23SCMAL111:ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES
Offered to: BSc(CHE,MAT, PHY,STA, CSC, AI, CSCS,DA,DS,ELE)
Course Type : Core (TH)
Semester: I   75 HOURS   **Credits: 4**

Course Objective:
The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of mathematical, physical, and chemical sciences. The course aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enabling them to apply scientific principles to real-world situations.

Learning outcomes:
1. Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.
2. To explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to connect their knowledge of physics to everyday situations
3. To explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to Connect their knowledge of chemistry to daily life.
4. Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical
Principles can be used to explain and predict phenomena in different contexts.
5 To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.

UNIT I: ESSENTIALS OF MATHEMATICS: **9hrs**

Complex Numbers: Introduction of the new symbol i – General form of a complex number – Modulus- Amplitude form and conversions
Functions: Introduction – Ordered Pairs – Function (Definitions) – Inverse Function – Real Valued Functions – Types of Functions – Problems.
Vectors: Definition of vector addition – Cartesian form – Scalar and vector product and problems
Statistical Measures: Mean, Median, Mode of a data and problems.

UNIT II: ESSENTIALS OF PHYSICS: [No Problems]

Definition and Scope of Physics- Measurements and Units - Motion of objects- Newton's Laws of Motion - Laws of Thermodynamics and Significance - Acoustic waves, Electromagnetic Spectrum- Electric and Magnetic fields - Coulomb's Law, Behaviour of atomic and nuclear particles- Electrons, Protons, Neutrons, Wave-particle duality- Uncertainty principle (Only Qualitative treatment)- Theories and understanding of universe - Big Bang Theory.

UNIT III: ESSENTIALS OF CHEMISTRY: **9hrs**
Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY: 9hrs
Applications of Mathematics in Physics & Chemistry: Calculus, Differential Equations & Complex Analysis.
Physics for Electronics and Semiconductor Industry, Automotive and Aerospace Industries,

Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE: **9hrs**
Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications. Ethical and social implications: Network and security concepts- Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

RECOMMENDED BOOKS:
1. Functions of one complex variable by John.B.Conway, Springer- Verlag.
2. Elementary Trigonometry by H.S.Hall and S.R.Knight
3. Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd.
4.Basic Statistics by B.L.Agarwal, New age international Publishers
5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman
6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker
7. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.
8. Physics for Technology and Engineering" by John Bird
9. Chemistry in daily life by Kirpal Singh
10. Chemistry of bio molecules by S. P. Bhutan
11. Fundamentals of Computers by V. Raja Raman
12. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson

STUDENT ACTIVITIES

UNIT I: ESSENTIALS OF MATHEMATICS:

1: Complex Number Exploration
Provide students with a set of complex numbers in both rectangular and polar forms. They will plot the complex numbers on the complex plane and identify their properties

2: Trigonometric Ratios Problem Solving
Give students a set of problems that require the calculation of trigonometric ratios and their relations. Students will solve the problems using the appropriate trigonometric functions (sine, cosine, tangent, etc.) and trigonometric identities.

3: Vector Operations and Applications
Provide students with a set of vectors in Cartesian form. Students will perform vector addition and subtraction operations to find the resultant vectors. They will also calculate the scalar and vector products of given vectors.

4: Statistical Measures and Data Analysis Give students a dataset containing numerical values. Students will calculate the mean, median, and mode of the data, as well as other statistical measures if appropriate (e.g., range, standard deviation). They will interpret the results and analyze the central tendencies and distribution of the data.

UNIT II: ESSENTIALS OF PHYSICS:

1. Concept Mapping
Divide students into groups and assign each group one of the topics. Students will create a concept map illustrating the key concepts, relationships, and applications related to their assigned topic.
Encourage students to use visual elements, arrows, and labels to represent connections and interdependencies between concepts.

2. Laboratory Experiment Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields. Provide the necessary materials, instructions, and safety guidelines for conducting the experiment. Students will work in small groups to carry out the experiment, collect data, and analyze the results. After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.

UNIT III: ESSENTIALS OF CHEMISTRY

1: Chemistry in Daily Life Presentation
Divide students into groups and assign each group a specific aspect of daily life where chemistry plays a significant role, such as food and nutrition, household products, medicine, or environmental issues. Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect.

2: Periodic Table Exploration Provide students with a copy of the periodic table. Students will explore the periodic table and its significance in organizing elements based on their properties. They

will identify and analyze trends in atomic structure, such as electronic configuration, atomic size, and ionization energy.

3: Chemical Changes and Classification of Matter Provide students with various substances and chemical reactions, such as mixing acids and bases or observing a combustion reaction. Students will observe and describe the chemical changes that occur, including changes in color, temperature, or the formation of new substances.

4: Biomolecules Investigation Assign each student or group a specific biomolecule category, such as carbohydrates, proteins, fats, or vitamins. Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body. They can create informative posters or presentations to present their findings to the class.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1. Interdisciplinary Case Studies Divide students into small groups and provide them with interdisciplinary case studies that involve the interdisciplinary application of mathematics, physics, and chemistry. Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

2: Design and Innovation Project Challenge students to design and develop a practical solution or innovation that integrates mathematics, physics, and chemistry principles. Students can choose a specific problem or area of interest, such as renewable energy, environmental conservation, or materials science.

3: Laboratory Experiments assign students laboratory experiments that demonstrate the practical applications of mathematics, physics, and chemistry. Examples include investigating the relationship between concentration and reaction rate, analyzing the behavior of electrical circuits, or measuring the properties of materials.

4: Mathematical Modeling Present students with real-world problems that require mathematical modeling and analysis.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

1. Identifying the attributes of network (Topology, service provider, IP address and bandwidth of

2. Your college network) and prepare a report covering network architecture.

3. Identify the types of malwares and required firewalls to provide security.

4. Latest Fraud techniques used by hackers.