Annexure-I

Course Structure with Syllabus for FYIMP Integrated B.Sc.-M.Sc. Physics

w.e.f. 06/05/2025

DEPARTMENT OF PHYSICS

UNIVERSITY OF KASHMIR

KUPWARA CAMPUS, J&K, INDIA-193222

Course Structure for FYIMP Integrated B.Sc.-M.Sc. Physics.

SEMESTER-I						
S. NO.	COURSE TYPE	COURSE CODE	TITLE OF COURSE	CREDITS		
				Theory	Practical	Tutorial
1.	Major	IPHYMJME0125	Mechanics	04	02	
2.	Minor	IXXXMNCL0125	Calculus-I	04		
3.	MDC	IXXXMDIT0023	Information Technology (Basic Computing)	03		
4.	AEC	IXXXAECS0023	Communication Skills	03		
5.	VAC	IXXXVAHW0023	Health and Wellness	02		
6.	VAC	IXXXVAES0023	Environmental Science Education	02		
7.	SEC	IXXXSEPC0123	Programming with C	02	02	
	TOTAL CREDITS			24		

SEMESTER-II						
S. NO.	COURSE TYPE	COURSE CODE	TITLE OF COURSE	CREDITS		
				Theory	Practical	Tutorial
1.	Major	IPHYMJEM0225	Electricity & Magnetism	04	02	
2.	Minor	IXXXMNCL0225	Calculus-II	04		
3.	MDC	IXXXMDGL0023	Geology (Physical Geology)	03		
4.	AEC	IXXXAEEL0023	English Language	03		
5.	VAC	IXXXVADT0023	Digital & Technological Solutions	02		
6.	VAC	IXXXVAUI0023	Understanding India	02		
7.	SEC	IXXXSEPP0223	Programming with Python	02	02	
	TOTAL CREDITS			24		

SEMESTER-III						
S. NO.	COURSE TYPE	COURSE CODE	TITLE OF COURSE	CREDITS		
				Theory	Practical	Tutorial
1.	Major	IPHYMJOW0325	Oscillations and Waves	03	01	
2.	Major	IPHYMJTD0325	Thermodynamics	03	01	
3.	Minor	IXXXMNDE0325	Differential Equations	04		
4.	MDC	IXXXMDCH0023	Chemistry (Food Adulteration)	03		
5.	AEC	IXXXAEAL0023	Arabic Language	03		
6.	SEC	IXXXSEAP0323	Advanced Programming with Python	02	02	
	TOTAL CREDITS			22		

SEMESTER-IV						
S. NO.	COURSE TYPE	COURSE CODE	TITLE OF COURSE	CREDITS		
				Theory	Practical	Tutorial
1.	Major	IPHYMJMP0425	Modern Physics	04		
2.	Major	IPHYMJBE0425	Basic Electronics	04		
3.	Major	IPHYMJMA0425	Mathematical Physics-I	04		
4.	Major	IPHYMJLB0425	Laboratory Classes based on 1,2 & 3		04	
5.	Minor	IXXXMNPS0425	Plane and Solid Geometry	04		
	TOTAL CREDITS			20		

SEMESTER-V						
S. NO.	COURSE TYPE	COURSE CODE	TITLE OF COURSE	CREDITS		
				Theory	Practical	Tutorial
1.	Major	IPHYMJQM0525	Quantum Mechanics-I	04		
2.	Major	IPHYMJSP0525	Statistical Physics	04		
3.	Major	IPHYMJSS0525	Solid State Physics-I	04		
4.	Major	IPHYMJLB0525	Laboratory Classes based on 1,2 & 3		04	
5.	Minor	IXXXMNAL0525	Algebra	04		
	TOTAL CREDITS			20		

SEMESTER-VI						
S. NO.	COURSE TYPE	COURSE CODE	TITLE OF COURSE	CREDITS		
				Theory	Practical	Tutorial
1.	Major	IPHYMJOL0625	Optics and Lasers	04		
2.	Major	IPHYMJMA0625	Mathematical Physics-II	04		
3.	Major	IPHYMJIV0625	Internships/Projects with Viva Voce	03+01(Viva)		
4.	Major	IPHYMJLB0625	Laboratory Classes based on 1 & 2		04	
5.	Minor	IPHYMNNT0625	Numerical Techniques	04		
	TOTAL CREDITS			20		

SEMESTER-VII (Honors)						
S. NO.	COURSE TYPE	COURSE CODE	TITLE OF COURSE	CREDITS		
				Theory	Practical	Tutorial
1.	Major	IPHYMJCM0723	Classical Mechanics	04		
2.	Major	IPHYMJSS0723	Solid State Physics-II	04		
3	Major	IPHYMJQM0723	Quantum Mechanics-II	04		
4.	Major	IPHYMJED0723	Electrodynamics	04		
5.	Major	IPHYMJLB0723	Laboratory Classes based on 1, 2, 3 & 4		04	
	TOTAL CREDITS			20		

SEMESTER-VIII (Honors)						
S. NO.	COURSE TYPE	COURSE CODE	TITLE OF COURSE	CREDITS		
				Theory	Practical	Tutorial
1.	Major	IPHYMJHE0825	High Energy Physics	04		
2.	Major	IPHYMJAM0825	Atomic & molecular Physics	04		
3.	Major	IPHYMJNM0825	Nanomaterials & Applications	04		
4.	Major	IPHYMJNP0825	Nuclear Physics-II	04		
5.	Major	IPHYMJLB0825	Laboratory Classes based on 1, 2, 3& 4		04	
	TOTAL CREDITS			20		

SEMESTER-VII(Research)						
S. NO.	COURSE TYPE	COURSE CODE	TITLE OF COURSE	CREDITS		
				Theory	Practical	Tutorial
1.	Major	IPHYMJCM0725	Classical Mechanics	04		
2.	Major	IPHYMJSS0725	Solid State Physics-II	04		
3	Major	IPHYMJQM0725	Quantum Mechanics-II	04		
4.	Major	IPHYMJED0725	Electrodynamics-II	04		
5.	Major	IPHYMJLB0725	Laboratory Classes based on 1, 2, 3& 4		04	
	TOTAL CREDITS			20		

SEMESTER-VIII (Research)						
S. NO.	COURSE TYPE	COURSE CODE	TITLE OF COURSE	CREDITS		
				Theory	Practical	Tutorial
1.	Major	IPHYMJHE0825	High Energy Physics	04		
2.	Major	IPHYMJNM0825	Nanomaterials & Applications	04		
3.	Major	IPHYMJRM0825	Research Methodology	04		
4.	Major	IPHYMJPD0825	Project with Dissertation	08		
	TOTAL CREDITS			20		

Syllabus for FYIMP Integrated B.Sc.-M.Sc. Physics.

SEMESTER-I			
Course Code	IPHYMJME0125	**Course Title**	Mechanics
Credits	04	**Lectures**	64
Course Type	MAJOR	**Assessment Marks**	100 (72: Ext.+28 Int.)

COURSE OBJECTIVES:

- Introduce about the basics of vectors.
- To familiarize students with fundamental concepts and laws in motion.
- Familiarize about the frame of gravitations, relativity and dynamics of planets.

COURSE OUTCOMES:

Students will be able to articulate and describe.

- Basics of vector calculus prerequisite for the course.
- The concept of center of mass, linear momentum, impulse, and conservation laws; apply the work-energy theorem.
- Newtons laws of motion and conservation principles.
- Study of central force, Gravitation and Kepler's laws.
- Dynamics of rigid bodies including rotation, torque, moment of inertia, combined translation and rotation

COURSE CONTENTS:

UNIT-I

Vectors: Addition, scalar multiplication, basis vectors, dot and cross product of vectors, Derivative of a vector w.r.t a parameter (analytical and geometric), partial derivative, total derivative, gradient and operator ∇. Cartesian coordinates, plane polar coordinates. Velocity and acceleration, kinematical equations, Motion in plane polar coordinates: Velocity and acceleration in polar coordinates. Newton's First, Second and Third Law, Applications: contact forces, tension in a string, friction, viscosity, linear restoring force.

UNIT-II

Centre of Mass, Centre of mass for discrete and continuous bodies, Dynamics of system of particles. Momentum, Conservation of momentum, centre of mass coordinates, impulse, momentum and mass flow, momentum transport. Work Energy Theorem, Newton's second Law and concept of work, Work energy theorem in one and several dimensions, Applications of work energy theorem, Potential energy: Illustrations, Force and potential energy: stability, non-conservative forces.

UNIT-III

Collisions: Elastic and inelastic collisions, collisions in CM coordinates. Angular Momentum: Angular momentum of a particle, Torque, Fixed rotation axis, Dynamics of pure rotation, Physical pendulum, Combined Translation and Rotation: Work-Energy theorem.

UNIT-IV

Rigid Body Motion: angular velocity and momentum as vectors, conservation of angular momentum, angular momentum of rotating rigid body: The moment of inertia matrix, Principal axes, rotational kinetic energy, Finite and infinitesimal rotations. Central Force Motion, 1 body problem, general properties: palnar motion, law of equal areas, conserved quantities, the energy equation and energy diagrams, planetary motion, Kepler's Laws.

RECOMMENDED BOOKS:

1. Daniel Klepner, Robert J. Kolenkow: An Introduction to Mechanics, 2009, McGraw Hill Education.
2. B. L. Worshnop, H. T. Flint: Advanced Practical Physics for Students; 9E, 1950, Khosla Publishing House.
3. H. S. Hans, S. P. Puri: Mechanics, 2E, 1994, McGraw Hill.
4. I. E. Irodov: Fundamental Laws of Mechanics, 2004, CBS Publishers.
5. J. P. Den Hartog: Mechanics, 2007, Dover.

LABORATORY COURSE (CREDITS: 02)

LIST OF PRACTICALS

1. To measure the thickness of wires using vernier caliper and screw gauge.
2. To find the Moment of Inertia of a Flywheel.
3. To compare the moment of inertia (I) of a solid sphere of same mass using a torsion pendulum and hence to show that 'I' depends on the distribution of mass.
4. Study terminal velocity of spheres falling through viscous fluid.
5. To determine the co-efficient of viscosity of water by measuring its flow through a capillary tube of uniform bore.
6. Experimental verification of momentum conservation and kinetic energy, and evaluation of coefficient of restitution using hanging spheres.
7. Determine moment of inertia of different bodies using Torsional pendulum.
8. To determine the value of 'g' and velocity for a freely falling body using Digital Timing Technique.
9. To study the Motion of a Spring and calculate the value of (a) Spring Constant and (b) value of g.

RECOMMENDED BOOKS:

1. Advanced Practical Physics for students, B. L. Flint and H. T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted I 985, Heinemann Educational Publishers.
3. Practical Physics by C. L. Arora S. Chand & Company, New Delh

SEMESTER-I			
Course Code	IXXXMNCL0125	**Course Title**	Calculus-I
Credits	04	**Lectures**	64
Course Type	MINOR	**Assessment Marks**	100 (72: Ext.+28 Int.)

COURSE OBJECTIVES:

- To study and understand the notions of differential calculus and to imbibe the acquaintance for using the techniques in field of mathematics and physics.
- To prepare the students for taking up problems based on advanced physics and research.

COURSE OUTCOMES:

- Apply the formal definition of limits using the ε-δ approach and analyze continuity and types of discontinuities in real-valued functions.
- Compute derivatives of standard functions using rules of differentiation and apply L'Hospital's Rule to evaluate indeterminate forms.
- Use partial and total derivatives to analyze functions of two variables and apply Euler's theorem to homogeneous functions.
- Solve integrals using standard techniques such as substitution, integration by parts, and partial fractions.

COURSE CONTENTS:

UNIT-I

Brief review of real valued functions. Limit of a function, ϵ-δ definition of a limit, calculating limits using limit laws, continuity and types of discontinuities, limits at infinity, horizontal and vertical asymptote. Derivative of a function and differentiation. Geometric and physical interpretation of a derivative. The tangent and velocity problems.

UNIT-II

Derivative of polynomial and exponential functions, product and quotient rule, derivative of trigonometric functions, chain rule, implicit differentiation, derivatives of logarithmic functions. Higher-order derivatives. Indeterminate forms and L'Hospital's Rule.

UNIT-III

Brief review of functions of two variables, partial derivative and total derivative. Homogeneous function and Eulers theorem. Application of differentiation for finding Maximum and Minimum values of a function and increasing-decreasing function. The Mean Value Theorem. Concavity, Convexity and point of inflection. Intermediate value theorem. Taylors and Maclaurins expansion of functions.

UNIT-IV

Antiderivative and Indefinite integrals. Integration as reverse of differentiation. Integration by substitution and by parts, trigonometric substitution, integration of rational functions by partial fractions and special cases.

RECOMMENDED BOOKS:

1.Calculus – Early Transcendentals by James Stewart, 8th edition 2015.
2. Thomas, G. B., Weir, M. D., & Hass, J. Thomas' Calculus 11th edition, 2005, Addison-Wesley.
3.A First Course in Calculus - by Serge Lang, 5th edition, 1986, Springer.
4.Calculus – by Howard Anton 8th edition, 2005, Wiley.
5.Integral Calculus - by Hari Krishan, 2006, S. Chand Publishing.
6.Calculus I & II by Tom Apostol, 2nd edition, 1969, Wiley.

SEMESTER-I			
Course Code	IXXXMDIT0023	**Course Title**	Information Technology
Credits	03	**Lectures**	48
Course Type	MDC	**Assessment Marks**	75 (54: Ext.+21 Int.)

COURSE OBJECTIVES:

- To acquire the skill of trouble shooting whenever there are problems in the working of computer.
- To gain the experience of word processor and spreadsheets.

COURSE OUTCOMES:

- On completions of the course, the student will be able to Describe a computer system.
- Describe the working of a computer, Open the windows operating system, Use word processing package,
- Appreciate the use of the Microsoft package in education, Acquire the skill of trouble shooting whenever there are problems in the working of computer.

COURSE CONTENTS:

UNIT-I

Basics of Computers: Definition of Computer, Characteristics of Computer, Components of a Computer System, Hardware and Software, Classification of Computers, Introduction to Operating Systems, Types of operating system, Viruses and Protection, Evolution and Generations of Computers.

System Software – Operating System and its Functions, Central Processing Unit (C.P.U), Application Software – Office Packages etc., Input and Output Devices. Data representation in Digital Computer. Number System and their Conversions.

UNIT-II

Problem Solving using Computers: Algorithm, Flowchart, Pseudocode and Source Code. Representation of Algorithm, Flowchart, Pseudo code with examples.

Computer languages - Machine language, Assembly language, Higher level languages, 4GL. Translator Programs - Compiler, Interpreter, Assembler.

Internet: History of Internet, Features and uses of Internet. Connecting to Internet, Internet Connections, Internet Services. Introduction to WWW, Web browsers, Websites, Email, Search Engine etc. URL, IP Address, Domain Name. Introduction to E-commerce, E-governance, E-government, with relevant examples like AMS, Admissions System etc.

UNIT-III

MS office: Introduction to MS office, Components and Features, Using Office in Online and Offline Mode.

MS Word: Creating Letter, Table, Fonts, Page Layout Document, Formatting, Spell Check, Print Preview, Template, Color, Mail Merge, Auto Text, Inserting Picture, Word Art.

MS Excel: Introduction to Excel, Sorting, Formulas, Graphs, Scientific Functions.

PowerPoint: Introduction to PowerPoint, Creation of Slides, Inserting Pictures, Preparing Slide Show with Animation.

RECOMMENDED BOOKS:

1. Computer Fundamentals, P.K Sinha, 6th Edition, BPB Publications, 2011.
2. Introduction to Information Technology, V Rajaraman, PHI
3. Introduction to Computers, Peter Norton, 7th Edition, McGraw Hill Education
4. Fundamentals of Computers, V. Rajaraman, PHI Publications

SEMESTER-I			
Course Code	IXXXAECS0023	**Course Title**	Communication Skills
Credits	03	**Lectures**	48
Course Type	AEC	**Assessment Marks**	75 (54: Ext.+21 Int.)

COURSE OBJECTIVES:

- To enhance learners' communication skills in both social and professional contexts.
- To sensitize students to their communicative behavior by allowing the learners, understand the basics and the importance of Technical Communication.
- To equip learners with the professional skills by giving training in writing various tasks like letters, technical reports and e-mails etc.

COURSE OUTCOMES:

- Listening to oral instructions in order to perform a given task.(The skills of Listening will be taught and tested through specially prepared materials)
- The skills of Speaking will be developed conducting various communicative Activities- Role play, conversations, extempore etc.
- The Reading Skills will be enhanced through comprehending and unseen texts.
- The skills of Writing will be developed and assessed on Text based writing.

COURSE CONTENTS:

UNIT-I

Communication Skill

- Communication: An Introduction
- Definition and Scope
- Process of Communication
- Barriers to Communication (semantic/linguistic, physical, psychological, socio-cultural)/ Overcoming Barriers
- Verbal/Non-Verbal Communication

UNIT-II

Soft Skills

- Introduction to Soft Skills
- Personality Development/Emotional Intelligence
- Time Management/leadership Skills
- Interpersonal relations/Public Speaking
- Facing Interviews/ Group Discussion/Presentation Skills

UNIT-III

Writing Skills

- Letter Writing- Formal and Informal
- CV, Email, Message
- Minutes, Report Writing
- Notice, Memoranda
- Short Speech

RECOMMENDED BOOKS:

1. Muralikrishna C., Sunita Mishra "Communication Skills for Engineers" 2nd edition, Pearson, New Delhi 2010 Vyas Manish A., Yogesh L. Patel, "Tasks for the English Classroom", MacMillan, New Delhi, 2012.
2. Achar Deeptha, Charul Jian and et al, English for Academic Purposes,Book-1&2 University Granthnirman Board, Gujarat, 2011
3. Michael vince, 'Advanced Language Practice', Macmillan Education, oxford,2003
4. Eisenbach Iris, "English for Materials Science and Engineering", Springer Fachmedien Wiesbaden GmbH 2011
5. Lougheed Lin, "Business Correspondence: A Guide to Everyday Writing', Longman, Pearson Education, Inc, 200

Note: Adequate practice to be given in the class to improve speaking and writing competence

Textbook recommended: Step Ahead with English (Published by Orient BlackSwan)

SEMESTER-I			
Course Code	IXXXVAHW0023	**Course Title**	Health and Wellness
Credits	02	**Lectures**	32
Course Type	VAC	**Assessment Marks**	50 (36: Ext.+14 Int.)

COURSE OBJECTIVES:

- To help understand the importance of a healthy lifestyle
- To familiarize students about physical and mental health
- To create awareness of various life style related diseases
- To provide understanding of stress management

COURSE OUTCOMES:

On successful completion of this course, the student will be able to have a knowledge regarding

- Physical health
- Mental health
- Spiritual well-being
- Emotion and social connection

COURSE CONTENTS:

UNIT-I

INTRODUCTION TO HEALTH & WELLNESS

Define and differentiate health and wellness. Importance of health and wellness Education. Historical background of yoga and its relevance in contemporary world. Need and importance of yoga. Asanas and meditation for healthy well-being. Prenatal yoga for women well-being. Yoga and stress management. Diet and nutrition for health & wellness. Essential components of balanced diet for healthy living with specific reference to the role of carbohydrates, proteins, fats, vitamins & minerals. Processed foods and unhealthy eating habits. Identification of suicidal tendencies. Substance abuse (Drugs, Cigarette, Alcohol), de-addiction, counselling and rehabilitation.

UNIT-II

MANAGEMENT OF HEALTH AND WELLNESS

Healthy foods for prevention of life-threatening diseases with special reference to cancer, Hypertension, Diabetes and Cardiovascular diseases. Physical Fitness and components of Physical Fitness. Advantages of Good Physique. Active and sedentary lifestyles and its implications. Postural deformities and its corrective measures. Psychological wellbeing and its importance in the field of Sports. Role of sleep in maintenance of physical and mental health.

RECOMMENDED BOOKS:

1. Physical Activity and Health by Claude Bouchard, Steven N. Blair, William L. Haskell.
2. Mental Health Workbook by Emily Attached & Marzia Fernandez, 2021.
3. Mental Health Workbook for Women: Exercises to Transform Negative Thoughts and Improve Well-Being by Nashay Lorick, 2022.
4. Lifestyle Diseases: Lifestyle Disease Management, by C. Nyambichu& Jeff Lumiri, 2018.
5. Physical Activity and Mental Health by Angela Clow & Sarah Edmunds, 2013.

SEMESTER-I			
Course Code	IXXXVAES0023	**Course Title**	Environmental Science Education
Credits	02	**Lectures**	32
Course Type	VAC	**Assessment Marks**	50 (36: Ext.+14 Int.)

COURSE OBJECTIVES:

This course attempts to create pro-environment attitude and a behavioural pattern in student community and society that attaches importance and priority to create sustainable life style and awareness on various environmental issues.

COURSE OUTCOMES:

This course is expected to inculcate a critical thinking on various dimensions of environment through knowledge, skill, critical thinking and problem-solving.

COURSE CONTENTS:

UNIT-I

UNDERSTANDING THE ENVIRONMENT

Environment: concept, importance and components

Ecosystem: Concept, structure and function (food chain, food web, ecological pyramids and energy flow) Ecosystem services: (Provisioning, regulating and cultural)

Biodiversity: levels, values and threats and conservation

Concept and objectives of environmental education, environmental ethics

UNIT-II

NATURAL RESOURCES AND ENVIRONMENTAL POLLUTION

Natural resources: Renewable and non-renewable (Global status, distribution and production)

Management of natural resources: Individual, community and government managed

Air, water and soil pollution: Causes, consequences and control

Solid waste management: Collection, segregation, transportation and disposal; 3R's

Climate change: Causes and consequences.

RECOMMENDED BOOKS:

1. Asthana, D. K. Text Book of Environmental Studies. S. Chand Publishing.
2. Basu, M., Xavier, S. Fundamentals of Environmental Studies, Cambridge University Press, India.
3. Basu, R. N., (Ed.) Environment. University of Calcutta, Kolkata.
4. Bharucha, E. Textbook of Environmental Studies for Undergraduate Courses. Universities Press.
5. Miller T.O. Jr., Environmental Science, Wadsworth Publishing Co.
6. Wagner K.D. Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p.
7. Mckinncv, M.L. & Schoch. R.M. Environmental Science systems & Solutions. Web enhanced edition. 639p.

SEMESTER-I			
Course Code	IXXXSEPC0123	**Course Title**	Programming with C
Credits	02	**Lectures**	32
Course Type	SEC	**Assessment Marks**	50 (36: Ext.+14 Int.)

COURSE OBJECTIVES:

- Introduce the basic syntax, data types, operators, and control structures of the C language.
- Develop problem-solving skills by applying C programming concepts to solve various problems.
- Introduce fundamental data structures like arrays, strings, pointers, and structures, and their applications.
- Understand basic file operations and how to read and write data to files.

COURSE OUTCOMES:

- Students will be able to develop C programs to solve various problems.
- Understand the principles of code organization and functional hierarchical decomposition.
- Students will be able to use different data types, including arrays, strings, and structures, effectively.
- Students will be able to apply their knowledge of C to solve practical problems

COURSE CONTENTS:

UNIT-I

C-LANGUAGE FUNDAMENTALS

Introduction to Programming, Compliers, Interpreters and Assembler. Algorithm and Flowchart, Introduction of C Language. Reserved Words, Built-In Data Types, Variables, Operators and Expressions, Statements, Compound Statements. Using Standard Inputs and Output Functions (printf, scanf). Editing Compiling & Linking a Program. The C-preprocessor and its use in Macro Definition, Operators: Assignment, Arithmetic, Relational, Logical, Conditional and Assignment Operator. Increment & Decrement (pre & post) Operators, Bitwise Operators. Control Statements: If, else & Switch-Case.

UNIT-II

CONTROL STATEMENTS, LOOPS, ARRAY AND FUNCTIONS

Loop Statements: for, while, do while (with break & continue) Statements. Nested Loops. Arrays: Array Initialization, Multi-Dimensional Arrays; Character Arrays & Strings; String Processing Functions.

User-Defined Functions: Prototype & Definition; Parameter Passing. Recursive Functions. Scope & Lifetime of Variables.

RECOMMENDED BOOKS:

1. Balaguruswamy, Programming in ANSI C, Tata McGraw Hill.
2. Torrence W Pratt, Programming Language Design and Implications, PHI.
3. Gottfried Programming with C.
4. Let Us C by Yashwant Kanetkar BPB Publications.

PRACTICALS (CREDITS: 02)

Lab-Sheet: Basic Programming using C to write: (Minimum ten (10) to be performed)

1. Read the value of variable and display.
2. To sum of two numbers entered by the user.
3. To demonstrate the use of arithmetic operators.
4. To demonstrate use of relational operators.
5. To demonstrate the use of increment and decrement (pre and post) operators.
6. To check whether a number entered by user is odd or even.
7. To find largest of three numbers.
8. To display first n natural numbers.
9. To find sum of first n natural numbers.
10. To compute factorial of a number.
11. To compute Fibonacci series.
12. To perform addition, subtraction and multiplication of two numbers and make use of switch-case statement
13. To demonstrate use of conditional operator.
14. To display individual digits of a number.
15. To compute sum of digits of a number.
16. To reverse a number.
17. To compute the sum of the first n terms of the following series S = 1+1/2+1/3+1/4+……
18. To compute the sum of the first n terms of the following series S =1-2+3-4+5…….
19. To demonstrate argument passing by value and by reference
20. To compute factorial of a number.
21. To compute factorial of a number.
22. To demonstrate use of basic Math functions inbuilt in C
23. To create an array, read its elements from user, traverse / display the individual elements.
24. To compute sum of elements of an array.
25. To check whether an element exists in an array or not.
26. To create a two-dimensional array, read its elements, traverse/display the individual elements.
27. To find sum of two matrices
28. To compute multiplication of two matrices.
29. To demonstrate basic String functions.
30. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not

SEMESTER-II			
Course Code	IPHYMJEM0225	**Course Title**	Electricity & Magnetism
Credits	04	**Lectures**	64
Course Type	MAJOR	**Assessment Marks**	100 (36: Ext.+14 Int.)

COURSE OBJECTIVES:

The aim of this course is to develop understanding of the various concepts of vector analysis, electrostatics, magnetostatics, dielectric and magnetic properties of materials.

COURSE OUTCOMES:

On Completion of this Course the students will be able to:

- Apply Coulomb's and Gauss's Law for the electrostatic force.
- Explain the relationship between electrostatic field and potential.
- Use Lorentz force law for magnetic force and solve the related problems.
- Understand dielectric and magnetic properties of matter.

COURSE CONTENTS:

UNIT-I

Vector Analysis: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Product Rules, Second Derivatives, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). The Dirac Delta Function (One-Dimensional and Three Dimensional). Electrostatics: Electrostatic Field. electric flux, Gauss's theorem of electrostatics. Differential form of Gauss Law.

UNIT-II

Applications of Gauss's law: Electric field due to point charge. infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet. charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor, Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field.

UNIT-III

Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric. Magnetism: Magnetostatics: Biot-Savart's law & its application: straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia. para, and ferro-magnetic materials.

UNIT-IV

Electromagnetic induction: Faraday's laws of electromagnetic induction, Lenz's law, Induced electric field, Self-Inductance (L) and mutual inductance (M), L of single coil, M of two coils. Energy in magnetic fields. Maxwell's equations and Electromagnetic wave propagation: Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field. electromagnetic wave propagation through vacuum and isotropic dielectric medium. transverse nature of EM waves, polarization.

RECOMMENDED BOOKS:

1. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I,1991, Oxford Univ. Press.
2. Electricity and Magnetism, Edward M. Purcell, 1986. Mc-Graw Hill Education
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

5. D.J. Griffiths. Introduction to Electrodynamics, fourth Edition, 2017, Cambridge University Press.

LABORATORY COURSE (CREDITS: 02)

LIST OF PRACTICALS

1. To study the variation of magnetic field with distance along the axis of circular coil carrying current by plotting a graph.
2. To find the value of horizontal component of earth's magnetic field using deflection and vibration magnetometer.
3. To trace the B. H. curve for a ferro magnetic material using C.R. O and to find the magnetic parameters from B. H. hysteresis loop.
4. Cathode Ray Oscilloscope (CRO): (i) To obtain the wave form of A. C. mains supply using CRO. (ii) To measure D.C. voltage using CRO (iii) To measure phase difference between current and voltage for R-C and L-R A.C. circuit using a CRO.
5. Helmholtz coil (i) To study the variation of magnetic field with position of paired coils in Helmholtz arrangement along the axis of the coils carrying current. (ii) To study the principle of super imposition of magnetic field (iii) To calculate the radius of the coil.
6. To use a multi-meter for measuring (i) Resistance (ii) A.C. and D.C. Voltage (iii) A.C. and D.C Current
7. Ballistic Galvanometer: (i) Measurement of charge and current sensitivity (ii) Measurement of Critical Damping Resistance (iii) Determine a high resistance by Leakage Method
8. To study the characteristics of a Series RC Circuit.
9. To study the A series LCR circuit and determine its (i) Resonant Frequency (ii) Quality Factor
10. To study a parallel LCR circuit and determine its (i) Anti-resonant frequency and (ii) Quality factor
11. To compare capacitances of two capacitors by De-Sauty's null method.
12. Measurement of field strength B and its variation in a Solenoid.
13. To determine a Low Resistance by Carey Foster's Bridge.

RECOMMENDED BOOKS::

1. Advanced Practical Physics for students, B. L. Flint and H. T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted I 985, Heinemann Educational Publishers.
3. Practical Physics by C. L. Arora S. Chand & Company, New Delhi.

SEMESTER-II			
Course Code	IXXXMNCL0225	**Course Title**	Calculus-II
Credits	04	**Lectures**	64
Course Type	MINOR	**Assessment Marks**	100 (72: Ext.+28 Int.) *

COURSE OBJECTIVES:

- To study and understand the notions of integral calculus and to imbibe the acquaintance for using the techniques in physics and research.
- To prepare the students for taking advanced courses physics where analytical methods are involved.

COURSE OUTCOMES:

- The techniques involved in the course shall be used to estimate area and to solve complex problems.
- The techniques involved in the course shall be used to solve complex integrals.

COURSE CONTENTS:

UNIT-I

Definite integral and its properties. definite integral as limit of sum. Applications of definite integral in finding areas under curve and area between two curves. Arc length. volumes and areas of surfaces of revolution.

UNIT-II

Improper integral: definition, examples, types and evaluation by using limits and comparison tests. Differentiation under an integral sign. Curve tracing: components and method for tracing a curve.

UNIT-III

Sequences and their limits. Infinite series and convergence tests including geometric series, p-series, comparison test, ratio test, root test and alternating series. Absolute and conditional convergence. Power series with radius and interval of convergence.

UNIT-III

Parametric equations and calculus of parametric curves including derivatives and arc length. Polar coordinates and graphs of polar equations. Area and arc length in polar coordinates

RECOMMENDED BOOKS:

1. Calculus – Early Transcendentals by James Stewart, 8th edition 2015.
2. Thomas, G. B., Weir, M. D., & Hass, J. THOMAS' CALCULUS 11th edition, 2005, Addison-Wesley.
3. Integral Calculus, S. D. Chopra and M. L. Kochar, Kapoor Sons.
4. Integral Calculus, Shanti Narayan and P.K. Mittal, S. Chand, 2005
5. First Course in Calculus - by Serge Lang, 5th edition, 1986, Springer.
6. Calculus – by Howard Anton 8th edition, 2005, Wiley.
7. Integral Calculus - by Hari Krishan, 2006, S. Chand Publishing.
8. Calculus I & II by Tom Apostol, 2nd edition, 1969, Wiley.

SEMESTER-II			
Course Code	IXXXMDGL0023	**Course Title**	Geology (Physical Geology)
Credits	03	**Lectures**	46
Course Type	MDC	**Assessment Marks**	75 (54: Ext.+21 Int.)*

COURSE OBJECTIVES:

- The study of this course will help learners to grasp basic concepts in physical geology, in addition, will help them to understand the dynamic nature of the Earth's surface, various processes, and landforms.

COURSE OUTCOMES:

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

- Define the field of Geomorphology and explain its essential principles.
- Outline the mechanism of the dynamic nature of the Earth's surface and interior of the Earth.
- Illustrate and explain the forces affecting the crust of the earth and its effect on it.
- Understand the conceptual and dynamic aspects of landform development and their identification.

COURSE CONTENTS:

UNIT-1

Origin and evolution of Earth: Catastrophism, uniformitarianism, Epeirogenesis and orogenesis, and base level of erosion. Origin and evolution of Earth`s crust. Theory of Isostasy, Earthquakes: Distribution and types

UNIT-II

Introduction to different types of rocks, Rock cycle; cycle of erosion, weathering: definition and types, agents of weathering. Soils: Soil formation and soil profile; Soils of Jammu and Kashmir; Karewas of Kashmir

UNIT-III

Geomorphic processes and resulting landforms: Geological work of river, wind, and glaciers; erosional and depositional features. Volcanoes: types, distribution, and eruptional features. Karst topography: Surface and sub-surface features.

RECOMMENDED BOOKS:

1. Bloom A. L., 2003: Geomorphology: A Systematic Analysis of Late Cenozoic Landforms, Prentice-Hall of India, New Delhi.
2. Bridges E. M., 1990: World Geomorphology, Cambridge University Press, Cambridge. Christopherson, Robert W., (2011),
3. Geosystems: An Introduction to Physical Geography, 8 Ed., Macmillan Publishing Company Kale V. S. and Gupta A., 2001:
4. Introduction to Geomorphology, Orient Longman, Hyderabad. Knighton A. D., 1984:
5. Fluvial Forms and Processes, Edward Arnold Publishers, London. Richards K. S., 1982:
6. Rivers: Form and Processes in Alluvial Channels, Methuen, London. Selby, M.J., (2005),
7. Earth's Changing Surface, Indian Edition, OUP Skinner, Brian J. and Stephen C. Porter (2000),
8. The Dynamic Earth: An Introduction to physical Geology, 4th Edition, John Wiley and Sons.

SEMESTER-II			
Course Code	IXXXAEEL0023	**Course Title**	English Language
Credits	03	**Lectures**	46
Course Type	AEC	**Assessment Marks**	75 (54: Ext.+21 Int.)*

COURSE OBJECTIVES:

- Enhancing comprehension through reading and listening, and improving speaking and writing abilities.
- Fostering an understanding and appreciation of literary works, including different genres and literary devices.
- Improving the ability to express oneself effectively in various situations, including public speaking and writing
- Encouraging students to analyze texts, evaluate information, and form reasoned opinions

COURSE OUTCOMES:

- Students will be able to understand and appreciate literary works, including different genres and literary devices.
- Obtain the knowledge of literary devices and genres.
- Acquire the skills of creativity to express one's experiences.
- They will be able to engage in critical discussions and debates.

COURSE CONTENT:

UNIT-I:

Poetry

1. Robert Frost: "The Road Not Taken"
2. Nissim Ezekiel: "Night of the Scorpion"

UNIT-II:

Short Story

1. Mulk Raj Anand: "The Lost Child"
2. Henry Lawson: "The Loaded Dog"

UNIT-III:

Language in Use

1. Reading Comprehension
2. Paragraph Writing/ Essay Writing
3. Homonyms, Homophones/ Commonly misspelt words
4. Idioms and Phrases/ Phrasal verbs
5. Spellings and Sound Patterns in English/ One-Word substitution

RECOMMENDED BOOKS:

1. Step Ahead with English (Published by Orient Black Swan) (Note: Exercises at the end of the literary pieces to be done in the class.)

SEMESTER-II			
Course Code	IXXXVADT0023	**Course Title**	Digital & Technological Solutions
Credits	02	**Lectures**	32
Course Type	VAC	**Assessment Marks**	50 (36: Ext.+14 Int.)

COURSE OBJECTIVES:

- To gain familiarity with digital paradigms.
- To sensitize about role & significance of digital technology.
- To provide know how of communications & networks.
- To bring awareness about the e-governance and Digital India initiatives.
- To provide a flavour of emerging technologies - Cloud, Big Data, AI, 3D printing.

COURSE OUTCOMES:

- Students will gain knowledge about digital paradigm.
- Realization of importance of digital technology, digital financial tools, e-commerce.
- Know-how of communication and networks.
- Familiarity with the e-governance and Digital India initiatives.
- An understanding of use & applications of digital technology.
- Basic knowledge of machine learning and big data.

COURSE CONTENTS:

UNIT-I

Introduction & Evolution of Digital Systems. Role & Significance of Digital Technology. Information & Communication Technology & Tools. Computer System & it's working, Software and its types. Operating Systems: Types and Functions. Problem Solving: Algorithms and Flowcharts.

Communication Systems: Principles, Model & Transmission Media. Computer Networks & Internet: Concepts & Applications, WWW, Web Browsers, Search Engines, Messaging, Email, Social Networking. Computer Based Information System: Significance & Types. E-commerce & Digital Marketing: Basic Concepts, Benefits & Challenges.

UNIT-II

Digital India & e-Governance: Initiatives, Infrastructure, Services and Empowerment. Digital Financial Tools: Unified Payment Interface, Aadhar Enabled Payment System, USSD, Credit / Debit Cards, e-Wallets, Internet Banking, NEFT/RTGS and IMPS, Online Bill Payments and PoS. Cyber Security: Threats, Significance, Challenges, Precautions, Safety Measures, & Tools, legal and ethical perspectives.

Emerging Technologies & their applications: Overview of Cloud Computing, Big Data, Internet of Things, Virtual Reality, Blockchain & Cryptocurrency, Robotics, Machine Learning & Artificial Intelligence, 3-D Printing. Digital Signatures.

RECOMMENDED BOOKS:

1. F S Masoodi, Z S Masoodi and K B Dar, Digital and Technological Solutions, BPB Publications.
2. V. Rajaraman, Introduction to Information Technology, 3rd Edition, PHI.
3. E Balagurusamy, Fundamentals of Computers, Tata Mc GrawHill.
4. Behrouz A. Forouzan, Data Communications and Networking, McGraw Hill.
5. Pramod Kumar, Anuradha Tomar, R. Sharmila, Emerging Technologies in Computing Theory, Practice, and Advances, Edition 2021, Chapman and Hall/CRC Imprint.
6. Buvya, Broberg, and Gosciniski, Cloud Computing- Principals and Paradigms, Wiley.

SEMESTER-II			
Course Code	IXXXVAUI0023	**Course Title**	Understanding India
Credits	02	**Lectures**	32
Course Type	VAC	**Assessment Marks**	50 (36: Ext.+14 Int.)*

COURSE OBJECTIVES:

- To make student appreciate the value of pluralism and unity in diversity.
- To highlight the contribution of India to different branches of Knowledge.
- To make students understand and appreciate the contribution made by different sections of the society towards freedom struggle.
- To Inculcate in students the values promoted by the Indian National Movement.

COURSE OUTCOMES:

- Students will be able to understand India from diverse perspectives, including its place in the global arena, its national identity, and its local realities.
- Students will develop a comprehensive understanding of India's diverse cultures, languages, and traditions.
- Students will be equipped with the knowledge and skills to participate actively in democratic processes and contribute to the nation's progress.

CONTENTS:

UNIT-I

Bharatavarsha: Concept, Origin and its Evolution;

The Idea of India: Unity in diversity and Composite culture

Indian Education Systems: Vedic, Buddhist, Muslim; Modern Education

India's Contribution to the World: Medicine- Charaka, Sushruta, Mathematics and Astronomy- Aryabhatta, Varahmihira, Ramanuja; India's Contribution to Philosophy: Sad Darshan.

Major Socio-Religious Reform Movements: Brahmo Samaj, Arya Samaj, Aligarh Movement.

UNIT-II

India's struggle for Freedom: Revolt of 1857; Foundation and Role of Indian National Congress

Makers of Modern India: Raja Ram Mohan Roy, Rabindernath Tagore, Sir Syed Ahmad Khan, Dada Bhai Naoroji, M.K. Gandhi, J.L. Nehru, V.B. Patel, Abul Kalam Azad, B.R. Ambadekar

Contribution of Peasants, Tribal's, Working Classes and Women to Freedom Movement

Legacy of Indian National Movement: Secularism, Socialism, Democracy.

Making of Indian Constitution and its Salient Features.

RECOMMENDED BOOKS:

1. Basu, D. (2012) 'Introduction to the Constitution of India'. New Delhi. Lexis Nexis.
2. Bhikku, Parekh (1989). Colonialism. Tradition and Reforms: An Analysis of Gandhi's Political Discourses, Neu Delhi. Sage Publications.
3. Bipan Chandra (1987). India's Struggle for Independence. Penguin. Delhi.
4. Dhar. P. K. (2000): Growing Dimensions of Indian Economy. Kalyani Publishers. New Delhi.

5. Dhingra. I. C. (2020): Indian Economy. Sultan Chand & Sons. New Delhi.
6. Dutt, R. and Sundharam (2018): Indian Economy. S. Chand & Co. Ltd. New Delhi
7. Gautam A (2009): Advanced Geography of India. Sharda Pustak Bhawan. Allahabad.
8. Godschalk. D.R. (et.al.) (1999): Natural Hazard Mitigation Recasting Disaster Policy and Planning. Island Press. Washington. D.C.

SEMESTER-II			
Course Code	IXXXSEPP0223	**Course Title**	Programming with Python
Credits	02	**Lectures**	32
Course Type	SEC	**Assessment Marks**	50 (36: Ext.+14 Int.)

COURSE OBJECTIVES:

This course is designed as the first course that:

- Introduces programming concepts using Python to Computer Science students.
- Focuses on the development of Python programming to solve problems of different domains.
- Introduces the concept of object- oriented programming.

COURSE OUTCOMES:

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

- Understand the basics of programming language
- Develop, document, and debug modular Python programs.
- Apply suitable programming constructs and built-in data structures to solve a problem.
- Use and apply various data objects in Python.
- Use classes and objects in application programs and handle files.

COURSE CONTENTS:

UNIT-I

Introduction to the Python language and Interpreter. Basic features and the Print() method. Basic Syntax, Shell and Scripting. Variables and Basic Data types. Operators in Python. Decision Control Structures. If, ifelse, if-elif ladder, nested if.

Looping structures in Python. While loop and loop exit statements, break, continue and pass Range function and for loop. Nested loops.

UNIT-II

Basic data structures in Python, Lists and various methods to manipulate lists. List Slicing. Some basic statistical methods on lists. sort() and reverse() methods. List Comprehension.

Dictionary and tuples and various manipulation methods. Strings in Python. String Slicing. String manipulation methods.

Files in Python. File opening and closing. File modes and types of files. With clause for file opening. Directory and file navigation methods in os-package. Functions in python Defining a function, calling a function, Types of functions, Function Arguments, Global and local variables.

RECOMMENDED BOOKS:

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, Cengage Learning,
2. David Beazley, Brian K. Jones “Python Cookbook”, 3rd Edition. O’Reilly Publications
3. Jake VanderPlas “Python Data Science Handbook” O’Reilly Publications
4. David Beazley, “Python Essential Reference (4th Edition) “Addison Wesley

LABORATORY COURSE (CREDITS: 02):

LIST OF PRACTICAL PROGRAMMING WITH PYTHON: (Minimum ten (10) to be performed)

1. Write basic programs to demonstrate the use of decision control structures in python
2. Write a program in Python to check f a number is positive, print an appropriate message
3. Write a program to prompt the user for hours and rate per hour to compute gross pay. Take into account that the factory gives the employee 1.5 times the hourly rate for hours worked above 40 hours.
4. Write basic programs to demonstrate the use of looping structures in python
5. Write a program to demonstrate continue, break and exit statement
6. Write a program to demonstrate lists in python, iterate through the list and find sum of elements
7. Write a program in python to demonstrate various methods of list data structure
8. Write a Python program to multiply all the items in a list
9. Write a Python program to get the largest number from a list
10. Write a Python program to get the smallest number from a list
11. Write a program to demonstrate sort(), reverse() methods.
12. Write a Python program to remove duplicates from a list
13. Write a program to demonstrate List Comprehensions
14. Write a program which demonstrates

a. Tuple having integers, tuple with mixed data types, nested tuple
b. Accessing tuple elements through indexing
c. Negative indexing
d. Slicing
e. Deleting a tuple
f. Iteration through tuple.

15. Write basic programs to open a file, write on a file, reading a file, closing a file
16. Write a program to prompt for a file name, and then read through the file line-by-line
17. Write a Python program to read first n lines of a file
18. Write a Python program to read last n lines of a file
19. Write a Python program to count the number of lines in a text file
20. Write a Python program to count the frequency of words in a file
21. Write a Python program to write a list to a file
22. Write a Python program to copy the contents of a file to another file
23. Write a Python program to append text to a file and display the text
24. Write a Python program to create a tuple
25. Write a Python program to create a tuple with different data types
26. Write a Python program to create a tuple with numbers and print one item
27. Write a Python program to unpack a tuple in several variables
28. Write a Python program to add an item in a tuple
29. Write a program to create a function that takes two arguments, name and age, and print their value.
30. Write a program to create function func1() to accept a variable length of arguments and print their value.

SEMESTER-III			
Course Code	IPHYMJOW0325	**Course Title**	Oscillations and Waves
Credits	03	**Lectures**	48
Course Type	MAJOR	**Assessment Marks**	75 (54: Ext.+21 Int.)

COURSE OBJECTIVES:

- The objective of the course is to develop an understanding of oscillatory and wave motion in physical systems having importance in Physics.

COURSE OUTCOMES:

After completion of the course, the student shall understand (and solve problems):

- Oscillatory phenomenon of variety of physical systems using simple harmonic equation.
- damped oscillations, role of damping, forced oscillations and resonance.
- coupled oscillations, discrete and continuous normal modes of physical systems.
- wave equation, its physical significance and phenomenon of interference.

COURSE CONTENTS:

UNIT-I

Periodic Motion and Superposition: - Sinusoidal vibrations, Simple harmonic motion, Representation: Rotating vector, complex exponential, Superposition: two vibrations of same frequency, Beats, many vibrations of same frequency, combination at right angles and Lissajous Figures. Free and damped Vibrations, Mass-Spring system, solution of harmonic oscillator equation, Elasticity and Young's modulus, torsional Pendulum, water in U- tube, massive springs.

UNIT-II

Damped and Forced Vibrations: decay of vibrations, effect of large damping, Undamped oscillator with oscillating force, forced oscillator with damping, Resonance, transient phenomenon, Electric resonance as example. Coupled Oscillators and discrete Normal Modes- Two coupled oscillators, symmetry considerations, superposition of Normal modes, Normal frequencies, Forced Vibrations and resonance for two coupled oscillators, N coupled oscillators, properties, longitudinal oscillations. Normal modes for very large N. Continuous Normal modes, Free Vibrations of a stretched strings, Forced vibrations of a stretched string. Longitudinal Vibrations of a rod.

UNIT-III

Progressive Waves- Wave, Normal modes and travelling waves, progressive waves in 1D, wave speed, superposition, pulses, pulses of constant shape, superposition of pulses, Dispersion, phase and group velocity, cut-off phenomenon, energy of mechanical wave, transport of energy by a wave, momentum flow and mechanical radiation pressure, waves in two and three dimensions.

RECOMMENDED BOOKS:

1. Vibrations and Waves, A.P. French, MIT Introductory Physics Series.
2. Optics, Ajoy Ghatak, McGraw Hill.
3. Waves and Oscillations, R.N. Chaudhuri. New Central Age International Publishers.
4. Optics: From Fourier to Fresnel, Charles S. Adams, Ifan G. Hughes, University Oxford Press.

LABORATORY COURSE (CREDITS: 01):

LIST OF PRACTICALS

1. To determine value of acceleration due to gravity (g) at a place using Bar Pendulum.
2. To determine the value of 'g' at a place using Kater's Pendulum.
3. Verify Hooke's law and measure the spring constant and time period.
4. To study different modes of oscillation in coupled pendulum using a suitable method.
5. To study Lissajous Figures.
6. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment.
7. To find the Young's modulus of the material of the rectangular bar by bending.
8. To determine the modulus of rigidity of copper by Maxwell's needle.
9. To find the Young's modulus, modulus of rigidity and Poisson's ratio for the material of a wire by Searle's method.

SEMESTER-III			
Course Code	IPHYMJTD0325	**Course Title**	Thermodynamics
Credits	03	**Lectures**	48
Course Type	MAJOR	**Assessment Marks**	75 (54: Ext.+21 Int.)

COURSE OBJECTIVES:

This syllabus aims to equip students with a comprehensive understanding of the principles and applications of thermodynamics, enabling them to analyse and solve complex thermodynamic problems and apply these concepts to various real-world scenarios.

- Students will be able to differentiate between intensive and extensive thermodynamic variables and apply these concepts to describe the properties of a system.
- Students will learn how heat can be converted into work and vice versa, gaining an appreciation for the energy balance in thermodynamic processes.
- Students will explore the practical applications of the First Law of thermodynamics.

COURSE OUTCOMES:

- Students will comprehend the Second Law of Thermodynamics and its implications, including the concept of entropy, and they will distinguish between reversible and irreversible processes.
- Students will study deviations from ideal gas behaviour and become familiar with the van der Waals equation of state.
- Students will learn about the cooling effect achieved through adiabatic demagnetization; a technique used in cryogenics.

COURSE CONTENTS:

UNIT-I

Concepts of Thermodynamics: Thermodynamic systems, thermodynamic variables, Thermodynamic equilibrium, Thermodynamic processes, Zeroth Law and temperature. Laws of thermodynamics: First law and Internal energy.

Applications of First Law: Heat capacities of a gas, Adiabatic transformation: equation of state, Work Done during Isothermal and Adiabatic Processes, Enthalpy.

UNIT-II

Second Law & Entropy: Heat Engines, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy temperature diagrams, Entropy of an Ideal gas, Entropy of Mixing. Maxwell's thermodynamic relations & applications: Clausius-Clapeyron Equation, phase changes, Thermodynamic relations involving heat capacities, TdS equations. Gibbs-Helmholtz equation. Joule Thomson effect, Third Law of thermodynamics and its consequences.

UNIT-III

Real Gases: Deviation from perfect gas behaviour, van der Waals' equation of state and comparison with experimental results, the critical constants. Joule-Thomson expansion for ideal and Van der Waals' gas, Liquefaction of gases: Boyles temperature and inversion temperature, principle of regenerative cooling and of cascade cooling. Cooling due to adiabatic demagnetization.

RECOMMENDED BOOKS:

1. Thermal Physics by S. C. Garg, R. M. Bansal and C. K. Ghosh (McGraw Hills)
2. Fundamentals of Statistical and Thermal Physics by F. Reif (Waveland Press, Inc.)
3. Heat and Thermodynamics by M. W. Zemansky and H. Dittman (McGraw Hill)
4. Thermodynamics Kinetic Theory and Statistical Thermodynamics F. W. Sears and G. L. Salinger

LABORATORY COURSE (CREDITS: 01):

LIST OF PRACTICALS:

1. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
2. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
3. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
4. To determine Mechanical Equivalent of Heat (J) by Callender and Barne's constant flow method.
5. To determine efficiency of an electric kettle by varying voltage.
6. To study the variation of Thermo-emf of a Thermocouple with Difference of Temperature of its Two Junctions.
7. To determine Stefan's Constant.
8. Measurement of Planck's constant using black body radiation.

RECOMMENDED BOOKS:

1. B.Sc. Practical Physics, C.L. Arora, S. Chand and Company Limited.
2. A textbook of Practical Physics, Indu Prakash, Ramakrishna, Kitab Mahal, New Delhi.

SEMESTER-III			
Course Code	IXXXMNDE0325	**Course Title**	Differential Equations
Credits	04	**Lectures**	64
Course Type	MINOR	**Assessment Marks**	100 (78: Ext.+28 Int.)*

COURSE OBJECTIVES:

Familiarize students with regard to:

- The types of differential equations, linearity and homogeneity in DEs'.
- Develop students' ability to formulate and solve differential equations using different methods based on the types of DEs'
- Apply these techniques to solve and analyze real-world problems

COURSE OUTCOMES:

- Solve exact, linear, and Bernoulli differential equations, and linear equations with constant coefficients.
- Analyze and solve higher-degree first-order differential equations, including Clairaut-type equations.
- Apply properties of Legendre polynomials and Bessel functions, and use Wronskian for solution analysis.
- Form and classify partial differential equations, and solve first-order PDEs using standard methods.

COURSE CONTENTS:

UNIT-I

Differential equations, exact differential equation, necessary and sufficient conditions for exactness, equation reducible to exact by integrating factor. Linear differential equation and Bernoulli's equation, symbolic operators, homogeneous and non-homogeneous linear differential equations with constant coefficients and those reducible to such equations.

UNIT-II

Miscellaneous forms of differential equations, first order higher degree equations solvable for x, y, z, p, equations from which one variable is explicitly absent, Clairut's form, equations reducible to Clairut's form.

UNIT-III

Legendre polynomials, Bessel function, recurrence relation and differential equation satisfied by each of these functions, Wronskian and its properties.

UNIT-IV

Formation of partial differential equations, order and degree of partial differential equations, concept of linear and non-linear partial differential equations, linear partial differential equation of first order, Lagrange's method, Geometrical interpretation of the form $Pp + Qq = R$, Charpit's method, classification of second order partial differential equations into elliptical, parabolic and hyperbolic through illustrations only.

RECOMMENDED BOOKS:

1. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.
2. M. D. Raisinghania, Ordinary differential Equations.
3. S. D. Chopra and M.L.Kochar, Integral Calculus, Kapoor Pub.
4. Shepley L. Ross, Differential Equations, 3rd Ed., John Willey and Sons, 1984.
5. Schaun Series, Differential Equations.

SEMESTER-III			
Course Code	IXXXMDCH0323	**Course Title**	Chemistry (Food Adulteration)
Credits	03	**Lectures**	48
Course Type	MDC	**Assessment Marks**	75(54: Ext.+21Int.)*

COURSE OBJECTIVES:

The purpose of this Food adulteration program is to provide the key knowledge base and laboratory resources to prepare students for careers as professionals in various industries and research institutions.

- To educate students about common food adulterants and their detection.
- To introduce students to food safety and standardization acts.
- To make students skilled in food adulteration testing and analytical instrumentation.

COURSE OUTCOMES:

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

- Comprehend certain basic skills of detecting adulteration in common foods.
- Extend their knowledge of detecting other kinds of adulteration.

COURSE CONTENTS:

UNIT-I

Food Adulteration Practices

Adulteration-Definition; types-Intentional, incidental, metallic and packaging hazard. Causes and methods of food adulteration. General Impact on Human Health. Detection and Prevention of Food Adulteration. Mitigation measures for addressing food adulteration.

Food additives- Definition, classification, role of additives in processed foods. Safe levels of additive uses and the institutions involved in the process.

UNIT-II

Food safety management systems

Importance and application of food regulation in the Indian and Global context, responsibilities for maintaining and enforcing food safety FSSAI, CODEX ALIMENTARIUS, HACCP, ISO 22000 series, TQM and codes of GMP. Auditing and accreditation (BIS, QCI, AGMARK etc).

UNIT-III

Adulteration of Common Foods and Methods of their Detection

LABORATORY DEMONSTRATION: (Attempt any three exercises)

Composition and adulterant detection in the following Foods- Milk, Edible Oil, Sugar, Spices, honey, flours, Ghee Beverages- Alcoholic and Non-Alcoholic. (one method of detection for each food item).

1. To detect the adulterants like paraffin wax/hydrocarbons, dyes and argemone in the fats, oils and ghee.
2. To detect the presence of adulterants like water, proteins, urea, formalin, detergent, sugar and starch in the milk.
3. To detect the adulteration of insoluble substance, chalk powder and washing soda in sugar.
4. To detect the adulteration of Red lead salts/brick powder in chilli powder, yellow lead salts/ colored saw
5. dust in turmeric and dried papaya seeds in pepper.
6. To detect sugar as an adulterant in honey.

RECOMMENDED BOOKS:

1. A first course in Food Analysis, A.Y. Sathe, New Age International (P) Ltd., 1999.
2. Food Safety, case studies – R. V. Bhat, NIN, 1992.
3. DART- Detect adulteration with rapid test. FASSAI, Imprinting Trust, assuring safe and nutritious food, Ministry of Health and Family Welfare, Government of India.
4. Rapid detection of food adulterants and contaminants Theory and Practice, S. N. Jh, 2016, Kindle Edition.
5. Domestic Tests for Food Adulterations, H. G. Christian, Forgotten books.

SEMESTER-III			
Course Code	IXXXAEAL0023	**Course Title**	Arabic Language
Credits	03	**Lectures**	48
Course Type	AEC	**Assessment Marks**	75 (54: Ext.+21 Int.)

COURSE OBJECTIVES:

- Students will gain a comprehensive understanding of Arabic grammar, vocabulary, and pronunciation
- To introduce students to the history, culture, and literature of the Arab world, providing context for the language.
- Students will develop practical skills in reading, writing, and basic conversation, allowing them to communicate effectively in Arabic.

COURSE OUTCOMES:

- Students will be able to recognize, read, and write Arabic alphabets and numerals.
- They will be able to understand and respond to basic questions and simple sentences in Arabic.
- Students will be able to use basic vocabulary to describe objects and express simple ideas.
- The course will enhance their ability to read and write simple Arabic texts and engage in basic conversations.

COURSE CONTENTS:

UNIT-I

1. اللغةالعربية: تعريفوجيز
2. حروفالهجاء(الأشكالوالأصوات)
3. حروفالعلةوالصحيحة
4. الحركاتالثلاثوالسكونوالشدةوالمدة
5. الحروفالشمسيةوالقمرية

UNIT-II

1. الكلمةوأنواعها(اسموفعلوحرف)
2. المعرفةوالنكرة
3. المذكروالمؤنث
4. المفردوالمثنىوالجمع
5. أسماءالإشارة

UNIT-III

1. التحيةوالتعارف(الدرسالأول
2. حوارفيالفصل(الدرسالثاني
3. هذابيتي(الدرسالثالث)

RECOMMENDED BOOKS:

1. الممتازفيالحواراتاليوميةلغيرالناطقينبالعربية،إعداد:مركزبيسالتعليمالعلومالإسلاميةواللغةالعربية.

RECOMMENDED BOOKS:

1. Arabic for beginners, Dr Syed Ali
2. A new Arabic Grammar, John A. Haywood
3. Essential Arabic, I. A. Faynan
4. Teach Yourself Arabic, S. A. Rahman
5. Arabic Made Easy, Abul Hashim
6. Let's Speak Arabic, S. A. Rahman
7. A Practical Approach to the Arabic language, Dr. Wali Akhter

SEMESTER-III			
Course Code	IXXXSEAP0323	**Course Title**	Advanced Programming with Python
Credits	02	**Lectures**	32
Course Type	SEC	**Assessment Marks**	50 (36: Ext.+14 Int.)

COURSE OBJECTIVES:

- To develop proficiency in advanced Python programming concepts, including list/set/dictionary comprehensions, functional programming.
- To introduce multi-threading, network programming, and CGI scripting, enabling learners to build basic web and server-side applications.
- To familiarize students with HTML, GUI development using tkinter, and event-driven programming models.
- To provide hands-on experience with Django, enabling students to understand the basics of web development using Python frameworks.

COURSE OUTCOMES:

By the end of this course, students will be able to:

- Demonstrate the use of list, set, and dictionary comprehensions with various conditions and apply range and zip functions in loop structures.
- Apply modular programming concepts using modules, packages, and command-line arguments with an understanding of the main() function in Python.
- Use lambda functions, pass functions as arguments, and implement map() and filter() functions for functional programming approaches.
- Create custom iterators and generators, and effectively utilize the itertools package for advanced iteration tasks.
- Build basic multi-threaded and client-server network applications using Python.
- Design and interact with web interfaces using HTML and CGI scripts and understand the basics of the Django web framework.
- Analyze and visualize data using NumPy, Pandas, Matplotlib, and Seaborn libraries.
- Develop graphical user interfaces using tkinter, including layouts with widgets such as buttons, labels, entry fields, and dialogs.

COURSE CONTENTS:

UNIT-1

List, set and dictionary Comprehension. List comprehension with for loop, single if, if-else and multiple if conditions. Range and zip functions with for loop.

Understanding Modules and Packages in Python. Main function in Python and command line arguments Lambda Functions. Passing functions as arguments to functions.

Map and filter in python.

Iterators and Generators in Python. The itertools package. Object Oriented Programming in Python. Classes and objects. Attributes, Inheritance, Overloading, Overriding, Data hiding, abstract classes Exception Handling in Python. Except clause, Try, finally clause. User Defined Exceptions

UNIT-II

Multithreading, Networks, and Client/Server Programming; introduction to HTML, interacting with remote HTML server, running html-based queries, downloading pages; CGI programming, programming a simple CGI form. The Django package – an Introduction. Introduction to scientific packages. Numpy, Pandas, Matplotlib, Seaborn. Graphical user interfaces; event-driven programming paradigm; tkinter module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames

RECOMMENDED BOOKS:

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, Cengage Learning.
2. David Beazley, Brian K. Jones "Python Cookbook", 3rd Edition. O'Reilly Publications.
3. Jake VanderPlas "Python Data Science Handbook" O'Reilly Publications.
4. David Beazley, "Python Essential Reference (4th Edition) "Addison Wesley.

PRACTICALS (2 CREDITS)

LAB SHEET-ADVANCED PYTHON PROGRAMING (Minimum ten (10) to be performed)

1. Write a python program to create a list and append elements to it.
2. Write a python Program to Subtract a List from Another List.
3. Write Python Program to count the number of times an item appears in the list.
4. Write a program in python to create a list of even number between the given numbers using range().
5. Write a python program to select some particular elements from a sequence of element using lambda.
6. Write a NumPy program to compute the multiplication of two given matrixes.
7. Write a NumPy program to concatenate element-wise two arrays of string.
8. Write a Pandas program to create and display a one-dimensional array-like object containing an array of data using Pandas module.
9. Write a Pandas program to get the powers of an array values element-wise.
10. Write a Python program to draw a line using given axis values with suitable label in the x axis, y axis and a title.
11. Write a Python programming to display a horizontal bar chart of the popularity of programming Languages.
12. Write a python program to Plotting a Distplot without the Histogram using seaborn.
13. Write Python program to demonstrate Multiple Inheritance.
14. Program to demonstrate the Overriding of the Base Class method in the Derived Class
15. Write Python Program to Demonstrate Multiple Inheritance with Method Overriding
16. Write Python program to overload "+", "-" and "*" operators by providing the methods __add__, __sub__ and __mul__.
17. Write a Python program to demonstrate the use of super() function
18. Write a program to Create python threads using function.
19. Write a program to Create python threads using class.
20. Write a python program to create a window with a button, label and entry field.
21. Write a python program to create the window with the selection widgets: Radiobutton, Checkbutton, Listbox and Combobox.
22. Write a program to create a digital clock with Tkinter to display the time.
23. Write a program to create a to-do list presented with Graphical User Interface(GUI) and Tkinter module.

SEMESTER-IV			
Course Code	IPHYMJMP0425	**Course Title**	Modern Physics
Credits	04	**Lectures**	64
Course Type	MAJOR	**Assessment Marks**	100 (72: Ext.+28 Int.)

COURSE OBJECTIVES:

This course is intended:

- To describe the experimental basis that culminated in the formation of quantum theory.
- To describe the dual nature of matter and radiation and the history of atomic models.
- To present elementary understanding of quantum mechanics and its application to simple systems.
- To introduce students to atomic, molecular, and nuclear structures and processes.
- To stimulate analytical and conceptual abilities required for higher studies in higher physics.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- Explain major experiments that laid the basis for quantum physics.
- Describe the wave-particle duality and apply it to practical phenomena.
- Use Schrödinger's equation to solve simple problems and interpret quantum mechanical outcomes.
- Describe atomic structure from quantum mechanical models and predict spectral characteristics.
- Describe molecular bonding, energy levels, and diatomic molecule spectra.
- Describe nuclear properties, types of radioactive decay, and the physics underlying nuclear reactions and energy generation.

COURSE CONTENTS:

UNIT-I

Review of electromagnetic waves – Planck's hypothesis and blackbody radiation – Photoelectric effect and Einstein's explanation – Compton effect – de Broglie matter waves – Davisson and Germer experiment – Heisenberg's uncertainty principle and its implications – Bohr's model of hydrogen atom – Energy levels and spectral lines – Limitations of Bohr's model – Vector atom model – Quantum numbers – Pauli's exclusion principle – Zeeman effect (qualitative).

UNIT-II

Introduction to wave mechanics – Time-independent Schrödinger equation – Wave function and probability interpretation – Elementary operators and expectation values – Postulates of quantum mechanics (brief overview) – Particle in one-dimensional box – Finite potential well (qualitative) – Quantum tunneling – Schrödinger equation for hydrogen atom (brief outline only) – Quantum numbers and energy levels – Probability density distribution – Selection rules and spin concept.

UNIT-III

Fine structure of spectral lines – Spin-orbit interaction – Stern-Gerlach experiment – Aufbau principle and periodic table – Hund's rules – Chemical bonding: ionic and covalent (qualitative treatment) – Hydrogen molecule: bonding and antibonding orbitals – Rotational and vibrational energy levels of diatomic molecules – Basics of electronic molecular spectra – Raman effect (qualitative).

UNIT-IV

Nucleus structure and properties: size, mass, binding energy – Nuclear stability and magic numbers – Radioactivity: alpha, beta and gamma decay – Radioactive decay laws – Half-life and mean life concept – Introduction to nuclear reactions – Q-value of a reaction – Fundamentals of nuclear fission and fusion – Uses of nuclear energy (nuclear reactors, fusion in stars) – Simple concepts of nuclear models (liquid drop model, shell model – qualitative).

RECOMMENDED BOOKS:

1. Arthur Beiser, Concepts of Modern Physics, Tata McGraw Hill, 6th Edition
2. H. S. Mani and G. K. Mehta, Introduction to Modern Physics, Affiliated East-West Press
3. David Halliday, Robert Resnick, and Jearl Walker, Fundamentals of Physics, Wiley
4. Paul A. Tipler and Gene Mosca, Physics for Scientists and Engineers, W.H. Freeman
5. Kenneth S. Krane, Modern Physics, Wiley
6. M. R. Wehr, J. A. Richards Jr., and T. W. Adair, Physics of the Atom, Narosa Publishing House.

SEMESTER-IV			
Course Code	IPHYMJBE0425	**Course Title**	Basic Electronics
Credits	04	**Lectures**	64
Course Type	MAJOR	**Assessment Marks**	100 (72: Ext.+28 Int.)

COURSE OBJECTIVES:

This course is intended:

- To introduce the fundamental concepts of semiconductors and electronic devices.
- To comprehend the operation of amplifiers, oscillators, and operational amplifiers.
- To acquire basic knowledge in digital logic and circuit design.
- To prepare students for higher-level courses in electronics and instrumentation.

COURSE OUTCOMES:

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

- Describe the operation of semiconductors and fundamental electronic devices.
- Analyze amplifier and oscillator circuits.
- Apply operational amplifiers in simple analog applications.
- Design and analyze basic digital logic and sequential circuits.

COURSE CONTENTS:

UNIT-I

Atomic structure and energy bands; solids classification. Intrinsic semiconductors: carrier concentration, mass action law, drift and diffusion currents, carrier lifetime. PN junction diode and its V-I characteristics. Rectifiers: half-wave, full-wave, and bridge. Zener diode: characteristics and voltage regulation. Bipolar junction transistor (CB and CE modes), transistor characteristics, h-parameters. JFET: input and output characteristics.

UNIT-II

CE amplifier: circuit and operation. Power amplifiers: class B and push-pull; efficiency analysis. Feedback in amplifiers: negative feedback and its effects. Conditions for oscillation: Barkhausen criterion. Oscillators: Hartley, Colpitts, and phase-shift – principle, circuit, and working.

UNIT-III

Differential amplifier and common mode rejection ratio (CMRR). Characteristics of ideal and practical op-amps. Virtual ground concept. Inverting and non-inverting amplifiers. Op-amp applications: adder, subtractor, integrator, differentiator, and unity gain buffer.

UNIT-IV

Number systems and conversions. Binary arithmetic and codes. Logic gates and Boolean algebra. Combinational circuits: adders, subtractors, multiplexers, encoders, and decoders. Sequential circuits: flip-flops (SR, D, JK, T), counters, and 4-bit shift registers including ring counter.

RECOMMENDED BOOKS:

1. Albert P. Malvino, Donald P. Leach, and Goutam Saha, Digital Principles and Applications, 8th Edition, 2015, McGraw Hill, India.
2. Adel S. Sedra, Kenneth C. Smith, and Arun N. Chandorkar, Microelectronic Circuits, 7th Edition, 2017, Oxford University Press, India.

3. Jacob Millman, Christos C. Halkias, and Satyabrata Jit, Electronic Devices and Circuits, 4th Edition, 2015, McGraw Hill, India.
4. Ben G. Streetman and Sanjay Kumar Banerjee, Solid State Electronic Devices, 7th Edition, 2018, Pearson Education, India.
5. Thomas L. Floyd, Digital Fundamentals, 11th Edition, 2017, Pearson Education, India.
6. M. S. Tyagi, Introduction to Semiconductor Materials and Devices, 2008, John Wiley & Sons Inc., India.
7. D. P. Kothari and I. J. Nagrath, Basic Electronics, 2nd Edition, 2017, McGraw Hill, India.

SEMESTER-IV			
Course Code	IPHMJMA0425	**Course Title**	Mathematical Physics-I
Credits	04	**Lectures**	64
Course Type	MAJOR	**Assessment Marks**	100 (72: Ext.+28 Int.)*

COURSE OBJECTIVES:

The emphasis of course is to equip students with the mathematical tools required in solving problem of interest to physicists. The mathematical tools might be building blocks to understand the fundamental analytical skills and hence enable them to solve a wide range of physics problems.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Apply Integrals to compute Inertia, Centre of Gravity, and volumes of different geometries in different coordinate systems.
- Understand the theory of matrices and using it to compute the eigenvalues, eigenvectors, diagonalization, and perform spectral decomposition and singular value decomposition.
- Understand basics of Vector calculus and application in physics.

COURSE CONTENTS:

UNIT-I

Double Integrals, Evaluation of Double Integral, in cartesian and in Polar Co-ordinates systems, Area in Cartesian and Polar Co-ordinates using double integrals, Integration by Change of Cartesian Coordinates into Polar Coordinates, calculation of moment of inertia of a Solids and Centre of Gravity using the double integration process.

Tripple integrations, Triple Integration in cartesian, cylindrical and spherical coordinate systems, Integration by Change of Cartesian Coordinates into Polar Coordinates, Volume in Cartesian and Polar coordinates using triple integrations, Volume of solids bounded by cylinder and cone.

UNIT-II

Vector Space, Subspace, Linear dependence and Independence, Basis and dimension of Vector Space, Inner Product, Orthogonality, Schwarz Inequality, Orthogonal basis, Change of basis (Orthogonal Transformations and Rotation), Gram-Schmidt orthogonalization procedure, Isomorphism of vector space, linear operators, Dual space, ket and bra notation, projection operator, Eigen values and Eigen functions.

UNIT-III

Matrices, Types of Matrices and their properties, Rank of a Matrix, Conjugate of a matrix, Adjoint of a matrix, Inverse of a matrix, Hermitian and Unitary Matrices, Trace of a matrix, Transformation of matrices - Characteristic equation, Eigen values and Eigen vectors, Cayley-Hamilton theorem, Diagonalization, Spectral Decomposition, Positive Definite. Normal and non-normal Matrices, singular value decomposition

UNIT-IV

Probability: Definitions and Simple properties. Random Variables (continuous and discrete), mean, variance, moments covariance, correlation. Marginal and conditional Probability distribution. Binomial, Poisson, and Gaussian Distribution, Mean and variance of these distributions. Limitations. Transformation of Random Variables. Error Propagation. Curve fitting. Chi squared and t-distribution. Confidence intervals.

RECOMMENDED BOOKS:

1. Mathematical Physics, H. K. Dass, and Rama Verma, ISBN-13, 8th edition, S Chand, Publications.
2. Mathematical Physics, Goswami, 1st edition, Cengage Learning.
3. Schaum's Outline of Linear Algebra – *Seymour Lipschutz*
4. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
5. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.

SEMESTER-IV			
Course Code	IPHYMJLB0425	**Course Title**	Lab. Based on 1,2, and 3
Credits	04	**Lectures**	64
Course Type	MAJOR	**Assessment Marks**	100 (72: Ext.+28 Int.)*

LIST OF PRACTICALS:

1. Study of V-I characteristics of a PN junction diode
2. Zener diode characteristics and voltage regulation
3. Verification of Half-wave and Full-wave Rectifiers
4. Input and output characteristics of a BJT in CE configuration
5. Study of Class B Push-Pull Amplifier
6. Design and implementation of a Hartley or Colpitts Oscillator
7. Characteristics of a JFET (transfer and drain characteristics)
8. Inverting and non-inverting amplifier using Op-Amp
9. Op-Amp as Integrator and Differentiator
10. Adder and Subtractor circuits using Op-Amp
11. Verification of logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR)
12. Boolean expression simplification and implementation
13. Implementation of Half-Adder and Full-Adder circuits
14. Study of Flip-Flops (SR, D, JK) using ICs.
15. Study of Photoelectric Effect using photocell
16. Determination of Planck's Constant using LEDs
17. Determination of Wavelength using Diffraction Grating using sodium lamp
18. Observation of Hydrogen Spectrum (Balmer Series) using hydrogen discharge tube
19. Study of e/m Ratio using Thomson's Method
20. To determine the value of e/m by helical methods.
21. Laser Diffraction through Single/Double Slit using diode laser
22. Determination of Laser Wavelength using diode laser
23. Observation of Zeeman Effect
24. Millikan Oil Drop Experiment
25. Study of Atomic Emission using Gas Discharge Tubes (Neon, Hydrogen)
26. Study of Photo-electric effect: Photo current versus intensity and frequency of light; maximum energy of photo-electrons versus frequency of light.
27. Calculate moment of inertia of a square or semicircular lamina using double integrals.
28. Perform SVD on a 2×2 or 3×3 matrix, using Matlab.

29. Generate Gaussian random numbers and plot PDF determine the Mean, variance, and central limit theorem.

RECOMMENDED BOOKS:

1. B.Sc. Practical Physics, C.L. Arora, S. Chand and Company Limited.
2. A textbook of Practical Physics, Indu Prakash, Ramakrishna, Kitab Mahal, New Delhi.

SEMESTER-IV			
Course Code	IXXXMNPS0425	**Course Title**	Plane and Solid Geometry
Credits	04	**Lectures**	64
Course Type	MINOR	**Assessment Marks**	100 (72: Ext.+28 Int.)

COURSE OBJECTIVES:

The primary objectives of this course are to:

- Introduce the fundamental concepts of plane and solid geometry.
- Develop spatial visualization skills and geometric reasoning.
- Analyze and solve geometrical problems involving two-dimensional and three-dimensional figures.
- Understand the properties of lines, angles, triangles, circles, polygons, and conic sections in the plane.
- Explore the geometry of 3D solids like cubes, spheres, cylinders, cones, and polyhedra.
- Apply geometric concepts in real-world and mathematical contexts.

COURSE OUTCOMES:

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

- Understand and apply geometric properties of parabolas and ellipses, including tangents, normals, polars, and parametric equations.
- Analyze hyperbolas and general second-degree equations, and trace standard conic sections.
- Solve problems involving planes, spheres, and cones using their standard equations and geometric properties.
- Examine cylinders and conicoids, and determine tangents, normals, and characteristic features of central conicoids.

COURSE CONTENTS:

UNIT-I

Parabola: Equation of tangent and normal, pole and polar, equation of chord in terms of middle point, parametric equation of parabola.

Ellipse: Tangents and normal's, pole and polar, parametric equation of ellipse, diameter and conjugate diameter.

UNIT-II

Hyperbola: Tangents and normals, equation of hyperbola referred to asymptotes as axes, rectangular and conjugate diameter, tracing of conics. General second-degree equation in x and y.

UNIT-III

Plane: Equation of plane, bisectors of angle between two planes, joint equation of planes, volume of tetrahedron. Sphere: Equation of sphere, condition for two spheres to be orthogonal.

Cone: Definition of cone, equation of cone, condition for general second-degree equation represents a cone, necessary and sufficient conditions for a cone to have three mutual perpendicular generators.

UNIT-IV

Cylinder: Equation of cylinder, enveloping cylinder of a sphere, central concoids. Tangent lines and tangent planes, normal to conicoid at a point on it, normal from a point to conicoid, shapes and features of the three central coincides, diametric planes.

RECOMMENDED BOOKS:

1. Coordinate Geometry of Conics, M R Puri. Kapoor publications
2. Solid Geometry, M R Puri. Kapoor publications.

3. Coordinate Geometry, Ram Ballabh, Malhotra Publications.
4. Coordinate Geometry of two- and three-dimension, P Balasubrahamanyam, G R Venkataraman.
5. Analytical Solid Geometry, Shanti Narayan. S Chand and Sons.

SEMESTER-V			
Course Code	IPHYMJQM0525	**Course Title**	Quantum Mechanics-I
Credits	04	**Lectures**	64
Course Type	MAJOR	**Assessment Marks**	100 (72: Ext.+28 Int.)*

COURSE OBJECTIVES:

The emphasis of course is to understand the basics and to:

- Introduce the foundational concepts of quantum mechanics.
- Develop understanding of quantum behavior through solvable models.
- Apply mathematical formalism to basic quantum systems.
- Build problem-solving skills using quantum principles.

COURSE OUTCOMES:

After completing this course, students will be able to:

- Explain core principles like wave-particle duality and uncertainty principle.
- Solve the Schrödinger equation for simple potentials.
- Analyze 1D and central potential quantum systems.
- Understand quantum angular momentum and hydrogen atom structure.

COURSE CONTENTS:

UNIT-I:

Wave-particle duality and the double-slit experiment. de Broglie hypothesis, phase and group velocity. Davisson-Germer experiment. Heisenberg's uncertainty principle and derivations. Introduction to quantum measurement. Postulates of quantum mechanics. Operators for position, momentum, and energy. Commutation relations and Hermitian operator properties.

UNIT-II:

Interpretation of the wave function and continuity equation. Time-independent Schrödinger equation in one dimension. Stationary states, eigenvalues, and eigenfunctions. Generalized uncertainty principle. Symmetry and antisymmetric of wavefunctions. Identical particles. Quantum observables and measurement outcomes.

UNIT-III:

Free particle and box normalization. Particle in an infinite and finite square well. Step potential and potential barrier: reflection, transmission, and tunneling. Barrier penetration and quantum tunneling. Periodic potentials and energy bands (qualitative). Simple harmonic oscillator: solution via differential and ladder operator methods.

UNIT-IV:

Separation of variables in spherical coordinates. Angular momentum operators, commutation relations and quantization. Spherical harmonics and space quantization. Hydrogen atom: Schrödinger equation for central potential, energy eigenvalues, quantum numbers. Ground state wavefunction and probability density. Degeneracy and parity.

RECOMMENDED BOOKS:

1. David J. Griffiths, INTRODUCTION TO QUANTUM MECHANICS, 2nd Edition, Pearson Education, 2004.
2. A. Ghatak and S. Lokanathan, QUANTUM MECHANICS: THEORY AND APPLICATIONS, Springer, 2004.

3. Mathews and Venkatesan, A TEXTBOOK OF QUANTUM MECHANICS, 2nd Edition, McGraw-Hill India, 2010.
4. Nouredine Zettili, QUANTUM MECHANICS: CONCEPTS AND APPLICATIONS, 2nd Edition, Wiley, 2009.
5. **S. Gasiorowicz**, QUANTUM PHYSICS, 3rd Edition, Wiley, 2003.
6. **R. Shankar**, PRINCIPLES OF QUANTUM MECHANICS, 2nd Edition, Springer, 2012.
7. **L.I. Schiff**, QUANTUM MECHANICS, 3rd Edition, McGraw-Hill, 1968.

SEMESTER-V			
Course Code	IPHYMJSP0525	**Course Title**	**Statistical Physics**
Credits	04	**Lectures**	64
Course Type	Major	**Assessment Marks**	100 (72: Ext.+28 Int.) *

COURSE OBJECTIVES:

This is a preparatory course for statistical mechanics. Therefore, it will cover concepts, such as probability/types of particle statistics, that will make the student grasp concepts of statistical mechanics, such as ensemble theory, more easily.

COURSE OUTCOMES:

- A student will learn about probability distributions and how to compute mean, variance, and other higher-order moments and cumulants of a distribution.
- The course will also teach the student the three distributions ubiquitous in physics and how to use Stirling's approximation.
- A student will understand three types of particle statistics by using a basic counting method.
- Concepts of equilibrium from a statistical perspective will be clear
- A student will be familiar with the partition functions and their use to solve for expectation values of macroscopic variables.
- Ideas of Entropy and their connections–Boltzmann and Gibbs Entropy will be clear.
- Partition function for the standard systems (Harmonic oscillator, free particle) will be known.

COURSE CONTENTS:

UNIT-I

Probability: Principles of counting (Permutation and Combinations), Probability distributions (Discrete and Continuous), Mean, Variance, Standard deviation, Moments and Moment generating function, Cumulants

and Cumulant generating function, Standard probability distributions: Binomial distribution, Poission Distribution, and Gaussian distribution with physical examples, Definition of Shanon Entrop for a distribution, Stirling approximation, Poission Distribution and Gaussian Distribution as limits of Binomial distribution.

UNIT-II

Particle Statistics: Microstates and Macrostates, Equally probable microstates, Equilibrium as most probable macrostate, Microstate counting for distinguishable particles and indistinguishable particles(bosons

and fermions). Boltzmann Entropy, Maxwell-Boltzmann distribution, Bose-Einstein distribution, and Fermi-Dirac distribution via maximization of the number of microstates.

UNIT-III

Classical Ideal Gas, RMS speed, mean square speed, most probable speed, Equipartition of energy, Internal energy and Specific heat of monatomic, diatomic and triatomic gases, Boltzmann entropy, Free

energy and pressure Quantum Ideal Gases Free Fermi Gas and Bose Gas, and their features such as Fermi level, Fermi degeneracy pressure, and Bose-Einstein condensate (qualitative only).

UNIT-IV

Gibbs distribution via maximization of Shannon Entropy with average energy constraint, Gibbs Entropy, Partition function, Average energy, specific heat as derivatives of partition function, Application

of partition function: Free particle (Average energy, specific heat, Gibbs Entropy), Classical and qunatum harmonic oscillator (Average energy, specific heat, Gibbs Entropy), classical spin in a magnetic

field (average energy, average magnetization, Gibbs entropy), quantum spin S particle in a magnetic field

(average energy, average magnetization, Gibbs Entropy), Equivalence of Boltzmann entropy and Gibbs Entropy (proof only at zero temperature).

RECOMMENDED BOOKS:

1. Statistical Physics by Tony Gu´enault
2. An Introduction to Thermal Physics by Daniel V. Schroeder
3. Thermal Physics by Charles Kittel and Herbert Kroemer
4. Statistical Mechanics, Kerson Huang (2ndEdition, Wiley-India, 2008).
5. Statistical Mechanics, R.K. Pathria (Butterworth-Heinemann, 1965).
6. Mathematical Methods, Arfken and Weber.

SEMESTER-V			
Course Code	IPHYMJSS0525	**Course Title**	Solid State Physics-I
Credits	04	**Lectures**	64
Course Type	MAJOR	**Assessment Marks**	100 (72: Ext.+28 Int.)*

COURSE OBJECTIVES:

The emphasis of course is to understand the basics of solid-state physics, the crystal structure concept and the thermal and electrical properties of solid.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Have a brief idea about crystalline and amorphous solids.
- Acquire knowledge about X-ray diffraction, Bragg's law.
- Understand the reciprocal lattice of different crystal structure.
- Analyze the concept of free electron gas model in solids.
- Density of states in one, two and three dimensions of fermions and bosons.

COURSE CONTENTS:

UNIT-I

Amorphous and Crystalline Materials. Periodicity in Crystal: Translational Vector, Lattice. Basis and Crystal Structure. Unit Cell and type of unit cell. Number of lattices point per unit cell. Symmetry Elements. Bravais Lattice in 2D and in 3D. Miller Indices: Plane, Family of Plane and Interplaner Spacing in term of Miller indices. Crystal Structure (Simple Cubic, Body Centre Cubic, Face Centre Cubic)

UNIT-II

Diffraction of X-rays by Crystals. Bragg's Law. Reciprocal Lattice: Reciprocal Lattice of SC, BCC, FCC, properties of reciprocal lattice. Ewald's construction (geometrical approach), Brillouin zones.

Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons.

UNIT-III

Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. Elementary band theory: Bloch Theorem, Kronig Penny model. Brillouin Zones. Formation of bands in solids, concept of effective mass.

UNIT-IV

Free electron gas model, Energy levels and density of states in one, two and three dimensions, Fermi momentum, Fermi energy, Fermi temperature, Effect of temperature, heat

capacity of electron gas (explicit calculation), Experimental heat capacity of metals, Concept of thermal effective mass, Electrical conductivity and Ohm's law, Experimental resistivity of metals, Matthiessen's rule, Motion in magnetic fields and Hall effect, Thermal conductivity of metals and Wiedmann-Franz law.

RECOMMENDED BOOKS:

1. Solid State Physics by S. O. Pillai, New Age International Publisher, New Delhi.
2. Introduction to Solid State Physics by C. Kittel, Wiley India Pvt. Ltd.
3. Solid State Physics by R. K. Puri, V.K. Babbar, S. Chand & Co. New Delhi.
4. Fundamentals of Solid-State physics by Saxena, Gupta, Pragati Prakashan Meerut.
5. Essentials of Solid State physics by S.P.Kuila, New Central Book Agency.

SEMESTER-V			
Course Code	IPHYMJLB0525	**Course Title**	Lab. Based on 1,2, and 3
Credits	04	**Lectures**	64
Course Type	MAJOR	**Assessment Marks**	100 (72: Ext.+28 Int.)

LIST OF PRACTICALS:

1. To determine Hall coefficient and mobility of a given semiconductor.
2. To measure the resistivity of a semiconductor (Si/Ge) with temperature by four probe method.
3. To determine conductivity of given semiconductor crystal using four probe method.
4. To measure the magnetic susceptibility of Solids.
5. Energy band gap in semiconductor using a PN junction diode.
6. Specific resistance and energy gap of a semiconductor by four probe method.
7. To measure the Coupling Coefficient of a piezoelectric crystal.
8. To measure the dielectric constant of a dielectric material with frequency.
9. To study the PE Hysteresis loop of a Ferroelectric crystal.
10. To determine the dielectric constant of paper.
11. To find the polarizability of a dielectric substance.
12. To determine the dielectric constant by charging and discharging of parallel plate capacitor.
13. Study of radiation using a GM counter (alpha, beta, gamma identification).
14. Measurement of background radiation levels in the local environment.
15. Verification of inverse square law using gamma source (low activity).
16. Counting statistics and decay law verification.
17. Half-life determination of a weak source (e.g., protactinium generator simulation).
18. Radiation shielding effectiveness with different materials.
19. Range of alpha particles in air using spark counter or simulation.
20. Plot spherical harmonics $Y^{l}_{m}(\theta,\varphi)$ for different l, m using Python/Matlab.
21. Plot $|\psi nlm(r, \theta,\varphi)|2$ for different quantum numbers of ground state and excited states using Python/Matlab.
22. Study of Probability distributions of dice.
23. Experimental study of Brownian motion using a Microscope.
24. Plot and analyze the Binomial distribution and Poisson distribution and evaluate the Mean, variance, standard deviation using Python/Matlab.
25. Plot Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac distributions, for different temperatures and energy levels using Matlab/Python.
26. For a system (free particle, harmonic oscillator, spin system), compute, the Partition function , Average energy, Specific heat, Gibbs Entropy using Python/Mathematia.

RECOMMENDED BOOKS:

1. B.Sc. Practical Physics, C.L. Arora, S. Chand and Company Limited.
2. A textbook of Practical Physics, Indu Prakash, Ramakrishna, Kitab Mahal, New Delhi.

SEMESTER-V			
Course Code	IXXXMNAL0525	**Course Title**	Algebra
Credits	04	**Lectures**	64
Course Type	MINOR	**Assessment Marks**	100 (72: Ext.+28 Int.)*

COURSE OBJECTIVES:

The objective of this course is to:

- Introduce the fundamental structures and concepts of abstract algebra.
- Develop a deep understanding of algebraic systems such as groups, rings, and fields.
- Foster the ability to reason abstractly and construct logical mathematical arguments.
- Explore the applications of algebraic structures in various areas of physics and research.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Understand basic algebraic structures and identify examples of groups.
- Apply subgroup concepts and homomorphisms to analyze group structures.
- Describe and work with permutation and classical matrix groups.
- Understand ring structures, ideals, and polynomial rings with examples.

COURSE CONTENTS:

UNIT-I

Sets and mappings, binary operations, and algebraic structures, equivalence relations and equivalence classes, congruence class of integers modulo n, Definition of binary operation and examples. Definition of group, examples including matrices, permutation groups, groups of symmetry, roots of unity. First properties of a group, laws of exponents, finite and infinite groups.

UNIT-II

Subgroups and cosets, order of an element, Lagrange's theorem. Normal subgroups, quotient groups. Cyclic groups, Subgroups and quotients of cyclic groups. Finite and infinite cyclic groups. Homomorphisms, kernel and image, isomorphism, homomorphism theorems.

UNIT-III

Permutation Groups: Cycles and Transpositions, Alternating maps and Alternating Groups, General Linear Groups, Special Linear Groups. Classical Groups: Sympletic Groups, Unitary Groups.

UNIT-IV

Definition of ring, examples including congruence classes mod n. Properties of rings. Integral domains, division rings and fields with examples. Homomorphisms and Isomorphisms. Subrings and ideals and Isomorphism theorems. Polynomial Ring.

RECOMMENDED BOOKS:

1. Algebra-I, Ramji Lal, Springer.
2. Topics in Algebra, I.N. Herstien, John Wiley.
3. Basic Abstract Algebra, P B Bhattacharya, S K Jain, S R Nagpaul: Cambridge.
4. Algebra, M. Artin, Prentice Hall of India.

5. Abstract Algebra, D.S Dumit and R.M. Foote, John Wiley.
6. Abstract Algebra, Joseph Gallian Narosa.
7. Basic Algebra I, N. Jacboson, Hindustan Publishing Corporation.
8. University Algebra, N.S Gopal Krishnan, New Age Internationals.
9. Modern algebra, Surjeet Singh and Qazi Zameerudin, New Age Internationals.

SEMESTER-VI			
Course Code	IPHYMJOL0625	**Course Title**	Optics and Laser Physics
Credits	04	**Lectures**	64
Course Type	MAJOR	**Assessment Marks**	100 (72: Ext.+28 Int.)

COURSE OBJECTIVES:

This course reviews the concepts of optics and laser Physics. The students will learn the basic laws and principles of optics. The students are envisioned with a fundamental understanding of light and its interactions with matter, including the principles of optics, lasers, and their applications.

COURSE OUTCOMES:

After taking this course, the students will have the understanding of the following core concepts and their applications to real physical systems

- Concepts of polarization of light and its production and analysis.
- Phenomena of interference and diffraction of light and their applications.
- Basic of Laser and its applications.

COURSE CONTENTS:

UNIT-I

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

An overview of Ray Optics: Fermat's Principle and its applications. The Ray Equation and its solutions. Ray Optics as a limiting Case of Wave Optics.

Polarization of Light: Plane, polar and elliptical polarization – Production and analysis. Matrix formulation of linearly polarised light. Jones Vector and Jones matrix.

UNIT-II

Interference of light: 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). Visibility of Fringes.

Newton's Rings: Measurement of wavelength and refractive index. Interferometer: Michelson-Interferometer. Fabry-Perot interferometer.

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

UNIT-III

Diffraction: Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula. (Qualitative discussion only) Fraunhofer diffraction: Single slit. Circular aperture, Double slit. Multiple slits. Diffraction grating. Resolving power of grating.

Fresnel Diffraction: 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.

UNIT-IV

Lasers: Spontaneous and Stimulated emissions of Light. Einstein's A and B coefficients. Metastable states.

Optical Pumping and Population Inversion: Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser.

Shape and width of spectral lines. Line broadening mechanism (Natural, Collision and Doppler broadening).

Dynamics of the Laser Processes: Rate equations for two, three and four level systems, production of a giant pulse – Q switching, mode-locking.

RECOMMENDED BOOKS:

1. Optics by Ajoy Ghatak, McGraw Hill
2. Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
3. Principles of Optics, Max Born and Emil Wolf, Pergamon Press.
4. Geometrical and Physical Optics by P. K. Chakrabarti
5. Fundamental of Optics, A. Kumar, H.R. Gulati and D.R. Khanna, 2011, R. Chand Publications.
6. Optics by Eugene Hecht and A R Ganeshan, Pearson Publication.

SEMESTER-VI			
Course Code	IPHYMJMA0623	**Course Title**	Mathematical Physics-II
Credits	04	**Lectures**	64
Course Type	MAJOR	**Assessment Marks**	100 (72: Ext.+28 Int.)

COURSE OBJECTIVES:

The emphasis of course is to equip students with the mathematical tools required in solving problem of interest to physicists. The mathematical tools and their use constitute fundamental analytical skills that students possess to solve physical problems.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Understand basics of series Expansions and its uses.
- Understand basics of special function that are important for several problems in physics.
- Understand the complex numbers and Integral transforms.

COURSE CONTENTS:

UNIT-I

Periodic functions. sine and cosine functions, Orthogonality property of sine and cosine function. Expansion of periodic functions in series of sine and cosine functions. Complex representation of Fourier series. Even and odd functions and their Fourier expansions. Complex Fourier series, Parseval's theorem. Application.

Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations.

UNIT-II

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

Partial Differential Equations: Solutions to partial differential equations, using separation of variables. Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry.

UNIT-III

Brief Revision of Complex Numbers. and their Graphical Representation. Euler's formula, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singularities, Multivalued, branch points, branch cuts. Integration: Integration of a function of a complex variable, Simply and multiply connected region. Cauchy's Inequality, Cauchy's Integral formula. Laurent and Taylor's expansion. Residues and Residue Theorem.

UNIT-IV

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. Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.). Laplace Transformations: Properties of Laplace Transform, Laplace Transform of the Derivative of f(t), t.f(t) and 1/t F(t). Inverse Laplace Transform, Inverse Laplace Transform of Derivative and Integral.

RECOMMENDED BOOKS:

1. Advanced Engineering Mathematics by Erwin Kreyszig, John Willey.
2. Mathematical Physics by H.K. Dass, S. Chand
3. Mathematical Methods for Physicists, by Arfkeen, Weber and Harris, Elsevier.

4. Complex Variables, A.K. Kapoor, 2014, Cambridge Univ. Press. First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett.

SEMESTER-VI			
Course Code	IPHYMJLB0625	**Course Title**	Lab. Based on 1,2
Credits	04	**Lectures**	64
Course Type	MAJOR	**Assessment Marks**	100 (72: Ext.+28 Int.)

LIST OF PRACTICAL

1. To determine the refractive index of the material of a prism using spectrometer.
2. To determine the wavelength of Hg source using Michelson's interferometer.
3. To determine the particle size using He Ne laser.
4. To determine the resolving power of a prism.
5. To measure power distribution and divergence parameters of He-Ne and Semiconductor System lasers.
6. To determine the spectral lines of Hg source using plane diffraction grating.
7. To determine the wavelength of Laser light using Diffraction of Single Slit.
8. To determine the resolving power of a plane diffraction grating.
9. To determine wavelength of sodium light using Newton's Rings apparatus
10. To measure the optical activity of sugar solution using a Polarimeter.
11. To determine wavelength of sodium light using Fresnel Biprism.
12. Fourier Transform of given function e.g. exponential, trigonometric etc. using Python/Matlab programming.
13. Compute and plot Fourier series of a square wave, sawtooth wave, or triangular wave using Python/Matlab programming.
14. Plot Legendre, Bessel, Hermite, and Laguerre functions for different orders using Python/Mathematica.
15. Use any numerical method to solve Laplace equation/ wave equation/ Heat Equation.
16. Generating and plotting Legendre Polynomials.
17. Generating and plotting Bessel function.

SEMESTER-VI			
Course Code	IXXXMNNT0625	**Course Title**	Numerical Techniques
Credits	04	**Lectures**	64
Course Type	MINOR	**Assessment Marks**	100 (72: Ext.+28 Int.)

COURSE OBJECTIVES:

The objectives of this course are to understand the numerical methods to solve problems involving root finding, Interpolations, Integration, differentiation, and differential equation. In addition, analyse the accuracy, stability, and efficiency.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

- Apply numerical methods to find approximate solutions to algebraic and transcendental equations.
- Use interpolation techniques to estimate function values and analyze data.
- Solve systems of linear equations using direct and iterative methods.
- Perform numerical differentiation and integration with an understanding of associated errors.
- Solve ordinary differential equations numerically using suitable algorithms.
- Analyze the convergence, stability, and error propagation in numerical algorithms.
- Apply numerical techniques to model and solve real-world scientific and engineering problems.

COURSE CONTENTS:

UNIT-I

Introduction to numerical methods, Bisection method, Method of False position, Secant method, Method of iterations, Newton-Raphson method, Convergence of iteration methods, Solution of system of linear algebraic equations: Dircet methods, Matrix inverse method, Gaussian elimination method, Gauss Jacobi, Eigen value problem.

UNIT-II

Finite difference operators: Backward, Forward and Central difference operators, Shift operator, Relation between operators, Interpolations with equal and unequal intervals, Newton's forward interpolation formula, Lagrange's and Hermite interpolation formula, Linear and quadratic spline interpolations.

UNIT-III

Numerical differentiation, Formulae for derivatives, Derivative using Newton's forward interpolation formula, Difference interpolating formula, Maxima and minima of tabulated functions.
Numerical integration, Trapezoidal rule, Simpson's one-third rule, Errors in numerical integration formula.

UNIT-IV

Numerical solution for the initial value problems for ODE'S, Taylor's series method, Euler's method, Runge-Kutta Method, Picard's method of successive approximations, Boundary value problems in PDE's,Finite difference methods for solution, Classification of second order PDE's, Finite difference approximations for partial derivatives, Solution of one-dimensional Laplace, Heat and Wave equation

RECOMMENDED BOOKS:

1. M. K. Jain, S. R. K. Iyengar, R. K. Jain, Numerical methods for scientific and engineering computation, New Age International Publishers.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI Learning.

3. B.S. Grewal, Numerical methods in engineering & science, KHAN NAPUBLISHERS. wave equations