d2y/dt2 + 2 dy/dt = -y

d2y/dt2 + e-tdy/dt = -y

Dirac Delta Function:

Fourier Series:

Evaluate the Fourier coefficients of a given periodic function (square wave)

Frobenius method and Special functions:

Calculation of error for each data point of observations recorded in experiments done

in previous semesters (choose any two).

UGC Document on LOCF Physics 149

Calculation of least square fitting manually without giving weightage to error.

Confirmation of least square fitting of data through computer program.

Evaluation of trigonometric functions e.g. sin θ, Given Bessel's function at N points. find its value at an intermediate point. Complex analysis: Integrate 1/(x2+2) numerically and check with computer integration.

Compute the nth roots of unity for n = 2, 3, and 4.

Find the two square roots of −5+12j.

Integral transform: FFT of

Solve Kirchoff's Current law for any node of an arbitrary circuit using Laplace's transform.

Solve Kirchoff's Voltage law for any loop of an arbitrary circuit using Laplace's Transform

Perform circuit analysis of a general LCR circuit using Laplace's transform.

Reference Books/Materials

Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence,3rd ed., 2006, Cambridge University Press.

Mathematics for Physicists, P. Dennery and A.Krzywicki, 1967, Dover Publications.

Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB:

Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V.

Fernández. 2014 Springer ISBN: 978-3319067896

A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rd Edn.,

Cambridge University Press

Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444

Scilab (A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand & Company

Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing

https://web.stanford.edu/~boyd/ee102/laplace_ckts.pdf

ocw.nthu.edu.tw/ocw/upload/12/244/12handout.pdf

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Conduct of Experiment**	**Lab Record/Viva Voce**	**Attendance**	**End Term Examination**
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire knowledge about the techniques related data analysis and curve fitting.	PO6
CO2	Better understand data interpretation and error analysis.	PO7
CO3	To use the computational methods to solve physical problems.	PO7
CO4	Use Matlab programs to calculate Fourier transform of various functions and implementation of complex numbers.	PO8
CO5	Apply Laplace transform using Matlab to solve ODE, PDE and other problems related to Physics and Engineering.	PO3

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-252A	Mathematical Physics-III Lab			3			3	3	3						3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1		2			2	3	3	3			1		1	1
CO2		2			2	3	3	3			1		1	1
CO3		2			2	3	3	3			1		1	1
CO4					2	3	3	3			1		1	1

1=lightly mapped 2= moderately mapped 3=strongly mapped

BSPH206A	Analog Systems And Applications	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Basics of Physics				
Co-requisites	--				

Course Objectives

Characteristics and working of pn junction.

Two terminal devices: Rectifier diodes, Zener diode, photodiode etc

NPN and PNP transistors: Characteristics of different configurations, biasing, stabilization and their applications.

CE and two stage RC coupled transistor amplifier using h-parameter model of the transistor.

Designing of different types of oscillators and their stabilities.

Ideal and practical op-amps: Characteristics and applications.

In the laboratory course, the students will be able to study characteristics of various diodes and BJT. They will be able to design amplifiers, oscillators and DACs. Also different applications using Op-Amp will be designed.

Course Outcomes

On completion of this course, the students will be able to

CO1. Gain deeper understanding of semiconductors physics and related principle concepts.

CO2. Implementation of theoretical knowledge in practical applications.

CO3. Bridge basic physics to electronics applications.

CO4. Advance skills and capability for formulating and solving problems. Expand the analytical ability to solve circuit based designs.

Catalog Description

This course designed to introduces the introductory concepts of semiconductor. The structure of course is planned to impart the functional knowledge of semiconductors to the device applications of semiconductors. The course includes the application of individual semiconductor part and the complex circuits of various component includes Integrated circuits. It also emphasizes on understanding of amplifiers, oscillators, operational amplifier and their applications.

Course Content

Unit I: **15 Lecture hours**

Semiconductor Diodes: P and N type semiconductors. Energy Level Diagram.Conductivity and Mobility, Concept of Drift velocity. PN Junction Fabrication (Simple Idea). Barrier Formation in PN Junction Diode. Static and Dynamic Resistance. Current Flow Mechanism in Forward and Reverse Biased Diode. Drift Velocity. Derivation for Barrier Potential, Barrier Width and Current for Step Junction. Current Flow Mechanismin Forward and Reverse Biased Diode.

Two-terminal Devices and their Applications: (1) Rectifier Diode: Half-wave Rectifiers.

Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, C-filter (2) Zener Diode and Voltage Regulation. Principle and structure of (1) LEDs, (2) Photodiode and (3) Solar Cell.

Unit II: **15 Lecture hours**

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CEand CC

Configurations. Current gains α and β Relations between α and β. Load Line analysis of

Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cutoff and Saturation Regions.

Amplifiers: Transistor Biasing and Stabilization Circuits. Fixed Bias and VoltageDivider Bias. Transistor as 2-port Network. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B & C Amplifiers.

Coupled Amplifier: Two stage RC-coupled amplifier and its frequency response.

Unit III: **15 Lecture hours**

Feedback in Amplifiers: Effects of Positive and Negative Feedback on Input Impedance, Output Impedance, Gain, Stability, Distortion and Noise.

Sinusoidal Oscillators: Barkhausen's Criterion for self-sustained oscillations. RC Phaseshift

oscillator, determination of Frequency. Hartley & Colpitts oscillators.

Unit IV: **15 Lecture hours**

Operational Amplifiers (Black Box approach): Characteristics of an Ideal andPractical OpAmp. (IC 741) Open-loop and Closed-loop Gain. Frequency Response. CMRR. Slew Rate and concept of Virtual ground.

Applications of Op-Amps: (1) Inverting and non-inverting amplifiers, (2) Adder, (3)Subtractor, (4) Differentiator, (5) Integrator, (6) Log amplifier, (7) Zero crossingdetector (8) Wein bridge oscillator.

Conversion: Resistive network (Weighted and R-2R Ladder). Accuracy and Resolution. A/D

Conversion (successive approximation)

Text Books

1. Robert Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 8Th Edition, Pearson Education, India.

2. Albert P. Malvino, David J. Bates. Electronic Principles, Eighth Edition, McGraw-Hill Education, United States.

Reference Books/Materials

1. Electronic Communication, Rudy and Cohlen (Prentice Hall).

2. Semiconductor Devices Physics & Technology by S. M. Sze (John Wiley).

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Gain deeper understanding of semiconductors physics and related principle concepts.	PO1
CO2	Implementation of theoretical knowledge in practical applications.	PO2
CO3	Bridge basic physics to electronics applications	PO3
CO4	Advance skills and capability for formulating and solving problems. Expands the analytical ability to solve circuit based designs.	PO6 &PO8

		Acquire fundamental understanding and conceptual knowledge of physics.	Understand application of basic concepts of physics.	Link Physics with related disciplines.	Acquire procedural knowledge for professional subjects.	Develop skills in related field of specialization.	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling.	Develop skills in performing analysis and interpretation of data.	Develop Technical Communication and ICT skills.	Demonstrate professional behaviour with respect to attributes like objectivity, ethical values, self – reading etc.	: Acquire a fundamental, systematic or coherent understanding of the academic field of Physics.	Acquire procedural knowledge that creates different types of professional related to the disciplinary area of Physics.	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH206A	Analog Systems And Applications	3	3	3			3		3			3	2	2	3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1		2					3	3		1
CO2	2	3	3	1		1					3	2		1
CO3	2	2	3	2		2					3	2	2	2
CO4	2	3		2		2						2	2	2

1=lightly mapped 2= moderately mapped 3=strongly mapped

BSPH256A	ANALOG SYSTEMS AND APPLICATIONS LAB	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Basics of Physics				
Co-requisites	--				

Course Objectives

Dedicated demonstration cum laboratory sessions on the construction, functioning and uses of different electrical bridge circuits, and electrical devices like the ballistic galvanometer. To learn how charges behave through electric circuits.

Sessions on the review of scientific laboratory report writing, and on experimental data analysis.

Expand and exercise the students' physical intuition and thinking process through the experiments.

Interpretation of experimental data

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of laboratory instruments and their uses.

CO2. Better insight about data collection techniques.

CO3. Better understanding of data interpretation and error analysis..

CO4. Acquire knowledge about the techniques related data analysis and curve fitting.

Catalog Description

This course imparts the basic concepts of experimental physics. The course is design to give knowledge how to use basic instruments in laboratory and laboratory experiment protocols. The main focus is on data collection techniques and the data interpretation. For this purpose a series of experiments have been set. The difficulty level of experiments is set easy to moderate level due to introductory physics.

Course Content

At least 08 experiments from the following:

1. To study the V-I characteristics of a Zener diode and its use as voltage regulator.

2. Study of V-I & power curves of solar cells, and find maximum power point & efficiency.

3. To study the characteristics of a Bipolar Junction Transistor in CE configuration.

4. To study the various biasing configurations of BJT for normal class A operation.

5. To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.

6. To study the frequency response of voltage gain of a two stage RC-coupled transistor amplifier.

7. To design a Wien bridge oscillator for given frequency using an op-amp.

8. To design a phase shift oscillator of given specifications using BJT.

9. To design a digital to analog converter (DAC) of given specifications.

10. To design an inverting amplifier using Op-amp (741,351) for dc voltage of given gain

11. (a) To design inverting amplifier using Op-amp (741,351) & study its frequency response

(b) To design non-inverting amplifier using Op-amp (741,351) and study frequency response

12. (a) To add two dc voltages using Op-amp in inverting and non-inverting mode

(b) To study the zero-crossing detector and comparator.

13. To design a precision Differential amplifier of given I/O specification using Op-amp.

14. To investigate the use of an op-amp as an Integrator.

15. To investigate the use of an op-amp as a Differentiator.

16. To design a circuit to simulate the solution of simultaneous equation and 1st/2ndorder differential equation.

References for Laboratory Work:

1. Basic Electronics: A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller, 1994, Mc-Graw Hill. OP-Amps

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	Conduct of Experiment	Lab Record/Viva Voce	Attendance	End Term Examination
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire fundamental knowledge of laboratory instruments and their uses.	PO1& PO2
CO2	Better insight about data collection techniques.	PO6
CO3	Better understanding of data interpretation and error analysis.	PO6
CO4	Acquire knowledge about the techniques related data analysis and curve fitting	PO7 & PO8

		Acquire fundamental understanding and conceptual knowledge of physics.	Understand and application of basic concepts of physics.	Link Physics with related disciplines.	Acquire procedural knowledge for professional subjects.	Develop skills in related field of specialization.	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling.	Develop skills in performing analysis and interpretation of data.	Develop Technical Communication and ICT skills.	Demonstrate professional behaviour with respect to attributes like objectivity, ethical values, self – reading etc.	: Acquire a fundamental, systematic or coherent understanding of the academic field of Physics.	Acquire procedural knowledge that creates different types of professional related to the disciplinary area of Physics.	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH256A	ANALOG SYSTEMS AND APPLICATIONS LAB	3	3				3	3	3			3	1		3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3		1						3			2
CO2	1	1	2		2	3		3			2			2
CO3	2	2	3		1	3		3			2			2
CO4			1		2	3		3			2			3
1=lightly mapped 2= moderately mapped 3=strongly mapped														

BSPH301A	QUANTUM MECHANICS AND APPLICATIONS	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Quantum Mechanics				
Co-requisites	Mathematical Physics				

Course Objectives

1. Acquire knowledge of time independent perturbed systems using Schrödinger's equation.

2. Know about the mechanism related to electronic transitions using time independent perturbed systems.

3. Explanation of physical significance of phenomenon of scattering quantum mechanically.

4. Deep insight about the co-relationship between relativity and quantum mechanics.

Course Outcomes

On completion of this course, the students will be able to

CO1. Better understanding of perturbed quantum mechanical systems and their applications

CO2. Formulation of time-dependent perturbed systems and their correlation between experimental phenomenon.

CO3. Comprehend the concepts of quantum mechanical treatment of scattering and applications.

CO4. Gain deeper understanding of relativistic quantum mechanical systems and their reduction in nonrelativistic form.

Catalog Description

This course is intended to cover most of the basic topics in quantum mechanics, related to perturbed system.. This course gives the theoretical explanations of perturbed systems (time independent and time dependent both) and co-relates the experimental data to theoretical aspects. Here the scattering problem tackled by quantum mechanically. Moreover, the course bridges different branches of physics, like spectroscopy, relativity etc, to quantum mechanics

Course Content
Unit 1: 20 Lectures

Wave Function and Schrodinger equation: Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum and Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle. (6 Lectures)

Time independent Schrodinger equation-Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to spread of Gaussian wave-packet for a free particle in one dimension: wave packets, momentum space wavefunction (qualitative discussion); Position-momentum uncertainty principle. (10 Lectures)

Unit 2: 15 Lectures

General discussion of bound states in an arbitrary potential- continuity of wavefunction, boundary condition and emergence of discrete energy levels; application to one-dimensional problem-square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions; Hermite polynomials; ground state, zero point energy & uncertainty principle. (12 Lectures)

Unit 3: 10 Lectures

Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for second order partial differential equation; angular momentum operator & quantum numbers; Radial wavefunctions; shapes of the probability densities for ground & first excited states ; Orbital angular momentum quantum numbers l and m; s, p, d shells. (10 Lectures)

Unit 4: 15 Lectures

Atoms in Electric & Magnetic Fields: Space quantization- Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment, Stern- Gerlach Experiment. Zeeman Effect, Gyromagnetic Ratio and Bohr Magneton. (8 Lectures)
Atoms in External Magnetic Fields:- Normal Zeeman Effect. Paschen Back (Qualitative Discussion only). (4 Lectures)
Many electron atoms: Pauli's Exclusion Principle. Symmetric & Antisymmetric Wave Functions, Fine structure. Spin orbit coupling-LS and JJ coupling. Spectral Notations for Atomic State- Term symbols, Total angular momentum, Vector Model, Hund's Rule.
(10 Lectures)

Text books:

1. Advanced Quantum Mechanics, Satya Prakesh, Kedarnaath Ramnaath (2016)

2. . Introduction to Quantum Mechanics, D.J Griffith, Prentice Hall (1994).

Reference book(s) [RB]:

1. Modern Quantum Mechanics, J.J Sakurai, Revised Edition, 1994, Addision-Wesley.

2. Advanced Quantum Mechanics, B,S, Rajput, Pragati Prakashan (2004)

3. Quantum Mechanics: Theory and Applications, (2019), (Extensively revised 6th Edition), Ajoy Ghatak and S. Lokanathan, Laxmi Publications, New Delhi.

4. Quantum Mechanics, Eugene Merzbacher, 2004, John Wiley and Sons, Inc.

5. A Text book of Quantum Mechanics, P.M.Mathews& K.Venkatesan, 2nd Ed., 2010, McGraw Hill.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Better understanding of perturbed quantum mechanical systems and their applications.	PO1, PO2 & PO9
CO2	Formulation of time-dependent perturbed systems and their correlation between experimental phenomenon.	PO1, PO2 & PO9
CO3	Comprehend the concepts of quantum mechanical treatment of scattering and applications.	PO1, PO2 & PO9
CO4	Gain deeper understanding of relativistic quantum mechanical systems and their reduction in nonrelativistic form. .	PO1, PO2 & PO9

		Acquire advance science knowledge	Understand modern scientific education	Develop critical thinking and analytical ability	Establish new mechanism	Work on application driven research	Work on entrepreneurship projects	Enhance societal impact through communication of research outcomes	Acquire the capability to work independently or in a team	Develop skills in solving problems in Physics and related discipline	Develop Technical Communication and presentation skills	Understanding the advancement in physics in the area of classical mechanics, quantum mechanics and all related area of physics	Gain the experience and background required to model, analyse and solve advanced problems in physics.	Critically analyse and independently assess and evaluate research methods using numerical methods and simulation techniques.	Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH301A	QUANTUM MECHANICS AND APPLICATIONS	3	3							3		3	3	1	2

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3				2	1				3			
CO2	3	3					1				2			2
CO3	3	2			2		2				2			
CO4	3					2					2			

1=lightly mapped 2= moderately mapped 3=strongly mapped

BSPH351A	QUANTUM MECHANICS AND APPLICATIONS Lab	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Quantum Mechanics				
Co-requisites	Mathematical Physics				

Course Objectives

1. Acquire knowledge of time independent perturbed systems using Schrödinger's equation.

2. Know about the mechanism related to electronic transitions using time independent perturbed systems.

3. Get experimental significance of phenomenon of scattering quantum mechanically.

4. Deep insight about the co-relationship between relativity and quantum mechanics.

Course Outcomes

On completion of this course, the students will be able to

CO1.Understanding of C/C++/ language

CO2. Experimental Formulation of time-dependent perturbed systems and their correlation between experimental phenomenon.

CO3. Comprehend the concepts of quantum mechanical treatment of scattering and applications.

CO4. Gain deeper understanding of relativistic quantum mechanical systems and their reduction in nonrelativistic form.

Catalog Description

This course is intended to cover most of the basic topics in quantum mechanics related to the experimental explanations of perturbed systems (time independent and time dependent both) and co-relates the theoretical aspects to experimental data.

Course Content

Use C/C++/Scilab for solving the following problems based on Quantum

Mechanics like

1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom:

2. Solve the s-wave radial Schrodinger equation for an atom:

3. Solve the s-wave radial Schrodinger equation for a particle of mass m:

4. Solve the s-wave radial Schrodinger equation for the vibrations of hydrogen molecule:

Laboratory based experiments:

5. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency

6. Study of Zeeman effect: with external magnetic field; Hyperfine splitting

7. To show the tunneling effect in tunnel diode using I-V characteristics.

8. Quantum efficiency of CCDs

Reference Books:

Schaum's outline of Programming with C++. J.Hubbard, 2000,McGraw-Hill Publication

Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal., 3rd Edn., 2007, Cambridge University Press.

An introduction to computational Physics, T.Pang, 2nd Edn.,2006, Cambridge Univ. Press

Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific &

Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández.2014 Springer.

Scilab (A Free Software to Matlab): H. Ramchandran, A.S. Nair. 2011 S. Chand & Co.

A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rd Edn., Cambridge University Press

Scilab Image Processing: L.M.Surhone.2010 Betascript Publishing ISBN:978-6133459274

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Conduct of Experiment**	**Lab Record/Viva Voce**	**Attendance**	**End Term Examination**
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understanding of C/C++/ language	PO1, PO2 & PO9
CO2	Experimental Formulation of time-dependent perturbed systems and their correlation between experimental phenomenon	PO1, PO2 & PO9
CO3	Comprehend the concepts of quantum mechanical treatment of scattering and applications.	PO1, PO2 & PO9
CO4	Gain deeper understanding of relativistic quantum mechanical systems and their reduction in nonrelativistic form. .	PO1, PO2 & PO9

		Acquire advance science knowledge	Understand modern scientific education	Develop critical thinking and analytical ability	Establish new mechanism	Work on application driven research	Work on entrepreneurship projects	Enhance societal impact through communication of research outcomes	Acquire the capability to work independently or in a team	Develop skills in solving problems in Physics and related discipline	Develop Technical Communication and presentation skills	Understanding the advancement in physics in the area of classical mechanics, quantum mechanics and all related area of physics	Gain the experience and background required to model, analyse and solve advanced problems in physics.	Critically analyse and independently assess and evaluate research methods using numerical methods and simulation techniques.	Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH351 A	Quantum Mechanics and applications lab	3	3							3		3	3	1	2

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	3				3	3	3			2		2	2
CO2	1	3			1	2	2	1			1		2	2
CO3	3	3			1		1	1			2		1	1
CO4	3	3			1	2	2	2			2		2	
1=lightly mapped 2= moderately mapped 3=strongly mapped														

BSPH303A	Solid State Physics	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Crystallography				
Co-requisites	Mathematical Physics				

Course Objectives

To acquire knowledge of crystal structure

Understanding the magnetic properties of matter

Better understanding of dielectric properties of Materials

Better understanding of semiconductors

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand different types of crystals, miller indices and crystal defects.

CO2. Get knowledge about different types of magnetic materials and their practical applications.

CO3. Enhanc deep insight of ferroelectricity and properties of ferroelectric materials

CO4. Get Better understanding of types of semiconductors and fermi energy.

Catalog Description

This course is intended to cover most of the basic topics of solid state including Crystal Structure, Space groups; Packing fraction, Miller indices,Defects in crystal,X-Ray Diffraction, Diamagnetism and Paramagnetism, Superconductivity.. This course gives crystallographic knowledge and unable students to analyze the solid structures, which will also be beneficial for students in research field.

Course Content

15 Lectures

Crystal Structure: amorphous and crystalline materials, lattice translation vectors, lattice with a basis –unit cell, types of lattices symmetry elements, inter planer spacing, packing fraction, Miller Indices, Bonding in solids- ionic bond. covalent bond, metallic bonds, hydrogen bonding, van Der Waals bond, crystal defects , point defects, line defects, Burgers vector, surface imperfections.

15 Lectures

Magnetic Properties of Matter: Classification of Magnetic materials-Dia-, Para-, Ferri- and Ferromagnetic Materials, Classical Langevin Theory of dia magnetic materials.Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains.Discussion of B-H Curve. Hysteresis and Energy Loss, antiferromagnetism, ferrimagnetism .

15 Lectures

Dielectric Properties of Materials: Types of Polarization, Local Electric Field at an Atom, static, Dielectric Constant, Electric Susceptibility, Polarizability, Classical Theory of Electric Polarizability, three vectors, Clausius-Mosotti Equation. Variation of dielectric polarization with temperature and frequency, pizo-pyro and ferroelectricity properties, domain theory of ferroelectricity, Complex Dielectric Constant, dielectrics in alternating fields, relaxation in dielectrics, absorption and losses, dielectric breakdowns.

15 Lectures

Superconductivity: 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)

Text Books

1. S O Pillai, Solid State Physics (New Age International Limited).

2. B.D. Cullity and C. D. Graham, Introduction to Magnetic Materials (John Wiley and Sons, Inc.)

Reference Books/Materials

B.D. Cullity, Elements of X-Ray Diffraction (Addison-Wesley Metallurgy Series).

Charles Kittel, Introduction to Solid State Physics (John Wiley and Sons, Inc.).

N. W. Ascroft and N. D. Mermin, Solid State Physics (Harcourt Asia, Singapore).

M. Ali Omar, Elementary solid state physics: principles and applications (Pearson Education)

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand different types of crystals, miller indices and crystal defects.	PO1
CO2	Get knowledge about different types of magnetic materials and their practical applications.	PO1
CO3	Enhanc deep insight of ferroelectricity and properties of ferroelectric materials	PO2
CO4	Get Better understanding of types of superconductors	PO4

		Acquire fundamental understanding and conceptual knowledge of physics.	Understand application of basic concepts of physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling.	Develop skills in performing analysis and interpretation of data.	Develop Technical Communication and ICT skills	Demonstrate professional behaviour with respect to attributes like objectivity, ethical values, self – reading etc	: Acquire a fundamental, systematic or coherent understanding of the academic field of Physics.	Acquire procedural knowledge that creates different types of professional related to the disciplinary area of Physics.	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH303A	Solid State Physics	2	3			3						3	1		3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3					2						2			
CO2	3	3										2			
CO3	2	2			1							2			
CO4	3	1			1							2			
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH353A	SOLID STATE PHYSICS-I Lab	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Solid State Physics				
Co-requisites	--				

Course Objectives

Learn the basics of dielectric properties of the materials.

Develop an understanding of about Ferroelectric properties

Understanding the source of magnetic behaviour of the materials and experimental verification.

Experiments related to magnetism.

Course Outcomes

On completion of this course, the students will be able to

CO1. Better understanding of dielectric properties of the materials.

CO2. Understanding of semiconductor properties.

CO3. Deep insight about the magnetic behaviour and its source through experiments.

CO4. Enhanced experimental knowledge about Ferroelectric properties

Catalog Description

This course imparts the basic knowledge of construction of materials, microscopically. The course deals with the factors and conditions which are required to determine various properties like dielectric constant,magnetic susceptibility, semiconductor properties.. The course further delivers keen understanding of magnetism and its application in technology.

Course Content

1. Measurement of susceptibility of paramagnetic solution (Quinck`s Tube Method)

2. To measure the Magnetic susceptibility of Solids.

3. To determine the Coupling Coefficient of a Piezoelectric crystal.

4. To measure the Dielectric Constant of a dielectric Materials with frequency

5. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)

6. To determine the refractive index of a dielectric layer using SPR

7. To study the PE Hysteresis loop of a Ferroelectric Crystal.

8. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.

9. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150 oC) and to determine its band gap.

10. To determine the Hall coefficient of a semiconductor sample..

Text book :

1. Solid State Physics, S.O.PIllai, New Age Publication

2. Elements of X-Ray Diffraction, B.D. Cullity. Addison-Wesley Publishing Company,

3. Introduction to Magnetic Materials (2ndEdition,), B.D. Cullity and C.D. Graham, Wiley(2009)

References Books:

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.

2. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India.

3. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill.

4. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning.

5. Solid-state Physics, H. Ibach and H. Luth, 2009, Springer. Reference Books/Materials

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Conduct of Experiment**	**Lab Record/Viva Voce**	**Attendance**	**End Term Examination**
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Better understanding of dielectric properties of the materials.	PO1 & PO6
CO2	Understanding of semiconductor properties.	PO3 & PO8
CO3	Deep insight about the magnetic behaviour and its source through experiments.	PO2 & PO3
CO4	Enhanced experimental knowledge about Ferroelectric properties	PO3 & PO5

		Acquire advance science knowledge	Understand modern scientific education	Develop critical thinking and analytical ability	Establish new mechanism	Work on application driven research	Work on entrepreneurship projects	Enhance societal impact through communication of research outcomes	Acquire the capability to work independently or in a team	Develop skills in solving problems in Physics and related discipline	Develop Technical Communication and presentation skills	Understanding the advancement in physics in the area of classical mechanics, quantum mechanics and all related area of physics	Gain the experience and background required to model, analyse and solve advanced problems in physics.	Critically analyse and independently assess and evaluate research methods using numerical methods and simulation techniques.	Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH353A	SOLID STATE PHYSICS Lab	3	3	3		3	3		3			3	3	3	3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3				2							2			1
CO2	3							1				2			1
CO3	3	3			2							2			1
CO4	1	3			3			1				2			1
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH305A	BASIC INSTRUMENTATION SKILLS	L	T	P	C
Version 1.0		2	2	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Basics of Physics				
Co-requisites	Basics of Electronics				

Course Objectives

Dedicated demonstration cum hands on sessions on the construction, functioning and uses of different measuring Instruments such as Voltmeter, Ammeter, Multimeter, CRO, Function Generator etc.

To learn difference between analog and digital meters.

Sessions on the review of scientific laboratory report writing, and on experimental data analysis.

Expand and exercise the students' physical intuition and thinking process through the experiments.

Interpretation of experimental data

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of laboratory instruments and their uses.

CO2. Better insight about difference in working of digital and analog instruments.

CO3. Understand basics of measurement and error analysis.

CO4. Learn techniques related to data analysis and curve fitting.

Catalog Description

This course is to give exposure with various aspects of instruments and their usage through hands-on mode. Importance of measurement is explained along with the working of various measuring instruments. For this purpose a series of experiments have been set. Experiments listed below are to be done in continuation of the topics.

Course Content

Unit I: Basic of Measurement: 20 Lecture Hours

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

Electronic Voltmeter: Advantage over conventional multimeter for voltagemeasurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications and their significance.

Unit II: Cathode Ray Oscilloscope: 20 Lecture Hours

Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence &chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance.

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

Unit III: Signal Generators and Analysis Instruments: 10 Lecture Hours

Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. (4 Lectures) Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic(balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges.

Unit IV: Digital Instruments: 10 Lecture Hours

Principle and working of digital meters. Comparison of analog &digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter.(3 Lectures)

Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/frequency counter, time- base stability, accuracy and resolution.

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.

2. CRO as a versatile measuring device.

3. Circuit tracing of Laboratory electronic equipment,

4. Use of Digital multimeter/VTVM for measuring voltages

5. Circuit tracing of Laboratory electronic equipment,

6. Winding a coil / transformer.

7. Study the layout of receiver circuit.

8. Trouble shooting a circuit

9. Balancing of bridges

Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.

2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.

3. To measure Q of a coil and its dependence on frequency, using a Q- meter.

4. Measurement of voltage, frequency, time period and phase angle using CRO.

5. Measurement of time period, frequency, average period using universal counter/ frequency counter.

6. Measurement of rise, fall and delay times using a CRO.

7. Measurement of distortion of a RF signal generator using distortion factor meter.

8. Measurement of R, L and C using a LCR bridge/ universal bridge.

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope

2. Converting the range of a given measuring instrument (voltmeter, ammeter)

Reference Books:

Text book in Electrical Technology - B L Theraja - S Chand and Co.

Performance and design of AC machines - M G Say ELBS Edn.

Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.

Logic circuit design, Shimon P. Vingron, 2012, Springer.

Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.

Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill

Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008,

Springer

Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire fundamental knowledge of laboratory instruments and their uses.	PO1& PO2
CO2	Better insight about difference in working of digital and analog instruments.	PO6
CO3	Understand basics of measurement and error analysis.	PO6
CO4	Learn techniques related to data analysis and curve fitting.	PO7 & PO8

		Acquire fundamental understanding and conceptual knowledge of physics.	Understand and application of basic concepts of physics.	Link Physics with related disciplines.	Acquire procedural knowledge for professional subjects.	Develop skills in related field of specialization.	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling.	Develop skills in performing analysis and interpretation of data.	Develop Technical Communication and ICT skills.	Demonstrate professional behaviour with respect to attributes like objectivity, ethical values, self – reading etc.	: Acquire a fundamental, systematic or coherent understanding of the academic field of Physics.	Acquire procedural knowledge that creates different types of professional related to the disciplinary area of Physics.	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH 305A	Basic Instrumentation Skills	3	3				3	3	3			3	1		3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3										2			1
CO2		3			2							2			2
CO3	2	1				3						2			
CO4	1	1					3	3				1			
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH307A	Classical Dynamics	L	T	P	C
Version 1.0		5	1	0	6
Total Contact Hours	90				
Pre-requisites/Exposure	Basic Mathematical Physics				
Co-requisites					

Course Objectives

1. To familiarize the student with the e drawbacks of Newtonian approach and necessity of new approaches to solve problems involving the classical mechanical systems.

2. To understand the mechanics of small amplitude oscillations and normal modes of oscillations.

3. To acquire knowledge of special theory of relativity and understand two-body decay of an unstable particle.

4. To understand the concepts of fluid dynamics in terms of classical mechanics.

Course Outcomes

On completion of this course, the students will be able to

CO1. Define and understand basic mechanical concepts involving the dynamic motion of classical mechanical systems.

CO 2. To solve the problems related to potential energy, oscillations and normal mode of oscillations of classical mechanical systems.

CO 3. Solve problems of special theory of relativity s using the Lagrangian and Hamiltonian formulations of classical mechanics

CO 4. Gain deeper understanding of classical treatment of problems in fluid dynamics.

Catalog Description

This course is intended to familiarize the students about the drawbacks of Newtonian mechanics and solve the problems using classical mechanics. It discusses the motion of a mechanical system using Lagrange-Hamilton formalism. It also presents the classical formalism of special theory of relativity and fluid dynamics.

Course Content

Unit I Classical Mechanics of Point Particles: 35 Lecture Hours

Review of Newtonian Mechanics; Applicationto the motion of a charge particle in external electric and magnetic fields- motion in uniform electric field, magnetic field- gyroradius and gyrofrequency, motion in crossed electric and magnetic fields. Generalized coordinates and velocities, Hamilton's principle, Lagrangian and the Euler- Lagrange equations, one-dimensional examples of the Euler-Lagrange equations- one dimensional Simple Harmonic Oscillations and falling body in uniform gravity; applications to simple systems such as coupled oscillators Canonical momenta & Hamiltonian. Hamilton's equations of motion.

Applications: Hamiltonian for a harmonic oscillator, solution of Hamilton's equation for Simple Harmonic Oscillations; particle in a central force field- conservation of angular momentum and energy.

Unit II Small Amplitude Oscillations: 15 Lecture Hours

Minima of potential energy and points of stable equilibrium, expansion of the potential energy around a minimum, small amplitude oscillations about the minimum, normal modes of oscillations example of N identical masses connected in a linear fashion to (N -1) - identical springs. (10 Lectures)

Unit III Special Theory of Relativity: 25 Lecture Hours

Postulates of Special Theory of Relativity. Lorentz Transformations. Minkowski space. The invariant interval, light cone and world lines. Spacetime diagrams. Time -dilation, length contraction and twin paradox. Four-vectors: space-like, time-like and light-like. Four-velocity and acceleration. Metric and alternating tensors. Fourmomentum and energy-momentum relation. Doppler effect from a four-vector perspective. Concept of four-force. Conservation of four-momentum. Relativistic kinematics. Application to two-body decay of an unstable particle.

Unit IV Fluid Dynamics: 15 Lecture Hours

Density and pressure P in a fluid, an element of fluid and its velocity, continuity equation and mass conservation, stream-lined motion, laminar flow, Poiseuille's equation for flow of a liquid through a pipe, Navier-Stokes equation, qualitative description of turbulence, Reynolds number. (10 Lectures)

Reference book(s) [RB]:

1. Classical Mechanics, H.Goldstein, C.P. Poole, J.L. Safko, 3rd Edn. 2002,Pearson Education.

2. Mechanics, L. D. Landau and E. M. Lifshitz, 1976, Pergamon.

3. Classical Electrodynamics, J.D. Jackson, 3rd Edn., 1998, Wiley.

4. The Classical Theory of Fields, L.D Landau, E.M Lifshitz, 4th Edn., 2003, Elsevier.

5. Introduction to Electrodynamics, D.J. Griffiths, 2012, Pearson Education.

6. Classical Mechanics, P.S. Joag, N.C. Rana, 1st Edn., McGraw Hall.

7. Classical Mechanics, R. Douglas Gregory, 2015, Cambridge University Press.

8. Classical Mechanics: An introduction, Dieter Strauch, 2009, Springer.

9. Solved Problems in classical Mechanics, O.L. Delange and J. Pierrus, 2010, Oxford Press

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Define and understand basic mechanical concepts involving the dynamic motion of classical mechanical systems.	PO1, PO2 , PO5 & PO6
CO2	To solve the problems related to potential energy, oscillations and normal mode of oscillations of classical mechanical systems.	PO1, PO2, PO5 & PO6
CO3	Solve problems of special theory of relativity s using the Lagrangian and Hamiltonian formulations of classical mechanics	PO1, PO2 & PO5
CO4	Gain deeper understanding of classical treatment of problems in fluid dynamics.	PO1, PO2, PO3 & PO5

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand and application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH307A	Classical Dynamics	3	3	3		3	3					3		3	3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	1			1	2					2			
CO2	2	2				3					2			
CO3	2	3				3					2			2
CO4	3	1			1	3					1			1

1=lightly mapped 2= moderately mapped 3=strongly mapped

BSPH309A	Nuclear and Particle Physics	L	T	P	C
Version 1.0		5	1	0	6
Total Contact Hours	90				
Pre-requisites/Exposure	Basic Modern Physics				
Co-requisites					

Course Objectives

1. To familiarize the student with the constituents of nucleus, their intrinsic properties and nuclear models.

2. To understand the processes involved in radioactive decay and types of nuclear reactions.

3. To acquire knowledge of interaction of nuclear radiation with matter, detectors and accelerators for nuclear radiations.

4. To have an insight about various types of elementary particles and their interactions.

Course Outcomes

On completion of this course, the students will be able to

CO1. Better understand the basics of nucleus, nucleons, their properties and models.

CO 2. Comprehend the concept of radioactive disintegration and nuclear reactions.

CO 3. Have an understanding of characteristics of nuclear radiations and working of nuclear detectors and accelerators

CO 4. Gain deeper understanding of particle interactions and the laws governing the interactions.

Catalog Description

This course is intended to cover the concepts of nucleus, its constituents, properties and interactions of its constituents. It discusses the radioactive decay, elementary particles and various conservation laws governing the interaction of elementary particles. This course also makes a foundation for advanced courses on Nuclear and Particle physics and Nuclear Radiations.

Course Content

Unit I General Properties of Nuclei: 30 Lecture Hours

Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states. (10 Lectures)

Nuclear Models: Liquid drop model approach, semi empirical mass formula andsignificance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force. (12 Lectures)

Unit II Radioactivity decay: 20 Lecture Hours

(a) Alpha decay: basics of α-decay processes, theory of α-emission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) □-decay: energy kinematics for □- decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion. (10 Lectures)

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct Reaction, resonance reaction, Coulomb scattering (Rutherford scattering). (8 Lectures)

Unit III Interaction of Nuclear Radiation with matter: 20 Lecture Hours

Energy loss due to ionization (Bethe-Block formula), energy loss of electrons, Cerenkov radiation. Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter. (8 Lectures)

Detector for Nuclear Radiations: Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector. (8 Lectures)

Particle Accelerators: Accelerator facility available in India: Van-de Graaff Generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons. (5 Lectures)

Unit IV Particle physics: **20 Lecture Hours**

Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quarkmodel, color quantum number and gluons. (14 Lectures)

Text books:

1. Nuclear Physics by S N Ghoshal, First edition, S. Chand Publication, 2010.

Reference book(s) [RB]:

1Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).

2 Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).

3 Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).

4 Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press

5 Introduction to Elementary Particles, D. Griffith, John Wiley & Sons

6 Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi

7 Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP Institute of Physics Publishing, 2004).

8 Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).

9 Physics and Engineering of Radiation Detection, Syed Naeem Ahmed (Academic Press,

Elsevier, 2007).

10 Theoretical Nuclear Physics, J.M. Blatt & V.F.Weisskopf (Dover Pub.Inc., 1991)

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Better understand the basics of nucleus, nucleons, their properties and models.	PO1, PO2 & PO5
CO2	Comprehend the concept of radioactive disintegration and nuclear reactions.	PO1, PO2 & PO5
CO3	Have an understanding of characteristics of nuclear radiations and working of nuclear detectors and accelerators.	PO1, PO2 & PO5
CO4	Gain deeper understanding of particle interactions and the laws governing the interactions.	PO1, PO2, PO3 & PO5

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH309A	Nuclear and Particle Physics	3	3			1	2	2				2			

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO1	PSO2	PSO3	PSO4
CO1	3				1	2	2				2			
CO2	3				1						2			
CO3	3	3			1						2			
CO4	3	3									1			

1=lightly mapped 2= moderately mapped 3=strongly mapped

BSPH302A	ELECTROMAGNETIC THEORY	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Electricity and Magnetism				
Co-requisites					

Course Objectives

1. To familiarize the student with the fundamentals of electromagnetic waves, Maxwell's equations and electromagnetic energy density associated with electromagnetic waves.

2. To understand the factors governing the propagation of EM waves in unbounded and bounded media.

3. To acquire knowledge of polarization of electromagnetic waves.

4. To have an insight about wave guides and optical fibres.

Course Outcomes

On completion of this course, the students will be able to

CO1. Better understand the basics of electromagnetic waves and wave equations.

CO 2. Comprehend the concept of propagation of EM waves in different media under different conditions.

CO 3. Have an understanding of different types of polarization of EM waves.

CO 4. Gain deeper understanding of propagation of EM waves through waveguides and optical fibres.

Catalog Description

This course is intended to cover the concepts of electromagnetic waves and their properties and propagation. It discusses the propagation of electromagnetic waves through bounded and unbounded media. This course also makes a foundation for advanced courses such as optical fiber communication and waveguides.

Course Content

Unit I Maxwell Equations: 15 Lecture Hours

Review of Maxwell's equations. Displacement Current. Vectorand Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Boundary Conditions at Interface between Different Media. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, Momentum Density and Angular Momentum Density.

Unit II EM Wave Propagation in Unbounded Media: 20 Lecture Hours

Plane EM waves through vacuum andisotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth. Wave propagation through dilute plasma, electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth, application to propagation through ionosphere. (10 Lectures)

EM Wave in Bounded Media: Boundary conditions at a plane interface between twomedia. 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) (10 Lectures)

Unit III Polarization of Electromagnetic Waves: 15 Lecture Hours

Description of Linear, Circular and EllipticalPolarization. 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. Babinet Compensator and its Uses. Analysis of Polarized Light (12 Lectures)

Rotatory Polarization: Optical Rotation. Biot's Laws for Rotatory Polarization. Fresnel's Theory of optical rotation. Calculation of angle of rotation. Experimental verification ofFresnel's theory. Specific rotation. Laurent's half-shade polarimeter. (5 Lectures)

Unit IV Wave Guides: 10 Lecture Hours

Planar optical wave guides. Planar dielectric wave guide. Condition ofcontinuity at interface. Phase shift on total reflection. Eigenvalue equations. Phase and group velocity of guided waves. Field energy and Power transmission. (8 Lectures)

Optical Fibres: Numerical Aperture. Step and Graded Indices (Definitions Only). Single and Multiple Mode Fibres (Concept and Definition Only). (3 Lectures)

Text books:

1. Introduction to Electrodynamics, D.J. Griffiths, 3rd Ed., 1998, Benjamin Cummings.

Reference book(s) [RB]:

1. Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.

2. Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning

3. Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGraw Hill

4. Electromagnetic field Theory, R.S. Kshetrimayun, 2012, Cengage Learning

5. Engineering Electromagnetic, Willian H. Hayt, 8th Edition, 2012, McGraw Hill.

6. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer

Additional Books for Reference

1. Electromagnetic Fields & Waves, P.Lorrain & D.Corson, 1970, W.H.Freeman & Co.

2. Electromagnetics, J.A. Edminster, Schaum Series, 2006, Tata McGraw Hill.

3. Electromagnetic field theory fundamentals, B. Guru and H. Hiziroglu, 2004,Cambridge University Press

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Better understand the basics of electromagnetic waves and wave equations.	PO1, PO2 & PO5
CO2	Comprehend the concept of propagation of EM waves in different media under different conditions.	PO1, PO2 & PO5
CO3	Have an understanding of different types of polarization of EM waves.	PO1, PO2 & PO5
CO4	Gain deeper understanding of propagation of EM waves through waveguides and optical fibres.	PO1, PO2, PO3 & PO5

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH302A	Electromagnetic Theory	3	3	3		3						3			2

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3			3						3			
CO2	3	3			3	2					3			2
CO3	3	3	3		3						3			
CO4	3	3	3		3						3			2
1=lightly mapped 2= moderately mapped 3=strongly mapped														

BSPH352A	ELECTROMAGNETIC THEORY LAB	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Electricity & Magnetism, Electromagnetic Theory				
Co-requisites	--				

Course Objectives

Demonstration cum laboratory sessions on the concepts of electromagnetic theory such as polarization, reflection, refraction of EM waves.

Sessions on the review of scientific laboratory report writing, and on experimental data analysis.

Expand and exercise the students' physical intuition and thinking process through the experiments.

Interpretation of experimental data.

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of laboratory instruments and their uses.

CO2. Better insight about data collection techniques.

CO3. Better understanding of data interpretation and error analysis.

CO4. Acquire knowledge about the techniques related data analysis and curve fitting.

Catalog Description

This course involves the experimental verification of concepts of electromagnetic such as polarization, reflection, refraction, refractive index, wavelength and velocity of electromagnetic waves. The course is design to give knowledge how to use basic instruments in laboratory and laboratory experiment protocols. The main focus is on data collection techniques and the data interpretation. For this purpose a series of experiments have been set. The difficulty level of experiments is set easy to moderate level due to introductory physics.

Course Content

At least 08 experiments from the following:

1. To verify the law of Malus for plane polarized light.

2. To determine the specific rotation of sugar solution using Polarimeter.

3. To analyze elliptically polarized Light by using a Babinet's compensator.

4. To study dependence of radiation on angle for a simple Dipole antenna.

5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil,

Xylene, etc.) by studying the diffraction through ultrasonic grating.

6. To study the reflection, refraction of microwaves.

7. To study Polarization and double slit interference in microwaves.

8. To determine the refractive index of liquid by total internal reflection using Wollaston's airfilm.

9. To determine the refractive Index of (1) glass and (2) a liquid by total internal reflection

using a Gaussian eyepiece.

10. To study the polarization of light by reflection and determine the polarizing angle for airglass interface.

11. To verify the Stefan`s law of radiation and to determine Stefan's constant.

12. To determine the Boltzmann constant using V-I characteristics of PN junction diode.

Reference Books:

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

Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

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

Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Conduct of Experiment**	**Lab Record/Viva Voce**	**Attendance**	**End Term Examination**
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire fundamental knowledge of laboratory instruments and their uses.	PO1& PO2
CO2	Better insight about data collection techniques.	PO6
CO3	Better understanding of data interpretation and error analysis.	PO6
CO4	Acquire knowledge about the techniques related data analysis and curve fitting	PO7 & PO8

		Acquire fundamental understanding and conceptual knowledge of physics.	Understand and application of basic concepts of physics.	Link Physics with related disciplines.	Acquire procedural knowledge for professional subjects.	Develop skills in related field of specialization.	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling.	Develop skills in performing analysis and interpretation of data.	Develop Technical Communication and ICT skills.	Demonstrate professional behaviour with respect to attributes like objectivity, ethical values, self – reading etc.	: Acquire a fundamental, systematic or coherent understanding of the academic field of Physics.	Acquire procedural knowledge that creates different types of professional related to the disciplinary area of Physics.	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS1	PS2	PS3	PS4
BSPH352A	Electromagnetic Theory Lab	3	3				3	3	3			3	1		3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1									3			
CO2			1			3	1						1		1
CO3						3	1	3							1
CO4								3							1
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH304A	Statistical Mechanics	L	T	P	C
Version 1.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

To make them learn about the classical statistics and its applications.

To enable them to use classical theory of radiation to solve some problems of physics.

To give knowledge of quantum theory of radiation.

To impart knowledge about Bose Einstein statistics and Fermi Dirac statistics.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Apply concepts of classical statistics in solving problems of interest to physicists.

CO2. Better understand classical theory of radiation.

CO3. Understand use of quantum theory of radiation.

CO4. Solve equations encountered in Physics and Engineering using Bose Einstein statistics and Fermi Dirac statistics.

Catalog Description

This course imparts the basic concepts of classical statistics and its applications. It enables them to use classical theory of radiation to solve some problems of physics. This course give knowledge of quantum theory of radiation. The course introduces the basic concepts about Bose Einstein statistics and Fermi Dirac statistics.

Course Content

UNIT-I **15 Lecture Hours**

Classical Statistics: Macrostate & Microstate, Elementary Concept of Ensemble, PhaseSpace, Entropy and Thermodynamic Probability, Maxwell-Boltzmann Distribution Law, Partition Function, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression, Gibbs Paradox, Sackur Tetrode equation, Law of Equipartition of Energy (with proof) – Applications to Specific Heat and its Limitations, Thermodynamic Functions of a Two-Energy Levels System, Negative Temperature. (18 Lectures)

UNIT-II **15 Lecture Hours**

Classical Theory of Radiation: Properties of Thermal Radiation. Blackbody Radiation.Pure temperature dependence. Kirchhoff's law. Stefan-Boltzmann law: Thermodynamic proof. Radiation Pressure. Wien's Displacement law. Wien's Distribution Law. Saha's Ionization Formula. Rayleigh-Jean's Law. Ultraviolet Catastrophe. (9 Lectures)

UNIT-III **10 Lecture Hours**

Quantum Theory of Radiation: Spectral Distribution of Black Body Radiation.Planck's Quantum Postulates. Planck's Law of Blackbody Radiation: Experimental Verification. Deduction of (1) Wien's Distribution Law, (2) Rayleigh-Jeans Law, (3) Stefan-Boltzmann Law, (4) Wien's Displacement law from Planck's law. (5 Lectures)

UNIT-IV **20 Lecture Hours**

Bose-Einstein Statistics: B-E distribution law, Thermodynamic functions of a strongly Degenerate Bose Gas, Bose Einstein condensation, properties of liquid He (qualitative description), Radiation as a photon gas and Thermodynamic functions of photon gas. Bose derivation of Planck's law. (13 Lectures)

Fermi-Dirac Statistics: Fermi-Dirac Distribution Law, Thermodynamic functions of a Completely and strongly Degenerate Fermi Gas, Fermi Energy, Electron gas in a Metal, Specific Heat of Metals, Relativistic Fermi gas, White Dwarf Stars, Chandrasekhar Mass Limit. (15 Lectures)

Reference Books:

Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.

Statistical Physics, Berkeley Physics Course, F. Reif, 2008, Tata McGraw-Hill

Statistical and Thermal Physics, S. Lokanathan and R.S. Gambhir. 1991, Prentice Hall

Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.

Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer

An Introduction to Statistical Mechanics & Thermodynamics, R.H. Swendsen, 2012, Oxford Univ. Press

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply concepts of classical statistics in solving problems of interest to physicists.	PO1
CO2	Better understand classical theory of radiation.	PO4
CO3	Understand use of quantum theory of radiation.	PO5
CO4	Solve equations encountered in Physics and Engineering using Bose Einstein statistics and Fermi Dirac statistics.	PO2

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-304A	Statistical Mechanics			3				3	3						3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3										3			
CO2	3	3										3			
CO3	3	3										3			
CO4	3	3	2			2									1
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH354A	Statistical Mechanics Lab	L	T	P	C
Version 1.0		0	0	4	2
Total Contact Hours	30				
Pre-requisites/Exposure	Computer programming				
Co-requisites					

Course Objectives

To make them learn about the classical statistics and its applications.

To enable them to use classical theory of radiation to solve some problems of physics.

To give knowledge of quantum theory of radiation.

To impart knowledge about Bose Einstein statistics and Fermi Dirac statistics.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Apply concepts of classical statistics in solving problems of interest to physicists.

CO2. Better understand classical theory of radiation.

CO3. Understand use of quantum theory of radiation.

CO4. Solve equations encountered in Physics and Engineering using Bose Einstein statistics and Fermi Dirac statistics.

Catalog Description

This course imparts the basic concepts of classical statistics and its applications. It enables them to use classical theory of radiation to solve some problems of physics. This course give knowledge of quantum theory of radiation. The course introduces the basic concepts about Bose Einstein statistics and Fermi Dirac statistics.

Course Content

Use C/C++/Scilab/other numerical simulations for solving the problems based on Statistical Mechanics like:

1. Computational analysis of the behavior of a collection of particles in a box that satisfy Newtonian mechanics and interact via the Lennard-Jones potential, varying the total number of particles N and the initial conditions:

a) Study of local number density in the equilibrium state (i) average; (ii) fluctuations.

b) Study of transient behavior of the system (approach to equilibrium).

c) Relationship of large N and the arrow of time.

d) Computation of the velocity distribution of particles for the system and comparison with the Maxwell velocity distribution.

e) Computation and study of mean molecular speed and its dependence on particle mass.

f) Computation of fraction of molecules in an ideal gas having speed near the most probable speed.

2. Computation of the partition function $Z(\beta)$ for examples of systems with a finite number of single particle levels (e.g., 2 level, 3 level, etc.) and a finite number of non-interacting particles N under Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics:

a) Study of how $Z(\beta)$, average energy $<E>$, energy fluctuation ΔE, specific heat at constant volume Cv, depend upon the temperature, total number of particles N and the spectrum of single particle states.

b) Ratios of occupation numbers of various states for the systems considered above

c) Computation of physical quantities at large and small temperature T and comparison of various statistics at large and small temperature T.

3. Plot Planck's law for Black Body radiation and compare it with Raleigh-Jeans Law at high temperature and low temperature.

4. Plot Specific Heat of Solids (a) Dulong-Petit law, (b) Einstein distribution function, (c) Debye distribution function for high temperature and low temperature and compare them for these two cases.

5. Plot the following functions with energy at different temperatures

a) Maxwell-Boltzmann distribution

b) Fermi-Dirac distribution

c) Bose-Einstein distribution

Reference Books:

Elementary Numerical Analysis, K.E.Atkinson, 3 r d E d n . 2 0 0 7, Wiley India Edition

Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.

Introduction to Modern Statistical Mechanics, D. Chandler, Oxford University Press, 1987

Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.

Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer

Statistical and Thermal Physics with computer applications, Harvey Gould and Jan Tobochnik, Princeton University Press, 2010.

Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientificand Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014Springer ISBN: 978-3319067896Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444

Scilab Image Processing: L.M.Surhone. 2010, Betascript Pub., ISBN: 978 6133459274

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Conduct of Experiment**	**Lab Record/Viva Voce**	**Attendance**	**End Term Examination**
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply concepts of classical statistics in solving problems of interest to physicists.	PO1
CO2	Better understand classical theory of radiation.	PO4
CO3	Understand use of quantum theory of radiation.	PO5
CO4	Solve equations encountered in Physics and Engineering using Bose Einstein statistics and Fermi Dirac statistics.	PO2

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-354A	Statistical Mechanics Lab			3				3	3						3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
CO1						2									
CO2		3	3												
CO3		3	3												
CO4		3			1	2	3	3							3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH306A	Applied Optics	L	T	P	C
Version 1.0		2	2	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Waves and Optics				
Co-requisites	Electromagnetic Theory				

Course Objectives

To prepare the students to have basic ideas in.Applied Optics.

To introduce advance level experiments in the area of Fourier Optics, Fibre Optics, Lasers and holography.

To understand the working mechanism of various Laser systems and detectors.

To acquire knowledge of application areas of Fourier Optics and Fibre Optics.

Course Outcomes

On completion of this course, the students will be able to

CO1. Get familiar with the laboratory experimental set ups related to Applied Optics.

CO2. Acquire the knowledge of fundamentals of Fourier Optics, Fibre Optics and Holography.

CO 3. Understand the working of Lasers and other detectors such as LDR, LED, photodiode and IR sensor.

CO4. Recognize the applications of Fourier Optics, Fibre Optics and Holography in real world.

Catalog Description

This laboratory introduces the students to advanced level experiments in optics in the area of Fourier Optics, Lasers and detectors, Fibre Optics and Holography. Students are also exposed to optical sources, detector and measurement of various physical parameters using optical techniques.

Course Content

Theory includes only qualitative explanation. Minimum five experiments should be performed covering minimum three sections.

(i) Sources and Detectors (15 Lectures)

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

Experiments on Lasers:

a. Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid state laser.

b. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid state laser.

c. To find the polarization angle of laser light using polarizer and analyzer

d. Thermal expansion of quartz using laser

Experiments on Semiconductor Sources and Detectors:

a. V-I characteristics of LED

b. Study the characteristics of solid state laser

c. Study the characteristics of LDR

d. Photovoltaic Cell

e. Characteristics of IR sensor

(ii) Fourier Optics (15 Lectures)

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens

Experiments on Fourier Optics:

a. Fourier optic and image processing

1. Optical image addition/subtraction

2. Optical image differentiation

3. Fourier optical filtering

4. Construction of an optical 4f system

b. Fourier Transform Spectroscopy

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science.

Experiment:

To study the interference pattern from a Michelson interferometer as a function of mirror separation in the interferometer. The resulting interferogram is the Fourier transform of the power spectrum of the source. Analysis of experimental interferograms allows one to determine the transmission characteristics of several interference filters. Computer simulation can also be done.

(iii) Holography (15 Lectures)

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy, interferometry, and character recognition

Experiments on Holography and interferometry:

1. Recording and reconstructing holograms

2. Constructing a Michelson interferometer or a Fabry Perot interferometer

3. Measuring the refractive index of air

4. Constructing a Sagnac interferometer

5. Constructing a Mach-Zehnder interferometer

6. White light Hologram

(iv) Photonics: Fibre Optics (15 Lectures)

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

Experiments on Photonics: Fibre Optics

a. To measure the numerical aperture of an optical fibre

b. To study the variation of the bending loss in a multimode fibre

c. To determine the mode field diameter (MFD) of fundamental mode in a single-mode fibre by

measurements of its far field Gaussian pattern

d. To measure the near field intensity profile of a fibre and study its refractive index profile

e. To determine the power loss at a splice between two multimode fibre.

Reference Books:

Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.

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

Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.

Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer.

Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.

Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.

Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4th Edn., 1996, Cambridge Univ. Press

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Get familiar with the laboratory experimental set ups related to Applied Optics.	PO6, PO8
CO2	Acquire the knowledge of fundamentals of Fourier Optics, Fibre Optics and Holography.	PO1, PO2
CO3	Understand the working of Lasers and other detectors such as LDR, LED, photodiode and IR sensor.	PO8
CO4	Recognize the applications of Fourier Optics, Fibre Optics and Holography in real world.	PO2, PO6

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH-306A	Applied Optics	3	3				3		3					2	2

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1			1			3		3						3	3
CO2	3	3										2			
CO3	3	3						3				2			
CO4	3	3				3									3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

BSPH308A	Physics of Earth	L	T	P	C
Version 1.0		5	1	0	6
Total Contact Hours	90				
Pre-requisites/Exposure	Basic knowledge of origin of life and universe				
Co-requisites	--				

Course Objectives

To acquire the holistic understanding of planet earth.

To understand the structure and formation of earth and its atmosphere.

To comprehend the dynamical processes governing earth.

To gain the insight of evolution and origin of life on earth as well as the factors disturbing the survival on planet.

Course Outcomes

On completion of this course, the students will be able to

CO1. The students will be able learn about universe-galaxies, solar system and cosmic background.

CO2. Enable students to know the structure of earth and the four components- hydrosphere, atmosphere, cryosphere and biosphere.

CO3. Understanding the dynamical processes taking place on earth and also the detailed view of weather and climatic changes.

CO4. Understand origin of life on earth, Introduction to the geology and geomorphology of Indian subcontinent as well as the disturbing elements for the planet.

Catalog Description

This course imparts the understanding of main aspects of the origin of earth, components of universe-galaxies and solar system. It assesses the dynamical processes –cyclones, earthquake, Tsunami, weather and climatic changes as well as the different cycles of Biosphere. It coherently introduces the geology and geomorphology of Indian subcontinent, time line of major geological and biological events and future of evolution of the Earth and solar system: death of the Earth. The course also discusses about the effect of population growth and other human activities degrading the planet for future existence.

Course Content

Unit I The Earth and the Universe: 15 Lecture Hours

Origin of universe, creation of elements and earth. A Holistic understanding of our dynamic planet through Astronomy, Geology, Meteorology and Oceanography. Introduction to various branches of Earth Sciences. (b) General characteristics and origin of the Universe. The Milky Way galaxy, solar system, Earth's orbit and spin, the Moon's orbit and spin. The terrestrial and Jovian planets. Meteorites & Asteroids. Earth in the Solar system, origin, size, shape, mass, density, rotational and revolution parameters and its age. (c) Energy and particle fluxes incident on the Earth. (d) The Cosmic Microwave Background.

Structure:

The Solid Earth: Mass, dimensions, shape and topography, internal structure, magnetic field, geothermal energy. How do we learn about Earth's interior? (b) The Hydrosphere: The oceans, their extent, depth, volume, chemical composition. River systems. (c) The Atmosphere: variation of temperature, density and composition with altitude, clouds. (d) The Cryosphere: Polar caps and ice sheets. Mountain glaciers. (e) The Biosphere: Plants and animals. Chemical composition, mass. Marine and land organisms.

Unit II Dynamical Processes: 25 Lecture Hours

(a) The Solid Earth: Origin of the magnetic field. Source of geothermal energy. Convection in Earth's core and production of its magnetic field. Mechanical layering of the Earth. Introduction to geophysical methods of earth investigations. Concept of plate tectonics; seafloor spreading and continental drift. Geodynamic elements of Earth: Mid Oceanic Ridges, trenches, transform faults and island arcs. Origin of oceans, continents, mountains and rift valleys. Earthquake and earthquake belts. Volcanoes: types. (b) The Hydrosphere: Ocean circulations. Oceanic current system and effect of coriolis forces. Concepts of air-sea interaction; wave erosion and beach processes-Tides. Tsunamis. (c) The Atmosphere: Atmospheric circulation. Weather and climatic changes. Earth's heat budget. Cyclones. Climate: i. Earth's temperature and greenhouse effect. ii. Paleoclimate and recent climate changes. iii. The Indian monsoon system. (d) Biosphere: Water cycle, Carbon cycle, Nitrogen cycle, Phosphorous cycle. The role of cycles in maintaining a steady state.

Unit III Evolution: 10 Lecture Hours

Nature of stratigraphic records, Standard stratigraphic time scale and introduction to the concept of time in geological studies. Introduction to geochronological methods in their application in geological studies. History of development in concepts of uniformitarianism, catastrophism and neptunism. Law of superposition and faunal succession. Introduction to the geology and geomorphology of Indian subcontinent. 1. Time line of major geological and biological events. 2. Origin of life on Earth. 3. Role of the biosphere in shaping the environment. 4. Future of evolution of the Earth and solar system: Death of the Earth. (18 Lectures)

Unit IV Disturbing the Earth – Contemporary dilemmas **10 Lecture Hours**

(a) Human population growth. (b) Atmosphere: Green house gas emissions, climate change, air pollution. (c) Hydrosphere: Fresh water depletion. (d) Geosphere: Chemical effluents, nuclear waste. (e) Biosphere: Biodiversity loss. Deforestation. Robustness and fragility of ecosystems.

Reference Books

Planetary Surface Processes, H. Jay Melosh, Cambridge University Press, 2011.

Consider a Spherical Cow: A course in environmental problem solving, John Harte. University Science Books

Holme's Principles of Physical Geology. 1992. Chapman & Hall.

Emiliani, C, 1992. Planet Earth, Cosmology, Geology and the Evolution of Life and Environment. Cambridge University Press.

Modes of Evaluation: Quiz/ Presentation OR Assignments etc./ Mid Term Exam/ Attendance/ End Term Exam

Examination Scheme:

Components	**Quiz**	**Presentation OR Assignments/ etc.**	**Mid Term Exam**	**Attendance**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	The students will be able learn about universe-galaxies, solar system and cosmic background.	PO1
CO2	Enable students to know the structure of earth and the four components- hydrosphere, atmosphere, cryosphere and biosphere.	PO2
CO3	Understanding the dynamical processes taking place on earth and also the detailed view of weather and climatic changes.	PO6
CO4	Understand origin of life on earth, Introduction to the geology and geomorphology of Indian subcontinent as well as the disturbing elements for the planet.	PO3

		Acquire fundamental understanding and conceptualo knowledge of physics	Understand and application of basic concepts of Physics	Link Physics with related disciplines	Acquire procedural knowledge for professional subjects	Develop skills in related field of specialization	Develop investigative skills and problem solving approach	Develop skills in Mathematical modeling	Develop skills in performing analysis and interpretation of data.	Develop technical Communication and ICT skills	Demonstrate professional behavior with respect to attributes like objectivity, ethical values, self-reading etc. +	Acquire a fundamental, systematic or coherent understanding of the academic field of Physics	Acquire procedural knowledge that creates different types of professional understanding related to the disciplinary area of Physics	Acquire skills in areas related to one's specialization area within the disciplinary area of Physics and current and emerging development in the field of Physics.	Demonstrate the ability to use skills in Physics and its related areas of technology.
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH308A	Physics of Earth	3	2	3			3								

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2									1			
CO2	1	2	2									1			
CO3	1	2	2									1			
CO4	1	2	2									1			

1=lightly mapped 2= moderately mapped 3=strongly mapped

BSPH356A	Dissertation	L	T	P	C
Version 1.0		0	0	0	6
Pre-requisites/Exposure	Practical exposure				
Co-requisites	--				

Course Objectives

To learn how to carry out literature survey

To be associated with an area of research/research project and contribute towards domain knowledge.

To learn the art of technical report writing

To learn the art of verbal communication with the help of modern presentation techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Carry out the extensive literature survey.

C02. Learn to write and present technical reports/articles.

CO3. Learn to analyze various methods and techniques applicable to the topic to study and contribute to domain knowledge.

CO4. Learn to analyze/evaluate the result of the experiment carried out and present the results using data visualization methods.

Catalog Description

1. Students will be divided among faculty members of the Department for the supervision of the research work.

2. In the first week of Semester VI, each faculty member will assign a suitable research topic to the students from the selected topics in the areas of chemical sciences.

3. The student will work on the assigned research topic during semester VI in regular consultation with his/her assigned teacher.

4. The student will write a dissertation based on the research work carried out during Semester VI and prepare two copies to be submitted to the office of the Head of the Department duly signed by the student and the supervisor in the sixth week of VI semester or a date decided by the HOD of the department.

5. Before preparing power point presentation and submission of dissertation, each student has to deliver a seminar talk on his/ her research project work on a date fixed by HOD, necessary suggestions has to be incorporated in the final draft of dissertation.

6. The student will make a power point presentation based on the work carried out and mentioned in the dissertation to the board of examiners appointed by the University.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Internal (Interaction of Student with Supervisor)	External			Total
		Relevance of topic (20)	Presentation (20)	viva (10)	100
Weightage (%)	50	20	20	10	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Carry out the extensive literature survey.	PO1, PO2, PO3, PO4, PO6, PSO1, PSO2 PSO4
CO2	Learn to write and present technical reports/articles.	PO1, PO2, PO3, PO4, PO6, PO10, PSO1, PSO3 PSO4
CO3	Learn to analyze various methods and techniques applicable to the topic to study and contribute to domain knowledge.	PO1, PO5, PO6, PO7, PO8, PO10 PSO2, PSO3 PSO4
CO4	Learn to analyze/evaluate the result of the experiment carried out and present the results using data visualization methods.	PO6, PO7, PO8, PO9 PO10, PSO1, PSO2 PSO3 PSO4

		Enhancement in Advanced Scientific knowledge about chemistry	Development of critical, logical and innovative thinking	Demonstrate interdisciplinary approach	Learning of fundamental concepts and instrumentation techniques	Orientation towards research and development	Acquiring capability to work independently as well as a member of the diverse team	Understanding of impact of chemicals on the environment	Fostering communication skills	Ethical awareness and digital literacy	Capability to deal with professional responsibilities	Systematic and coherent understanding of theoretical and practical concepts	Appreciate the techniques for the qualitative and quantitative analysis	Learn problem solving approach	Apply principles ofchemistry to address societal problems
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO 3	PSO4
BSPH 356A	Dissertation	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO1	PSO 2	PSO3	PSO4
CO1	3		3								2		1	
CO2	3				3			3	3			3		
CO3		3	3	3		3				3	3			3
CO4					3	3	3	3	3	3	1	2	3	3
	1=lightly mapped 2= moderately mapped 3=strongly mapped													

BSMA274A	Introduction to LaTeX	L	T	P	C
Version 1.0		0	0	2	1
Total Contact Hours	15				
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

The objective of the course is

To learn about a document preparation system for high-quality typesetting

To learn typesetting of complex mathematical formulas

Course Outcomes

On completion of this course, the students will be able to

CO1. Typesetting journal articles, technical reports, books, and slide presentations.

CO2. Control over large documents containing sectioning, cross-references

CO3. Automatic generation of bibliographies and indexes

Catalog Description

The course aims to introduce students to LaTeX - a high quality open-source typesetting software. LaTeX is most commonly used for medium to large technical or scientific documents, but can be used for almost any type of publication. The course will, therefore, enable students to type a report, article, or mathematical document.

Course Content

ntroduction to LaTeX, Benefits and comparison with word processor, Installing LaTeX, Formatting lines and paragraph, Typesetting a simple document, Text alignment, installing packagesCreating Lists, Typing Math Formulas, Environments – equations, arrays, matrices, Footnotes, Fonts, Title and headers, Sectioning, Listing references, Math styles – cases, braces, math symbols. Graphics in LaTeX, Inserting Tables and Figures, Simple pictures using PSTricks, Sample article and report, Beamer presentation, Sample presentation, Using online resources

Text Books

David F. Griffiths, Desmond J. Higham, Learning LaTeX, Society for Industrial and Applied Mathematics(SIAM), 2016.

Stefan Kottwitz , LaTeX Beginner's Guide. Packt Publishing, Birmingham, UK, 2011.

Lamport, Leslie, LaTeX: A Document Preparation System, User's Guide and Reference Manual (2nd ed.). Addison-Wesley, 1994.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Typesetting journal articles, technical reports, books, and slide presentations.	PO1
CO2	Control over large documents containing sectioning, cross-references	PO1,PSO1
CO3	Automatic generation of bibliographies and indexes	PO1, PO5

	Enhancement in Advanced Scientific knowledge about chemistry	Development of critical, logical and innovative thinking	Demonstrate interdisciplinary approach	Learning of fundamental concepts and instrumentation techniques	Orientation towards research and development	Acquiring capability to work independently as well as a member of the diverse team	Understanding of impact of chemicals on the environment	Fostering communication skills	Ethical awareness and digital literacy	Capability to deal with professional responsibilities	Systematic and coherent understanding of theoretical and practical concepts	Appreciate the techniques for the qualitative and quantitative analysis	Learn problem solving approach	Apply principles ofchemistry to address societal problems
Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
Introduction to LaTeX	3				2						2			

1=weakly mapped

2=moderately mapped

3=strongly mapped

Programme and Course Mapping																
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PSO 1	PSO 2	PSO3	PSO4	PSO5	PSO6
CO1									3	3		3	2	1	1	2	2
CO2					2							3	2	1	1	2	2
CO3									3	3		3	2	1	1	2	2
1=lightly mapped 2= moderately mapped 3=strongly mapped																	

ETCS109A	Data Analysis and Visualization	L	T	P	C
Version 1.0		2	0	0	2
Total Contact Hours	30				
Pre-requisites/Exposure	Basics of Python				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the concepts of Python Programming Language with Libraries.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Remember the features and characteristics of different Python libraries and modules.

CO2. Understand fundamental concepts and syntax of the Python programming language.

CO3. Apply Python programming concepts to solve simple programming problems.

CO4. Analyze data structures and algorithms to optimize code efficiency and performance.

CO5. Evaluate the effectiveness and suitability of different libraries for specific programming tasks.

CO6. Create Python programs to solve real-world problems

Catalog Description

Data Analysis with Python is for everyone who would like to create meaningful insight out of the data with the power of Numpy, Pandas, Matplotlib& Seaborn. The course has the right recipe to equip student with the right set of skill to ingest, clean, merge, manipulate, transform and finally visualize the data to create the meaning out of the data at hand.

Course Content

UNIT – I **20 Lecture Hours**

NumPy: Array and vectorized computation: Multidimensional array object. Creating ndarrays, arithmetic with numpy array, basic indexing and slicing, Boolean indexing, transposing array and swapping axes, universal functions, array-oriented programming with arrays, conditional logic as arrays operations, file input and output with array

UNIT –II **20 Lecture Hours**

Pandas: Pandas data structure, series, DataFrame, Index Object, Reindexing, dropping entities from an axis, indexing, selection and filtering, integer indexes, arithmetic and data alignment, function application and mapping, soring and ranking, correlation and covariance, unique values, values controls and membership, reading and writing data in text format

UNIT –III **10 Lecture Hours**

Visualization with Matplotlib: Figures and subplots, colors, markers, line style, ticks, labels, legends, annotation and drawing on sublots, matplotlib configuration

UNIT –IV **10 Lecture Hours**

Plotting with pandas and seaborn: line plots, bar plots, histogram, density plots, scatter and point plots, facet grids and categorical data

Text Books

1.Fabio Nelli, Python Data Analytics 2nd Edition, Apress.

Reference Books/Materials

1. Python for Data Analysis: A Complete Beginner Guide for Python basics, Numpy, Pandas, Seaborn, Bokeh and Matplotlib for Data Analysis, AI Publishing LLC.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz/Assignment**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Remember the features and characteristics of different Python libraries and modules.	PO2
CO2	Understand fundamental concepts and syntax of the Python programming language.	PO3
CO3	Apply Python programming concepts to solve simple programming problems.	PO4
CO4	Analyze data structures and algorithms to optimize code efficiency and performance.	PO2
CO5	Evaluate the effectiveness and suitability of different libraries for specific programming tasks.	PO3
CO6	Create Python programs to solve real-world problems	PO4

		Enhancement in Advanced Scientific knowledge about chemistry	Development of critical, logical and innovative thinking	Demonstrate interdisciplinary approach	Learning of fundamental concepts and instrumentation techniques	Orientation towards research and development	Acquiring capability to work independently as well as a member of the diverse team	Understanding of impact of chemicals on the environment	Fostering communication skills	Ethical awareness and digital literacy	Capability to deal with professional responsibilities	Systematic and coherent understanding of theoretical and practical concepts	Appreciate the techniques for the qualitative and quantitative analysis	Learn problem solving approach	Apply principles ofchemistry to address societal problems
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
ETCS 109A	Data Analysis and Visualization		3	2	3							3		3	

1=weakly mapped; 2= moderately mapped; 3=strongly mapped

	Programme and Course Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PSO 1	PSO 2	PSO3	PSO4
CO1		3													
CO2			3												
CO3				3											
	1=lightly mapped			2= moderately mapped				3=strongly mapped							

ETCS159A	Data Analysis and Visualization Lab	L	T	P	C
Version 1.0		-	-	2	1
Total Contact Hours	15				
Pre-requisites/Exposure	Basics of Python				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the concepts of Python Programming Language with Libraries.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Practical understanding of data analysis with Python package like NumPy and Pandas.

CO2. Implementation of visualization tool (matplotlib and seaborn) so that one will be able to visualize and make correct decision based on the data.

CO3. To practice with real life data to feel confident of the topic and be able to ready to work on data analysis project or interview.

Catalog Description

This course complements ETCS109A. It enables them to write algorithms/programs for implementing python libraries such as NumPy, Pandas, Seaborn etc. The list of experiments helps organizing the data in variety of ways using python and to solve the given problem efficiently.

Course Content

The list of experiments will be based upon syllabus of ETCS109A.

Text Books

1.Fabio Nelli, Python Data Analytics 2nd Edition, Apress.

Reference Books/Materials

Python for Data Analysis: A Complete Beginner Guide for Python basics, Numpy, Pandas, Seaborn, Bokeh and Matplotlib for Data Analysis, AI Publishing LLC.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Conduct of Experiment**	**Lab Record/Quizzes/ Viva-Voce**	**Attendance**	**End Term PracticalExamination**
Weightage (%)	20	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Theoretical and practical understanding of data analysis with Python package like NumPy and Pandas.	PO2
CO2	The knowledge of visualization tool (matplotlib and seaborn) so that one will be able to visualize and make correct decision based on the data.	PO3
CO3	To practice with real life data to feel confident of the topic and be able to ready to work on data analysis project or interview,	PO4

		Enhancement in Advanced Scientific knowledge about chemistry	Development of critical, logical and innovative thinking	Demonstrate interdisciplinary approach	Learning of fundamental concepts and instrumentation techniques	Orientation towards research and development	Acquiring capability to work independently as well as a member of the diverse team	Understanding of impact of chemicals on the environment	Fostering communication skills	Ethical awareness and digital literacy	Capability to deal with professional responsibilities	Systematic and coherent understanding of theoretical and practical concepts	Appreciate the techniques for the qualitative and quantitative analysis	Learn problem solving approach	Apply principles ofchemistry to address societal problems
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
ETCS 159A	Data Analysis and Visualization Lab		3	2	3							3		3	

1=weakly mapped; 2= moderately mapped; 3=strongly mapped

	Programme and Course Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PSO 1	PSO 2	PSO3	PSO4
CO1		3													
CO2			3												
CO3				3											
	1=lightly mapped			2= moderately mapped			3=strongly mapped								

BSPH218A	INTERNSHIP IN PHYSICS	L	T	P	C
Version 1.0		0	0	0	2
Total Contact Hours	30				
Pre-requisites/Exposure	Practical exposure				
Co-requisites	--				

Course Objectives

1. To learn how to carry out literature surveys on the assigned topic.
2. To be associated with an area of research/research project and contribute towards domain knowledge through hands on.
3. To learn the art of technical report writing.
4. To learn the art of verbal communication with the help of modern presentation techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Carry out the extensive literature survey on the topic assigned by academicians and industry experts.

CO2. Learn to write and present technical reports/articles.

CO3. Learn to analyze various methods and techniques applicable to the topic to study and contribute to domain knowledge.

CO4. Learn to analyze/evaluate the result of the experiment carried out and present the results using data visualization methods.

Catalog Description

1. In the end of Semester IV, students will be asked to join research/academic organizations or industries to get hands on knowledge on the selected topics.
2. The student will work on the assigned topic for 3-4 weeks in regular consultation with his/her assigned expert/guide.
3. The student will write a report based on the work carried out during internship and prepare two copies to be submitted to the office of the Head of the Department duly signed by the student and the expert.
4. The student will make a power point presentation based on the work carried out and mentioned in the report to the board of examiners appointed by the University in the fifth semester. The student will be evaluated based on a report and presentation.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Internal (Interaction of Student with Supervisor)	External			Total
		Relevance of topic (20)	Presentation (20)	viva (10)	100
Weightage (%)	50	20	20	10	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Carry out the extensive literature survey.	**PO1, PO3**
CO2	Learn to write and present technical reports/articles.	**PO1, PO5, PO8, PO9**
CO3	Learn to analyze various methods and techniques applicable to the topic to study and contribute to domain knowledge.	**PO2,PO3,PO4, PSO1, PSO4**
CO4	Learn to analyze/evaluate the result of the experiment carried out and present the results using data visualization methods.	**PO5, PO6,PSO2 and PSO3**

		Enhancement in Advanced Scientific knowledge about chemistry	Development of critical, logical and innovative thinking	Demonstrate interdisciplinary approach	Learning of fundamental concepts and instrumentation techniques	Orientation towards research and development	Acquiring capability to work independently as well as a member of the diverse team	Understanding of impact of chemicals on the environment	Fostering communication skills	Ethical awareness and digital literacy	Capability to deal with professional responsibilities	Systematic and coherent understanding of theoretical and practical concepts	Appreciate the techniques for the qualitative and quantitative analysis	Learn problem solving approach	Apply principles ofchemistry to address societal problems
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH 218A	Internship in Physics	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1=weakly mapped; 2= moderately mapped; 3=strongly mapped

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO1	PSO 2	PSO3	PSO4
CO1	3		3								2		1	
CO2	3				3			3	3			3		
CO3		3	3	3		3				3	3			3
CO4					3	3	3	3	3	3	1	2	3	3

1=lightly mapped 2= moderately mapped 3=strongly mapped

Unit	**Internship in Physics**
Local	-
Regional	-
National	-
Global	-
Employability	Choice Based Credit System having field projects / research projects / internships (1.3.4) Courses on employability/ entrepreneurship/ skill development (1.1.3); Student centric methods, such as experiential learning, participative learning and problem-solving methodologies (2.3.1)
Entrepreneurship	Entrepreneurship; Team work/ Creativity by designing research problem
Skill Development	Disciplinary knowledge; Research related skills; scientific skills,
Professional Ethics	-
Gender	-
Human Values	-
Environment & Sustainability	-
SDG	Equal Access to TVET and Higher Education (SDG 4.3), Quality Education and skills for employability 4.4
NEP	Higher Education System through scientific temper (9.1.1) India's Higher Education System through scientific temper (9.1.1)Towards a More Holistic and Multidisciplinary Education opportunitiesfor cross-disciplinary and interdisciplinary thinking (11.6); strong culture of research and knowledge creation (17.6) "
POE/4th IR	Employability, Project, Hands on Experience, Entrepreneurship; Teamwork

BSPH356A	DISSERTATION	L	T	P	C
Version 1.0		0	0	0	6
Total Contact Hours	90				
Pre-requisites/Exposure	Practical exposure				
Co-requisites	--				

Course Objectives

1. To learn how to carry out literature survey.
2. To be associated with an area of research/research project and contribute towards domain knowledge.
3. To learn the art of technical report writing
4. To learn the art of verbal communication with the help of modern presentation techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Carry out the extensive literature survey.

C02. Learn to write and present technical reports/articles.

CO3. Learn to analyze various methods and techniques applicable to the topic to study and contribute to domain knowledge.

CO4. Learn to analyze/evaluate the result of the experiment carried out and present the results using data visualization methods.

Catalog Description

1. Students will be divided among faculty members of the Department for the supervision of the research work.
2. In the first week of Semester VI, each faculty member will assign a suitable research topic to the students from the selected topics in the areas of chemical sciences.
3. The student will work on the assigned research topic during semester VI in regular consultation with his/her assigned teacher.
4. The student will write a dissertation based on the research work carried out during Semester VI and prepare two copies to be submitted to the office of the Head of the Department duly signed by the student and the supervisor in the sixth week of VI semester or a date decided by the HOD of the department.
5. Before preparing power point presentation and submission of dissertation, each student has to deliver a seminar talk on his/ her research project work on a date fixed by HOD, necessary suggestions has to be incorporated in the final draft of dissertation.
6. The student will make a power point presentation based on the work carried out and mentioned in the dissertation to the board of examiners appointed by the University.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Internal (Interaction of Student with Supervisor)	External			Total
		Relevance of topic (20)	Presentation (20)	viva (10)	100
Weightage (%)	50	20	20	10	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Carry out the extensive literature survey.	PO1, PO3
CO2	Learn to write and present technical reports/articles.	PO1, PO5, PO8, PO9
CO3	Learn to analyze various methods and techniques applicable to the topic to study and contribute to domain knowledge.	PO2,PO3,PO4, PSO1, PSO4
CO4	Learn to analyze/evaluate the result of the experiment carried out and present the results using data visualization methods.	PO5, PO6,PSO3.PSO3

		Enhancement in Advanced Scientific knowledge about chemistry	Development of critical, logical and innovative thinking	Demonstrate interdisciplinary approach	Learning of fundamental concepts and instrumentation techniques	Orientation towards research and development	Acquiring capability to work independently as well as a member of the diverse team	Understanding of impact of chemicals on the environment	Fostering communication skills	Ethical awareness and digital literacy	Capability to deal with professional responsibilities	Systematic and coherent understanding of theoretical and practical concepts	Appreciate the techniques for the qualitative and quantitative analysis	Learn problem solving approach	Apply principles ofchemistry to address societal problems
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BSPH 356A	Dissertation	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO1	PSO 2	PSO3	PSO4
CO1	3		3								2		1	
CO2	3				3			3	3			3		
CO3		3	3	3		3				3	3			3
CO4					3	3	3	3	3	3	1	2	3	3

1=lightly mapped 2= moderately mapped 3=strongly mapped

Unit	**Dissertation**
Local	-
Regional	-
National	-
Global	-
Employability	Choice Based Credit System having field projects / research projects / internships (1.3.4) Courses on employability/ entrepreneurship/ skill development (1.1.3); Student centric methods, such as experiential learning, participative learning and problem-solving methodologies (2.3.1)
Entrepreneurship	Entrepreneurship; Team work/ Creativity by designing research problem
Skill Development	Disciplinary knowledge; Research related skills; scientific skills,
Professional Ethics	-
Gender	-
Human Values	-
Environment & Sustainability	-
SDG	Equal Access to TVET and Higher Education (SDG 4.3), Quality Education and skills for employability 4.4
NEP	Higher Education System through scientific temper (9.1.1) India's Higher Education System through scientific temper (9.1.1)Towards a More Holistic and Multidisciplinary Education opportunities for cross-disciplinary and interdisciplinary thinking (11.6); strong culture of research and knowledge creation (17.6) "
POE/4th IR	Employability, Project, Hands on Experience, Entrepreneurship; Team work