Mahatma Education Society's

Pillai HOC College of Arts, Science & Commerce (Autonomous)

Rasayani

Affiliated to University of Mumbai
NAAC Accredited with "A+" Grade in cycle II
ISO 9001:2015 Certified

SYLLABUS

Bachelors of Science (B. Sc.)

F. Y. B. Sc.

As per National Education Policy 2020

Academic Year 2026-27

Mahatma Education Society's

College Code: 870

PILLAI HOC COLLEGE OF ARTS, SCIENCE & COMMERCE

Pillai HOCL Educational Campus, HOC Colony, Rasayani, Via. Panvel, Dist. Raigad. Pin 410207

Tel: 02192 - 669000 / 01 / 02 / 03 / 04 / 05 / 06 / 07 / 08 / 09 *Website : www.phcasc.ac.in Email : phcasc@mes.ac.in*

(NAAC Accredited 'A+' Grade , CGPA – 3.26 in Cycle 2 & ISO 9001:2015 Certified)

Affiliated to the University of Mumbai, Approved by Government of Maharashtra

(AUTONOMOUS COLLEGE)

PHCASC/116/BoS/25-26

March 27, 2026

ATTENDANCE SHEET

Meeting of Board of Studies
Natural and Physical Sciences

A meeting of members of the Board of Studies of **Natural and Physical Sciences** for the term I of the Academic Year 2026-27 is scheduled on Friday, 27th March 2026 at 11.30 am in Conclave I, Pillai HOCL Educational campus. The meeting is presided by Dr. Richa Chauhan, Chairperson, to discuss the agenda mentioned below. Following members are present for the meeting.

Sr. No	Name	Category	Signature
1	Dr. Dinesh Navale	Expert nominated by the Vice-Chancellor	
2	Ms. Komal Kamble	Subject experts from outside the parent University	
3	Dr. Anand K Singh	Subject experts from outside the parent University	Dr. Anand Singh
4	Dr. Bapu Gawade	Industry representative	
5	Mr. Rushikesh Ghodvinde	College Alumnus	
6	Dr. Rinkoo Shantnu	Principal	
7	Dr. Richa Chauhan	Chairperson	
8	Ms. Remya MG	Member (Env. Sci.)	
9	Dr. Archana Bhagwat	Member (Chemistry)	
10	Dr. Sulochana Bhalekar	Member (Chemistry)	

11	Dr. Vineetha P	Member (Physics)	
12	Ms. Komal Gunjal	Member (Chemistry)	
13	Ms. Shruti C. Hogale	Member (Physics)	Shruti C. Hogale
14	Ms. Juilee Shirke	Member (Physics)	

Dr. Richa Chauhan

Chairperson

Dr. Rinkoo Shantnu

Principal

M.E.S. PILLAI HOC COLLEGE OF ARTS, SCIENCE AND COMMERCE (AUTONOMOUS) RASAYANI

1. Introduction

A **B.Sc. in Physics, Chemistry, and Mathematics** is a three-year undergraduate program designed to build a strong foundation in scientific principles while connecting theoretical understanding with practical experimentation. The program aims to develop a deep insight into the laws of nature, chemical processes, and mathematical reasoning, equipping students with interdisciplinary scientific competence.

In F.Y. B.Sc., the curriculum is comprehensive and integrates core concepts from physics, chemistry, and mathematics, along with their modern applications in research, industry, and technology. Students develop key abilities throughout the course:

1. **Scientific Inquiry and Problem-Solving**
   Students learn to approach scientific problems analytically, interpret experimental data, and design solutions using logical and quantitative reasoning. This strengthens their ability to understand and investigate natural phenomena.
2. **Technical and Laboratory Proficiency**
   The program provides extensive exposure to laboratory techniques, mathematical modelling, computational tools, and experimental methods. Students gain practical experience in areas such as spectroscopy, thermodynamics, quantum mechanics, material science, mathematical analysis, and applied statistics.
3. **Innovation, Research Orientation, and Professionalism**
   Learners are encouraged to stay updated with emerging developments in sciences, fostering curiosity, scientific thinking, and innovative approaches. The program instils professionalism through teamwork, research projects, and ethical scientific practices.

This interdisciplinary training prepares graduates for diverse scientific careers, higher studies, research opportunities, and roles in industry. It also empowers students to explore entrepreneurial ventures in science-based fields, supported by strong academic guidance, placement assistance, and exposure to modern advancements across physics, chemistry, and mathematics.

Programme Outcomes (POs)

PO. No.	PO Title	POs in brief
PO1	**Fundamental Knowledge Acquisition**	Graduates will demonstrate a comprehensive and foundational knowledge of their chosen discipline along with an awareness of interdisciplinary connections.
PO2	**Critical Thinking and Analytical Reasoning**	Graduates will be able to analyse complex problems, synthesize data from multiple sources (qualitative and quantitative), and employ logical reasoning to formulate well-supported conclusions and arguments.
PO3	**Effective Communication**	Graduates will exhibit proficiency in both written and oral communication, articulating ideas clearly, persuasively, and ethically to diverse audiences
PO4	**Problem Solving**	Graduates will possess the ability to identify, formulate, and design solutions for real-world problems in their professional or social contexts, applying relevant theoretical knowledge and practical skills.
PO5	**Information and Digital Literacy**	Graduates will demonstrate the capability to locate, evaluate, and effectively use information from various sources, and utilize modern tools and Information and Communication Technology (ICT) for professional and academic tasks.
PO6	**Research Skills and Scientific Temperament**	Graduates will develop a sense of inquiry and research methodology, including the ability to design experiments (where applicable), collect and analyse data, and interpret results while maintaining scientific rigor and intellectual honesty.
PO7	**Ethical Reasoning and Professional Integrity**	Graduates will recognize ethical dilemmas, commit to professional and academic ethics, and demonstrate an understanding of moral and social responsibilities in their personal and professional conduct.
PO8	**Employability and Professional Skills**	Graduates will acquire the necessary job-ready skills, managerial competencies, and professional values to secure gainful employment or pursue advanced education in their respective fields.
PO9	**Environmental and Sustainability Consciousness**	Graduates will understand the importance of environmental conservation and sustainable development, displaying responsibility toward ecological challenges and advocating for healthy environmental practices.
PO10	**Life-Long Learning**	Graduates will develop the capacity for independent and self-directed learning to continuously upgrade their knowledge and skills, enabling them to adapt to rapid technological and societal changes.
PO11	**Civic and Social Responsibility**	Graduates will act as responsible citizens with an informed awareness of constitutional values, engaging proactively in community development and addressing social needs.
PO12	**Empathy and Social Intelligence**	Graduates will be able to cultivate and demonstrate affective, interpersonal, social and emotional intelligence.

Programme Specific Outcomes (PSOs)

PSOs. No.	PSO Title	PSOs in brief
PSO1	**Advanced Learning and Research Capabilities for Physical Sciences**	To develop analytical skills for real-world problem solving, gain familiarity with recent scientific and technological developments, enhance learning through practical activities and projects, and acquire fundamental knowledge of optics.
PSO2	**Holistic Educational Framework for Building Foundational and Professional Competence in Chemistry**	To understand fundamental principles of inorganic, organic, and physical chemistry; foster continuous learning and scientific curiosity; explore career paths in chemistry-related fields; and apply foundational skills to entry-level roles in relevant industries.
PSO3	**Integrated Framework for Mathematical Knowledge, Analytical Skills, and Global Awareness**	To develop a strong understanding of fundamental mathematical principles and methods, and to use them effectively in modelling, solving, and interpreting real-world problems. To build mathematical tools for advanced study across scientific fields, and to enhance overall growth through problem-solving skills, modelling abilities, creativity, and communication. To provide students with exposure to global and local issues related to the mathematical sciences.
PSO4	**Teamwork, Project Management & Lifelong Career Growth**	Graduates will work effectively both independently and in teams, conduct scientific investigations and research projects efficiently, and pursue continuous learning to excel in higher studies, research, and emerging opportunities in science and technology.

Evaluation Pattern

Marking Code	Marking Scheme
A	50 Marks Semester End Exam, 50 Marks Continuous Assessment (distributed within 15 Marks Class Test, 15 Marks Presentation & Assignment, 10 Marks Online Quiz, 10 Marks Attendance & Class Participation)
B	50 Marks Semester End Exam
C	100 marks Continuous Assessment (distributed within 30 Marks Class Test, 30 Marks Presentation & Assignment, 30 Marks Online Quiz, 10 Attendance & Class Participation)
D	50 Marks of Continuous Assessment (distributed within 15 Marks Class Test, 15 Marks Presentation & Assignment, 10 Marks Online Quiz, 10 Marks Attendance & Class Participation)
E	50 Marks Practical Examination (distributed within 30 Marks Practical Module 1 & 2, 10 Marks Journal, 10 Marks Viva)

Course Structure

Semester I							
Course Code	**Course Type**	**Course Title**	**Theory/ Practical**	**Marks**	**Credits**	**Lectures/ Week**	**Evaluation Pattern**
HUSPH101	Major	Mechanics And Mathematical Physics	Theory	100	2	2	A
HUSPH101P	Major - Practical	Practical (HUSPH101)	Practical	50	1	2	E
HUSCY102	Major	Basics In Physical, Inorganic and Organic Chemistry I	Theory	100	2	2	A
HUSCY102P	Major - Practical	Practical (HUSCY102)	Practical	50	1	2	E
HUSMT103	Major	Algebra-I And Calculus-I	Theory	100	2	2	A
HUSMT103P	Major - Practical	Practical (HUSMT103)	Practical	50	1	2	E
HUSDI104	SEC	Digital Literacy and ICT Applications	Theory	100	2	2	A
HUSDI104P	SEC - Practical	Practical (HUSDI104)	Practical	50	1	2	E
HUSIK105	IKS	Traditional Indian Sciences and Their Relevance	Theory	50	2	2	D
HUAEC101	AEC	Communication Skills in English	Theory	50	2	2	D
HUVEC101	VEC	Fundamentals Of Social and Emotional Skills	Theory	100	3	3	C
HUOE101	OE	Content Writing	Theory	100	3	3	C
Total				**900**	**22**		**

Abbreviations:

SEC: Skill Enhancement Course
AEC: Ability Enhancement Course
VAC: Value Added Course
VEC: Value Education Course
IKS: Indian Knowledge System
OE: Open Elective

SEMESTER I

BOS	**NATURAL AND PHYSICAL SCIENCES**				
Course	**MECHANICS AND MATHEMATICAL PHYSICS**				
Course Code	**HUSPH101**	**Level**	**4.5**		
			Theory	**Practical**	**Total**
Semester	**I**	**Credits**	**2**	**1**	**3**
Type	**Major**	**No of Teaching hours**	**30**	**30**	**60**
Evaluation/ Assessment	**Total Marks**	**Semester End**	**Continuous**	**Practical**	
	150	**50**	**50**	**50**	

Learning Objectives	
1	Explain Newton's laws of motion, work, energy and be able to solve problems using them.
2	Understand Newton's laws and apply them in calculations of the motion of simple systems.
3	Understand the basic mathematical concepts and applications of them in physical situations.
4	Define and differentiate between scalar and vector quantities.
5	Demonstrate quantitative problem-solving skills in all the topics covered.

Course Outcomes	
CO1	Understanding of Newton's Laws to any physical situation and deduce its kinematical behaviour
CO2	Understanding of different frames of references and conservation laws
CO3	Understand and apply the concepts of momentum and its conservation
CO4	Understanding of Vector Algebra and Vector Calculus
CO5	Understand the physical interpretation of gradient, divergence and curl.

Modules At Glance

Module No.	**Content**	**No. of Lectures**	**Mapping with CO**
1	Introduction to mechanics	15	CO1, CO2, CO3
2	Vector analysis	15	CO3, CO4, CO5
3	Practical component	30	CO1, CO2, CO3, CO4, CO5

Syllabus

Module No.	Content	No. of Lectures
1	Unit 1: Introduction to Mechanics: **1. Motion, Work and energy:** i. Introduction to motion, Types of motion, Displacement, Velocity, Acceleration, Newton's first, second and third laws of motion, interpretation and applications, pseudo forces, Inertial and non-inertial frames of reference. Worked out examples (with friction present) ii. Work and Kinetic Energy, The Work-Energy Theorem, Work and Energy with Varying Forces, Power, Questions/Exercises/Problems 2. **Potential energy and Momentum:** i. Potential Energy and Energy Conservation, Gravitational Potential Energy, Elastic Potential Energy, Conservative and Non-conservative Forces, Force and Potential Energy ii. Momentum and Impulse, Conservation of Momentum, Momentum Conservation and Collisions, Elastic Collisions, Center of Mass, Questions/Exercises/Problem	15
2	Unit 2: Vector Analysis: **1. Basics of Vectors and Scalars:** Introduction, some basic concepts, Position vector, Types of vectors, Laws of Vector algebra, Addition of vectors, Multiplication of vectors, Unit vector, rectangular unit vectors, Components of a vector. Scalar fields, Vector fields, Dot or Scalar product, Cross or Vector product, Commutative and Distributive Laws. **2. Vector algebra:** Scalar Triple product, Vector Triple product (omit proofs) Applications based on Dot, Cross and Triple products, Gradient, divergence and curl	15
Case Study Scenario		
M1	Based on the given situation, answer the following questions: The owner of a high-voltage transmission line wants to estimate magnetic exposure for people working or living near the line. a) Using the Biot–Savart law (or Ampère's law for a long straight conductor), calculate the magnetic flux density at a point **2.0 m** away from a long straight transmission conductor carrying a current of **500 A** b) Discuss the safety implications for nearby human exposure.	
M2	Based on the given situation, answer the following questions: A research team is analysing electric-field exposure around compact high-voltage equipment. 1. A point charge of **q = +3.0 μC** is fixed at the origin, representing a simplified model of a highly charged component inside the device. The team wants to determine the electric-field strength experienced by a technician standing **0.50 m** away from the component.	

References Books:

1. Berkeley Physics Course: Mechanics Vol-I

2. HCV: H.C. Verma, Concepts of Physics-Part I (Second Reprint of 2020) Bharati Bhavan Publishers and Distributers

3. RH: Resnick and Halliday: Physics – I, 5th Edition.

4. Mechanics – H. S. Hans and S. P. Puri, Tata McGraw Hill (2nd ED.).

Semester End Evaluation (50 Marks) **Time : 2 Hours**

Paper Pattern

Question No.	Questions	Total Marks : 50
Q1	Attempt any three out of five (05M) Module I	15
Q2	Attempt any three out of five (05M) Module II	15
Q3	Attempt any three out of five (05M) Module III	15
Q4	Case study/application-based question- One question of five marks	05
	Total	50

Practical Syllabus

Sr. No.	Content	No. of Lectures
1	**List of Experiments: (Group A)** 1. Use of Vernier Callipers 2. Measurement of diameter of a thin wire using micrometre screw gauge. 3. Use of Travelling Microscope 4. To determine the horizontal component of Earth's magnetic field(H) in the laboratory using deflection and vibration magnetometer 5. Radius of curvature of convex lenses using spherometer 6. Determination of diameter of thin wire using Wedge Shaped Film	**10**
2	**List of Experiments: (Group B):** 7. Spectroscopy: To measure the wavelength of a light source 8. Study of laser beam divergence 9. Combination of lenses 10. Study of Spectrometer and determination of angle of prism 11. Spectrometer: Schuster's Method 12. Interference: Newton's rings experiment measures the wavelength of light.	**10**
3	**Skill experiments**: (Minimum Four Experiments) will be conducted, for example 1. Graph plotting: Straight line, Intercept, slope, Area under the graph, Cut off frequency from frequency response graph 2. To determine the Resistance & Capacitance using Color code/Number & verify using Multimeter (Analog/Digital). 3. Finding the focal length of the lens using Parallax method 4. Absolute and relative error calculation 5. Use of Voltmeter, Ammeter, Galvanometer and power supply 6. How to use Multimeter	**10**

Semester End Practical Evaluation **Time: 2.5 Hours**

Question No.	Questions	Total Marks
Q.1	Experiment	40
Q.2	Journal	05
Q.3	Viva	05

BOS	**Natural And Physical Sciences**				
Course	**Basics In Physical, Inorganic And Organic Chemistry I**				
Course Code	**HUSCY102**	**Level**	**4.5**		
			Theory	**Practical**	**Total**
Semester	**I**	**Credits**	2	1	3
Type	**Major**	**No of Teaching hours**	30	30	60

Evaluation/ Assessment	**Total Marks**	**Semester End**	**Continuous**	**Practical**
	150	**50**	**50**	**50**

Learning Objectives	
1	To understand and apply the concepts of liquid state properties, chemical kinetics, and perform accurate chemical calculations.
2	To explain atomic structure and trends in the periodic table to predict the behaviour of elements and compounds.
3	To identify, classify, and name organic compounds using IUPAC rules and analyse their stereochemical aspects.

Course Outcomes	
After successful completion of this course, students would be able to: -	
CO1	The learner will be able to demonstrate foundational knowledge in physical, inorganic, and organic chemistry with problem-solving skills in real-world chemical contexts.
CO2	The learner will be able to analyze molecular structures using principles from atomic theory, periodicity, and be able to explain the concept of allotropy and compare their uses based on physical and chemical properties.
CO3	The learner will be able to analyze and communicate chemical knowledge effectively, including accurate nomenclature, molecular geometry, and reaction mechanisms.

Modules At Glance

Module No.	**Content**	**No. of Lectures**	**Mapping with CO**
1	Physical Chemistry	10	CO1
2	Inorganic Chemistry	10	CO2
3	Organic Chemistry	10	CO3
4	Practical component	30	CO1, CO2, CO3

Syllabus

Module No.	Content	No. of Lectures
1	**Physical Chemistry** Chemical Calculations: (2L) Methods of expressing concentration of solutions: Normality, Molarity, Molality, Mole fractions, ppm, ppb. Preparation of solutions (Dilution). (Numerical problems expected wherever necessary) Chemical Kinetics: (6L) Rate of reaction, rate constant, measurement of reaction rates, order and molecularity of reaction, Integrated rate equation of Pseudo-unimolecular reaction, first order and Second order reactions (with equal initial concentration of reactants). Determination of order of reaction by a) Integration method b) Graphical method c) Half time method (Numerical problems expected wherever necessary). Liquid State - I: (2L) Viscosity: Introduction, coefficient of viscosity, relative viscosity, specific viscosity, reduced viscosity, determination of viscosity by Ostwald viscometer	10
2	**Inorganic Chemistry** Periodic Table and Periodicity: (2L) Long form of Periodic Table: Classification for elements as main group, transition and inner transition elements. Periodicity in the Following Properties (5L) Atomic and ionic size, electron gain enthalpy, ionization enthalpy, effective nuclear charge (Slater's rule), electronegativity, Pauling and Mulliken methods. (Numerical problems expected, wherever applicable.) Allotropy: (3L) Definition, types of allotropy: structural and dynamic, crystalline allotropes: diamond, graphite, amorphous forms: charcoal, soot, coke, fullerenes, graphene, carbon nanotubes, comparative properties: structure, hardness, conductivity, uses.	10
3	**Organic Chemistry** Classification and Nomenclature of Organic Compounds: (5L) Nomenclature of mono and bi-functional aliphatic compounds on the basis of priority order of the following classes of compounds: Alkanes, alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones, carboxylic acids. Stereochemistry: (5L) Projection formulae: Flying Wedge projection, Fischer Projection, Newman and Sawhorse Projection formulae (erythro, threo isomers of tartaric acid and 2,3 -dichlorobutane) and their interconversions; Geometrical isomerism in alkene: cis–trans and syn-anti isomerism R/S nomenclature, E/Z notations with C.I.P rules. Conformational analysis of alkanes (propane, ethane, and n-butane)	10
Case Study Scenario		
M1	Sketch Fischer, Sawhorse and Newman Projection Formula of Tartaric Acid.	
M2	Solve the following: The Solution Containing 36 g water and 46 g glycerin C3H5(OH)3 (Mol Wt= 92). Calculate mole fraction of both the substances. (C=12, H=1, O=16)	

References Books

1. P.W. Atkins & Julio de Paula – Physical Chemistry
2. K.L. Kapoor – A Textbook of Physical Chemistry (Volumes 1 & 2)
3. R.C. Mukherjee – Modern Approach to Chemical Calculations
4. J.D. Lee – Concise Inorganic Chemistry
5. W.W. Atkins & T. Overton – Shriver and Atkins' Inorganic Chemistry
6. Morrison & Boyd – Organic Chemistry
7. P. S. Kalsi -Stereochemistry: Conformation and Mechanism, New Age International Publishers
8. Vogel's Textbook of Practical Organic Chemistry
9. Vogel's Textbook of Quantitative Chemical Analysis

Semester End Evaluation (50 Marks) **Time : 2 Hours**

Paper Pattern

Question No.	Questions	Total Marks : 50
Q1	Attempt any three out of five (05M) Module I	15
Q2	Attempt any three out of five (05M) Module II	15
Q3	Attempt any three out of five (05M) Module III	15
Q4	Case study/application-based question- One question of five marks	05
	Total	50

Practical Syllabus

Sr. No	List of Practical's	No. of Lectures
1.	Physical Chemistry 1) To prepare 0.1 N succinic acid and standardize the NaOH solution of different concentrations. 2) To standardize sodium thiosulphate solution. 3) To determine the rate constant for the hydrolysis of ester using HCl as catalyst. 4) Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature (Any two solutions).	10
2.	Inorganic Chemistry 1) Volumetric analysis a) To determine the strength of commercial acid samples (HCl). b) To estimate the content of Na_2CO_3 and $NaHCO_3$ in the given sample using a double indicator. 2) Gravimetric analysis a) To determine the percent purity of sample of $BaSO_4$ containing NH_4Cl b) To determine the percent purity of ZnO containing $ZnCO_3$.	10
3.	Organic Chemistry 1) Purification of organic compounds by recrystallization selecting suitable solvent (minimum 2 Organic compounds to be given) (Students are expected to report a) Solvent for recrystallization. b) Percentage Yield and the melting points of the purified compound.) 2) Basic principles involved in characterization of Organic compound (minimum 4 Solid Organic compounds) (Students should perform Preliminary Tests, Solubility Test, obtain melting point and recrystallize the compound with given solvent)	10

Semester End Practical Evaluation **Time: 2.5 Hours**

Question No.	Questions	Total Marks
Q.1	Experiment	40
Q.2	Journal	05
Q.3	Viva	05

BOS	**Natural And Physical Sciences**				
Course	**Algebra-I And Calculus-I**				
Course Code	**HUSMT103**	**Level**	4.5		
			Theory	**Practical**	**Total**
Semester	**I**	**Credits**	2	1	3
Type	**Major**	**No of Teaching hours**	30	30	60

Evaluation/ Assessment	**Total Marks**	**Semester End**	**Continuous**	**Practical**
	150	50	50	50

Learning Objectives	
1	This course gives introduction to basic concepts of Algebra and Calculus with rigor and prepares students to study further courses in linear and abstract algebra and Calculus.
2	To reflect the broad nature of the subject and develop mathematical tools for continuing further study in various fields of sciences.
3	To enhance students' overall development, problem solving skills, creative talent, and power of communication are necessary for various kinds of employment.

Course Outcomes	
CO1	Understand the concept of Functions and Relations
CO2	Understand the real number system, differential equations, the integer and rational number system and illustrate examples of polynomials in $\mathbb{R}[x]$
CO3	Explain the properties and theorems of polynomials with suitable examples and also explain the concepts of modulus, infimum and supremum.
CO4	Verify the concepts related to sequences, like bounded, convergent, divergent, Cauchy, etc. and also to verify the statements of theorems by applying them in problem-solving.
CO5	Construct counter examples related to bounded sets, bounded sequence, Cauchy sequence and convergent sequence.
CO6	Understand the concepts of limit and continuity of functions and various counting techniques which are used to handle problems on finite sets and apply them in day-to-day life.

Modules At Glance

Module No.	**Content**	**No. of Lectures**	**Mapping with CO**
1	Relations, Functions, Integers and Polynomials	15	CO1, CO2, CO3
2	Real Number System, Sequences in R and Limits and Continuity	15	CO4, CO5, CO6
		30	

Syllabus

Module No.	Content	No. of Lectures
I	Module 1: Relations, Functions, Integers and Polynomials (15 Hours) (1) Definition of relation and function, domain, co-domain and range of a function, composition of functions, image $f(A)$, inverse image $f-1(B)$ for a function f: $X\rightarrow Y$, injective, surjective, bijective functions, examples of functions including constant, identity, polynomial. Finite and infinite sets (definition and examples only). (2) Equivalence relation, Equivalence classes, properties such as two equivalences classes are either identical or disjoint, definition of partition, every partition gives an equivalence relation and vice versa. (3) Statement of well-ordering property of non-negative integers, Principle of finite induction (first and second) because of Well-Ordering Principle. (4) Divisibility in integers, division algorithm, greatest common divisor (g.c.d.) and least common multiple (l.c.m.) of two non-zero integers, basic properties of g.c.d. such as existence and uniqueness of g.c.d. of two non-zero integers a & b and that the g.c.d. can be expressed as $ma+nb$ for some m, $n\in\mathbb{Z}$, Euclidean algorithm (examples only). Primes, Euclid's lemma, Fundamental Theorem of arithmetic (Statement only), the set of primes is infinite. (5) Congruence, definition and elementary properties, congruence is an equivalence relation on $\mathbb{Z}$, residue classes and partition of $\mathbb{Z}$, addition and multiplication modulo n, examples. linear congruence equations (solving problems of the type a_x congruent to b modulo n). Examples. (6) Definition of a polynomial, polynomials over $\mathbb{R}$, algebra of polynomials, degree of polynomial, basic properties. (7) Division algorithm in $\mathbb{R}[X]$ (without proof), and g.c.d of two polynomials and its basic properties, Euclidean algorithm (Statement and examples only) (8) Roots of a polynomial function, relation between roots and coefficients, multiplicity of a root. Elementary consequences such as, Remainder theorem, Factor theorem, A polynomial function of degree n over $\mathbb{R}$ has at most n roots (without proof). (9) Necessary condition for a rational number p q to be a root of a polynomial with integer coefficients (viz. p divides the constant coefficient and q divides the leading coefficient), the corollary for monic polynomials (viz. a rational root of a monic polynomial with integer coefficients is necessarily an integer). Simple consequence such as irrationality of $\sqrt{p}$ for any prime number p.	15

II	**Module 2: Real Number System, Sequences in R and Limits and Continuity (15 Hours)** (1) Real number system and order properties of $\mathbb{R}$, absolute value and its properties. AM-GM inequality, Cauchy-Schwarz inequality (without proof), Intervals and neighbourhoods, Hausdorff property. (2) Bounded sets, supremum and infimum, maximum and minimum, statement of lub axiom and its consequences, Archimedean property and its applications, density of rational. (3) Definition of a sequence and examples, convergence of sequences, limit of a convergent sequence and uniqueness of limit, bounded sequence, divergent sequence. (4) Algebra of convergent sequences, Sandwich theorem, monotone sequence, monotone convergence theorem. (5) Definition of subsequence, subsequence of a convergent sequence is convergent and converges to the same limit, Cauchy sequence, every convergent sequence is a Cauchy sequence and converse. (6)ε-δ definition of Limit of a function, uniqueness of limit if it, exists, algebra of limits, limits of composite function, sandwich theorem, left- hand limit f(x), right-hand limit f(x), non-existence of limits, f(x), f(x) and f(x) $=\pm\infty$. (7) Continuous functions: Continuity of a real valued function at a point and on a set using ε-δ definition, examples, Continuity of a real valued function at end points of domain using ε-δ definition, f is continuous at a if and only if f(x) exists and equals to f(a), Sequential continuity, Algebra of continuous functions, discontinuous functions, examples of removable and essential discontinuity.	15
Case Study Scenario		
M1	A company labels items by weight. Two items are "equally heavy" if their weights differ by a multiple of 3 grams. What are the equivalence classes? Is this a partition of all possible weights?	
M2	A student takes exam papers numbered 1 through 50 and wants to distribute them into boxes based on roll number modulo 6. How many papers go into each residue class? Which class contains number 47?	

References Books:

1. David M. Burton, Elementary Number Theory, Seventh Edition, McGraw Hill Education (India) Private Ltd.
2. Norman L. Biggs, Discrete Mathematics, Revised Edition, Clarendon Press, Oxford 1989.
3. K. G. Binmore, Mathematical Analysis, Cambridge University Press, 1982.
4. R. G. Bartle-D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994.
5. R. R. Goldberg, Methods of Real Analysis, Oxford and IBH, 1964.
6. James Stewart, Calculus, Third Edition, Brooks/ Cole Publishing company, 1994.

7. Sudhir Ghorpade and Balmohan Limaye, A course in Calculus and Real Analysis, Springer International Ltd, 2000.

Semester End Evaluation (50 Marks) **Time : 2 Hours**

Paper Pattern

Question No.	Questions	Total Marks : 50
Q1	Attempt any three out of five (05M) Module I	15
Q2	Attempt any three out of five (05M) Module II	15
Q3	Attempt any three out of five (05M) Module III	15
Q4	Case study/application-based question- One question of five marks	05
	Total	50

Practical Syllabus

Sr. No	Practical's	No. of Lectures
	Module 1	
1.	Examples based on Functions	15
2.	Equivalence relations.	
3.	Principles of finite induction and Polynomials.	
4.	GCD and LCM in $\mathbb{Z}$ using the Division Algorithm and Euclidean Algorithm and prime numbers	
5.	Congruence and its properties.	
6.	Linear congruence equations.	
7.	Algebra of polynomials.	
8.	GCD and LCM in $\mathbb{R}[x]$ using Division Algorithm and Euclidean Algorithm in $\mathbb{R}[x]$	
9.	Roots of the polynomials	
10.	Rational root theorem	
	Module 2	
1.	Algebraic, order and absolute properties of real numbers.	15
2.	Inequalities, Archimedean Property, Hausdorff Property, LUB axiom of $\mathbb{R}$	
3.	Convergent and divergent Sequences	
4.	Bounded Sequence, Monotone Sequence and Sandwich theorem.	
5.	Cauchy Sequence, Subsequence.	
6.	Linear congruence equations.	
7.	Applications of properties of real numbers and sequences.	
8.	Limit of function and Sandwich theorem.	
9.	Algebra of limit of a function	
10.	Continuous and discontinuous functions	

Semester End Practical Evaluation **Time: 2.5 Hours**

Question No.	Questions	Total Marks
Q.1	Experiment	40
Q.2	Journal	05
Q.3	Viva	05

BOS	**Natural And Physical Sciences**					
Course	**Digital Literacy and ICT Applications**					
Course Code	**HUSDI104**	**Level**		**4.5**		
				Theory	**Practical**	**Total**
Semester	**I**	**Credits**		2	1	3
Type	**SEC**	**No of Teaching hours**		30	30	60
Evaluation/ Assessment	**Total Marks**	**Semester End**	**Continuous**	**Practical**		
	150	50	50	50		

Learning Objectives	
1	Understand the fundamentals of ICT and its real-world applications
2	Describe and demonstrate knowledge of computer hardware, software, and operating systems
3	Apply create, format, and manage documents using word processing tools
4	Analyze and visualize data using spreadsheet software
5	Utilize digital tools for communication, collaboration, and online productivity

Course Outcomes	
CO1	Understand the fundamental concepts of ICT and its role in various sectors like education, health, governance, and business.
CO2	Identify and describe the core components of a computer system including hardware, software, and operating systems
CO3	Demonstrate proficiency in using word processing, spreadsheets, and presentation tools for academic and professional tasks.
CO4	Apply internet tools, email, and social media responsibly for information gathering and communication.
CO5	Utilize cloud-based storage and collaboration platforms for file sharing, real-time teamwork, and virtual communication.

Modules At Glance

Module No.	**Content**	**No. of Lectures**	**Mapping with CO**
1	Foundations of ICT and Computer Fundamentals	15	CO1, CO2, CO3
2	Practical ICT Tools for Productivity and Collaboration	15	CO4, CO5
		30	

Syllabus

Module No.	Content	No. of Lectures
1	**Introduction to ICT**: Definition, importance, evolution, and impact of ICT in society. **Components of ICT:** Hardware, Software, People, Data, and Processes **ICT in Everyday Life:** Applications in education, health, governance, business **Computer Fundamentals**: Input/output devices, memory, storage, types of computers **Operating Systems:** Basics of Windows and Linux, file management	15
2	**Word Processing Tools**: Creating, formatting, and editing documents (MS Word/Google Docs) **Spreadsheet Tools**: Data entry, formulas, charts (MS Excel/Google Sheets) **Presentation Tools**: Creating presentations, design, transitions (MS PowerPoint/Google Slides) **Internet and Web Technologies**: Web browsers, search engines, email, social media **Cloud Computing and Collaboration Tools:** Google Drive, Dropbox, MS OneDrive, Teams, Zoom	15

References Books:

1. Leon, A., Leon, M. (2009). Fundamentals of Information Technology. New Delhi: Vikas Publishing House.
2. ITL Education Solutions Limited. (2006). Introduction to Information Technology. New Delhi: Pearson Education.
3. Sinha, P. K., Sinha, P. (2007). Computer Fundamentals (6th ed.). New Delhi: BPB Publications.
4. Nordell, R. (2021). Microsoft Office 365: In Practice (2021 Edition). New York: McGraw-Hill Education.

Semester End Evaluation (50 Marks) **Time : 2 Hours**

Paper Pattern

Question No.	Questions	Total Marks : 50
Q1	Attempt any three out of five (05M) Module I	15
Q2	Attempt any three out of five (05M) Module II	15
Q3	Attempt any three out of five (05M) Module III	15
Q4	Case study/application-based question- One question of five marks	05
	Total	50

Practical Syllabus

Sr. No.	List of Practical	CO Mapping	No. of Hours
1	**Creating and Formatting a Document (Word/Google Docs)** a.Type a formal letter/application. b.Format using font styles, bullet points, headings, page numbers. c.Add header, footer, and watermark. d.Resume / CV Creation Using Word Processor	CO3	3
2	**Table and Image Handling in Word Processors** a.Insert a table with student data. b.Merge/split cells, use shading. c.Add and wrap an image. d.Add a caption to the image.	CO3	3
3	**Basic Data Entry and Formatting in Spreadsheets (Excel/Google Sheets)** a.Create a student marksheet with 5 subjects. b.Format cells, use borders and colors. c.Apply text wrap, alignment, and number formats.	CO3	3
4	**Use of Formulas and Functions in Spreadsheets** a.Use formulas: COUNT, SUM, AVERAGE, MAX, MIN. b.Apply conditional formatting for marks < 35. c.Use IF function for pass/fail result. d.Data Validation and Drop-Down Menus in Excel	CO3	3
5	**Creating Charts and Graphs in Spreadsheets** a.From the previous marksheet, create: b.A bar chart for subject-wise performance. c. A pie chart for overall result distribution. d. Customize titles, legends, and colors.	CO3	3
6	**Mail Merge for Bulk Letter Generation (MS Word + Excel)**	CO4	3
7	**Designing a Presentation with Transitions and Animations (PowerPoint/Slides)** a. Create a 5-slide presentation on a topic (e.g., Cyber Security). b. Apply slide layouts, themes, and animations. c. Use transitions between slides.	CO3 ,CO4	3
8	**Hyperlinks, Multimedia, and Slide Master Use in Presentations** a. Add audio/video to a slide. b. Insert hyperlinks (internal and external).	CO4	3
9	**Internet Browsing and Online Research** a. Use search engines for a topic (e.g., Artificial Intelligence). b. Bookmark 3 relevant resources. c. Save information in a Word document with source links	CO5	3
10	**Using Google Forms to Collect Data** a. Design a survey (e.g., student tech usage habits). b. Share the form and collect responses.	CO5	3

Semester End Practical Evaluation **Time: 2.5 Hours**

Question No.	Questions	Total Marks
Q.1	Experiment	40
Q.2	Journal	05
Q.3	Viva	05