DEPARTMENT OF PHYSICS

PROGRAM OUT COMES

1. Students are intended to develop a conceptual understanding of physics principles. They will be able to demonstrate concepts in Newtonian Mechanics, Electromagnetism, special theory of relativity, Thermodynamics, Solid state physics, Statistical physics, Atmospheric physics, and Quantum mechanics.
2. Graduates should be able to transfer and apply the acquired concept and principles to study different branches of physics
3. Demonstrate the ability to translate a physical description to a mathematical equation and conversely explain the physical meaning of the mathematics, represent key aspects of physics through graphs and diagrams and use geometric arguments in problem-solving
4. The objective of the course is to introduce students to research skills and specialise in a relevant to their research interests under close supervision
5. To develop the skills and expertise on comprehensive understanding of techniques, and a thorough knowledge of the literature, applicable to their own research.
6. Demonstrated originality in the application of knowledge, together with a practical understanding of how research and enquiry are used to create and interpret knowledge in their field
7. Demonstrated some self-direction and originality in tackling and solving problems, and acted autonomously in the planning and implementation of research; and produced a dissertation for examination
8. Make measurements on physical systems understanding the limitation of the measurements and the limitations of models. Complete an experimental work, and report to the faculty by tabulating the readings and present the outcome of the experimental work

PROGRAM SPECIFIC OUT COMES

1. Students will develop the proficiency in the acquisition of data using a variety of laboratory instruments and in the analysis and interpretation of such data
2. Students will show that they have learned laboratory skills enabling them to take measurements in a physics laboratory and analyze the measurements to draw valid conclusion
3. Students will be capable of oral and written scientific communication and will prove that they can think critically and work independently
4. Students will realize and develop an understanding of the impact of physics and science on society
5. Develop proficiency in the analysis of complex physical problems and the use of mathematical or other appropriate techniques to solve them
6. Demonstrate skills in the use of computers for control, data acquisition and data analysis in experimental investigations
7. Provide a systemic understanding of core physical concepts, principles and theories along with their applications

COURSE OUT COME

SEMESTER I

MECHANICS-1, HEAT AND THERMODYNAMICS-1

1. Synthesize Newtonian Physics with static analysis to determine the complete load impact in motion and friction, planetary motion, work and energy, system of particles, black body radiation on all components of a given structure with a complete load.
2. Translate physical descriptions into mathematical equations, and conversely, explain the physical meaning of kinectic theory of gases.
3. Demonstrates understanding of basic concepts of the zeroth,1^{st} and 2^{nd} Laws of Thermodynamics by utilizing energy balance analysis and entropic analysis.
4. Design an experiment to measure a given physical quantity.Make measurements on physical systems.
5. Estimate sources of error in a measurement.Use graphs and diagrams to convey results.Exhibit clear physical and mathematical arguments including effective use of equations.

SEMESTER II

MECHANICS-2, HEAT AND THERMODYNAMICS-2

1. Understand the concepts of Mechanics, Heat and Thermodynamics
2. Understand physical characteristics of SHM and obtaining solution of the oscillator using differential equations
3. Understand simple harmonic vibrations of same frequency and different frequencies by using the mathematical solution of differential equation
4. Solve wave equation and understand significance of transverse waves
5. Solve wave equation of a longitudinal vibration in bars free at one end and also fixed at both the ends
6. Understand the define the enthalpy H, Helmholtz function F and the Gibbs function G and state their roles in determining equilibrium under different constraints
7. Using suitable results from the theory of functions of many variables a variety of thermodynamic derivatives including heat capacity, thermal expansively and compressibility, gaining the knowledge to solve problems in which such derivatives appear.
8. Sketch the phase diagram of a simple substance in various representations and understand the concept of an 'equation of state' and the basic thermodynamics of phase transitions
9. Analyze the effects of Relativity by Newtonian and Special Theory of Relativity and explain the gravitational effect using General theory of Relativity

SEMESTER III

ELECTRICITY AND MAGANTISM

1. Understand the basic of Current and voltage and solve DC circuit analysis problems. DC network theorems.

2. Possess adequate knowledge to analyze electrical circuits using Kirchoff‟s laws and Apply the knowledge gained to explain the behavior of the circuit at series & parallel combination
3. Understand the basic mathematical concepts related to electromagnetic vector fields. Apply the principles of electrostatics to the solutions of problems relating to electric and magnetic field and electric potential, boundary conditions and electric energy density
4. Learn a broad foundational knowledge of the Concept of vector and scalar fields
5. Understand the concepts related to Faraday‘s law, induced emf and Maxwell‘s equations. Apply Maxwell‘s equations to solutions of problems relating to transmission lines and uniform propagation waves
6. Identify the presence of static electric charges and fields due to static charges
7. Understand the phenomena of Seeback effect & Peliter effect and apply the concept of thermo-emf wherever suitable

SEMESTER IV

PHYSICAL OPTICS, LASERS AND FIBER OPTICS

1. Demonstrate and understand the core of knowledge in physics, including the major premises of physical optics, lasers and fiber optics.
2. Exposure to written and oral communication skills in communicating interference, diffraction of light and polarisation.
3. A robust conceptual understanding of fourier series in physics concepts.
4. Critically assess current state of knowledge and expertise, and develop the understanding in optical fibres.
5. Design and conduct an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes in the field of opitcs.
6. Quantitatively determining error in an experiment and to use this to assess agreement with a specific theory or set of hypotheses.

SEMESTER V

STATISTICAL PHYSICS, QUANTUM MECHANICS-1, ATMOSPHERIC PHYSICS & NANO MATERIALS

1. Know the elementary concept of statistics. Understand statistical distribution of system of particles to study statistical ensembles and study Quantum statistics
2. understand various models in statistical mechanics and apply the significance and characteristics of critical phenomena
3. Gained knowledge about basic concept for Non-Relativistic Quantum mechanics
4. Calculate the de Broglie Wavelength of a wave associated with the particle, explain the importance of Davisson and Germer and GP Thomson experiments and Heisenberg‟s Uncertainty Principle and Describe the illustrations
5. Provide the elementary understanding, the basic information to face the study of meteorology and climatology.

6. Explain the physical laws governing the structure and evolution of atmospheric phenomena spanning a broad range of spatial and temporal scales.
7. Developing the capability to analyze environmental and atmospheric physics problems and determine possible solutions for them
8. Understand the importance of the Energy and Crystal classes, symmetries, space lattices and solid characters by introducing to Material Science
9. Synthesis Of Nanomaterials Understand the classification nanostructured materials and Characterization Techniques and Properties
10. Identify and compare state Nanocomposites and structures and perform a critical analysis of the research literature

SEMESTER V

ASTROPHYSICS, SOLID STATE PHYSICS AND SEMICONDUCTOR PHYSICS

1. Demonstrate understanding of the applications of numerical techniques for modeling physical systems for which analytical methods are inappropriate or of limited utility.
2. Demonstrate a thorough understanding of the analytical approach to modeling of astrophysics.
3. Understand the impact of solid state physics and electronic science on society.
4. Detailed study of semiconductor physics and its applications using mathematical tools.
5. Design a familiarity with the content of multiple disciplines or sub-disciplines of physics at the upper level.
6. Demonstrate an understanding of the analytical methods required to interpret and analyze results and draw conclusions as supported by data in conducting heating experiments.

SEMESTER VI

ATOMIC, MOLECULAR AND NUCLEAR PHYSICS

1. Gain Knowledge on basic material physics and research and able to make atomic calculations to show that they understood the atoms' electron structure at the deeper level.
2. Qualitative familiarity with theory concepts and working methods within atomic models and be able to use relevant measurement equipment and be able to evaluate experimental results
3. Learn to describe theories explaining the structure of atoms and the origin of the observed spectra
4. Develop primary skills to Identify atomic effect such as Zeeman effect and Stark effect and List different types of atomic spectra
5. Understanding knowledge to observed dependence of atomic spectral lines on externally applied electric and magnetic fields
6. Develop Skills to describe and explain the properties of nuclei and derive them from various models of nuclear structure and to understand the derivation of the various theoretical formulation of nuclear

7. Understand the decay process like α decay, β decay and Develop basic understanding of nuclear reactions and decays with help of theoretical formulate and laboratory experiments
8. Understand interaction of various types of radiation with matter which they observe in their daily life. It's easy for them now to relate the theory to practical
9. Skills to develop basic understanding of the interaction of various nuclear radiations with matter and develop the ability to understand the construct and operate simple Accelerators & detector systems for nuclear radiation
10. Understand the basic aspects of nuclear reactions, the Q-value of such reaction and its derivation from conservation laws, the reaction cross-sections, the types of nuclear reactions, direct and compound nuclear reactions

SEMESTER VI

ELECTRONICS, MAGNETIC MATERIALS,DIELECTRICS AND QUANTUM MECHANICS -II

1. An understanding of the content of a broad distribution of physics knowledge at the upper level, including: electronics, magnetic materials and dielectrics.
2. Demonstrate problem solving competence, including: Solving real-world problems through idealizations and estimation.
3. Acquiring in-depth knowledge in quantum mechanincs with applications.
4. Foundation to utilize a wide range of printed and electronic resources and information technologies to support their research on physical systems and present those results in the context of the current understanding of physical phenomena.
5. Demonstrates proficiency in the acquisition of data using a variety of laboratory instruments and in the analysis and interpretation of such data.
6. Critically assess current state of knowledge and expertise, and develop, implement, and refine a plan to acquire new knowledge for specific scientific goals and in pursuit of new intellectual interests.

DEPARTMENT OF MATHEMATICS

BSc Mathematics Program Specific Outcome:

- To enable the students to cultivate a mathematical way of thinking
- making conjectures, verifying them with further observations, generalizing them, trying to find proofs and making observations.
- To enable the students to quantify their experiences in other subjects they study.
- To enable the students to learn the basic structures of mathematics through unifying concepts and to motivate these structures through applications.
- To enable the students to study mathematics for themselves.
- To provide high quality mathematical education at all levels that will be vital for scientific and technological developments.

I SEMESTER

Mathematics I

On successful completion of the course students will be expected to reduce a matrix into a Row Reduced Echelon form, Normal Form, find inverse matrix. They can also recognize the difference between Homogeneous and non-homogeneous system of linear equations also students will be able to examine the consistency of the system of equations. They will also learn the meaning of Eigen values and Eigen Vectors and the method of using characteristic polynomials to compute eigenvalues and eigenvectors.

Students will be able to find the successive differentiation, also finding nth derivatives of some standard functions. Also, they will be able to solve problems and then they will learn the Leibnitz's theorem and able to write and understand the proof and its applications, they can also recognize and solve partial differentiation, first and higher derivatives of Homogeneous functions. They can also outline the Euler's theorem and its extension along with the proofs. Also Have complete understand of implicit functions and composite functions and Jacobians.

Students will be able to find the reduction formulae for some standard trigonometric functions with definite limit. They will learn the differentiation under integral sign which is so called Leibnitz's rule and solving problem on that. On completion of this unit successfully, Students will be able to find the Equation of the sphere in general and standard forms, equation of a sphere with given ends of a diameter. They can also recognize Tangent plane to a sphere, orthogonality of spheres. Standard equations of right circular cone and right circular cylinder and problems.

II SEMESTER

Mathematics II

On completion of this unit successfully, students will be able to Demonstrate when a binary algebraic structure forms a group. Construct Caley tables. Determine possible subgroups of a group. They can recognize and solve problems of modular system and permutation of the groups.

They will be able to outline the concepts of Angle between the radius vector and the tangent, Angle of intersection of curves, polar sub-tangent and polar subnormal, perpendicular from pole on the tangent, Pedal equations. They are expected to find Derivative of an arc in

Cartesian, parametric and polar forms Curvature of plane curves, formula for radius of curvature in Cartesian, parametric, polar and pedal forms, Centre of curvature, evolutes. Singular points, Asymptote, Envelopes and Application Problems.
Students will be able to recognize the Applications of Integral Calculus, computation of length of arc, plane area and surface area and volume of solids of revolutions for standard curves in Cartesian and Polar forms. Students are expected recognize and solve differential equations of first order and first degree Solutions of Linear equations, Bernoulli's equation, Exact equations, Equations of first order and higher degree nonlinear first order, higher degree solvable for p, y, x, Clairaut's equation. They can also outline the Orthogonal trajectories in Cartesian and polar forms and the application problems.

III SEMESTER

Mathematics III

At the completion of Group theory, Students will be able to understand the importance of algebraic properties with regard to working within various number systems, definition of subgroups, integral powers of an element of a group, order of an element of a group and its properties, Cyclic groups and its properties, Coset decomposition. They will be able to decide whether a given group is cyclic, and given a finite cyclic group, find a generator for a subgroup of a given order. Students will also understand Lagrange's theorem and outline the Consequences of Lagrange's theorem.

Students will understand the Definition of a Sequences, Bounded sequences, to find limit of a sequences, convergent, divergent and oscillatory sequences and Monotonic sequences and their properties with Cauchy's criterion. Students will have the knowledge and skills to understand that when sequences are enumerated, for example, the months of the year, a link is established between them and the set of the natural numbers. Students will follow the reasoning to go so far as to deduce the general term of a sequence as the mathematical expression that relates the position that occupies a term in the sequence with its value.

Students will understand the definition of convergence, divergence and oscillation of series. They will be able to outline the properties of Convergence series and properties of series of positive terms. They will also learn the Geometric series and Tests for convergence of series that is p series result. Students determine if a given series is a geometric series, and if a geometric series converges and they will be able to calculate the sum of a geometric series. Students will also learn the Comparison Test of series, Cauchy's root Test, D Alembert's test, Raabe's test and Absolute and conditional convergence and also D'Alembert test for absolute convergence . They will also learn to solve Alternating series by Leibnitz test. Further more they will learn Summation of binomial, Exponential and logarithmic series.

Students will learn the recapitulation of Equivalence Class and partition of a set. They will learn definition of the limit of a function in ε-δ form, continuity, types of discontinuities. They will be able to outline the properties of continuous function on a closed interval (boundedness, attainment of bounds and taking every value between bounds). They can understand the concepts of Differentiability and Differentiability implies Continuity and that its Converse is not true. They can understand the application of differentiability and continuity in Rolle's Theorem, Lagrange's and Cauchy's First Mean Value Theorem (Lagrange's form) and Maclaurin's expansion and Evaluation of limits by L' Hospital's rule.

IV SEMESTER

Mathematics IV

On completion of this unit students will understand the meaning of Groups, Normal subgroups examples and related problems. They can also recognise the definition of Quotient group, Homomorphism and Isomorphism of groups, Kernel and image of a homomorphism, Normality of the Kernel, Fundamental theorem of homomorphism and outline the properties related to isomorphism. They will also learn Permutation group and Cayley's theorem.

Students will understand the meaning of Trigonometric Fourier series of functions with period 2π and period 2L and hence find the Half range Cosine and sine series.

Students will be able to understand the definition of Differential Calculus, Continuity and differentiability of a function of two and three variables. They will be able to apply the same in Taylor's Theorem and expansion of functions of two variables. Students will aquire the knowledge of Maxima and Minima of functions of two variables and Learn the Method of Lagrange multipliers.

Students will understand the Definition and basic properties of Laplace transform of some common functions and Standard results of Laplace transform of periodic function. By Learning the basics they are expected to understand the Laplace transforms of derivatives and the integral of function. Also they will learn the Laplace transforms, Heaviside function convolution theorem (statement only) and Inverse Laplace transforms.

On completion of this unit , Students will aquire the knowledge of Second and higher order ordinary linear differential equations with constant Coefficients. They will learn the rules to find complementary function and particular integrals (standard types). With this they can solve Cauchy-Euler differential equation and Simultaneous linear differential equations (two variables) with constant coefficients. Further they can solve solutions of second order ordinary linear differential equations with variables coefficients by the following methods. (i). When a part of complementary function is given (ii). Changing the independent variable (iii). Changing the dependent variable (iv). Variation of parameters (v). Conditions for exactness and the solution when the equation is exact.

V SEMESTER

MATHEMATICS V

Students will gain the knowledge of definition of Rings, Types of Rings, Integral Domain and Fields and their properties following the definition and outline the properties of rings and Rings of integers modulo n. They will also understand the meaning of Subrings, Ideals ,Principal, Prime and Maximal ideals in a commutative ring , respective examples and standard properties following the definition. Further they will learn the meaning of Homomorphism, Isomorphism and related Properties. They will understand the definition of Quotient rings, Fundamental Theorem of Homomorphism of Rings and important concepts of Every field is an integral domain and Every finite integral domain is a field and thereby they will be able to solve the related Problems.

Students will acquire the knowledge of Scalar field, gradient of a scalar field and its geometrical meaning. Further students will be able to understand the concepts of directional derivative , Maximum directional derivative and Angle between two surfaces. They will also gain the knowledge of vector field, divergence and curl of a vector field and decide whether the function is solenoidal and irrotational fields with which they can solve and evaluate the scalar and vector potentials. Further they will learn the definition of Laplacian of a scalar field , vector identities and their Standard properties and also acquire the knowledge on Harmonic functions and solve the related Problems.

The Learning outcome of this unit is that students can define Finite differences and understand the Definition and properties of $\Delta, \nabla, \delta, \mu$ and E, the relation between them. They can also evaluate the nth difference of a polynomial. Further they will also understand the meaning of Factorial notations, separation of symbols and evaluate them. They will be able to recognise divided differences and related theorems. They will gain the basic definition and formulae of Newton Gregory forward and backward interpolation formulae and Lagrange's and Newton's interpolation formulae for unequal intervals, Inverse interpolation and can solve the same. They can also solve Numerical Integration: Quadrature formula by Trapezoidal rule , Simpon's 1/3 and 3/8 rule.

Mathematics VI

After the completion of the course students can explain the concept of Calculus of Variation, Variation of a function, variation of the corresponding functional, extremal of a functional, variational problem. They are now able to write theorem along with the proof of Euler's equation and its particular forms and problems can be solved. Students can solve standard problems like geodesics, minimal surface of revolution, hanging chain, Brachistochrone problem Isoperimetric problems.

Students are expected to solve line and multiple integrals in various methods. They are able to solve the problems by changing order of integration, change of variable, now they can easily recognize the surface area, volume, etc. After the completion of the course students are expected to write and prove Green's theorem, Gauss Divergence theorem, Stoke's theorem and trained to solve the problems based on the above discussed theorems.

VI SEMESTER

MATHEMATICS - VII

Students will learn the definition , examples and properties of Linear Algebra Vector space and Subspaces. They will also gain knowledge on the criterion for a subset to be a subspace. They gain the knowledge on definition of linear span of a set , linear combination, linear independent and dependent subsets and can solve the related problems. Students will be able to define Basis and dimensions and derive the Standard properties with Examples illustrating concepts and results. They will further understand to evaluate the Linear transformations, related properties and matrix of a linear transformation. They can also perform change of basis and evaluate range and kernel of a Linear Transformation and can find the rank and nullity thereby helpful to understand the Rank – Nullity theorem. Further they will also solve Non-singular and singular linear transformations and understand the Standard properties with Examples.

Students will be able to Define orthogonal curvilinear coordinates. They can also define the Fundamental vectors or base vectors, Scale factors or material factors and quadratic differential form. Further students will gain knowledge on Spherical curvilinear system: Cartesian and Cylindrical curvilinear system. They will also be able to do conversion of Cylindrical to orthogonal Spherical polar coordinates. They will gain knowledge on the Theorem: The Spherical coordinate system is orthogonal curvilinear coordinate system.

Students will be able to define Total differential equations and understand the Necessary condition for the equation Pdx+ Qdy+Rdz= 0 to be integrable and hence solve the problems. They can also evaluate Simultaneous equations. Further they will be able to Form Partial differential equation and evaluate Equations of First Order Lagrange's linear equation. They will also learn to evaluate Non-Linear PDE by Charpit's method and to solve Standard types of first order non-linear partial differential equation (By known substitution). They can also find the Solution of second order linear partial differential equations in two variables with constant coefficients by finding complementary function and particular integral. Further they can also find the Solution of one dimensional heat equations and Solution of one dimensional wave equations using Fourier series.

Mathematics VIII

Upon successful completion of Complex Analysis, a student will be able to Represent complex numbers algebraically and geometrically, Define and analyze limits and continuity for complex functions as well of analyticity and the Cauchy Riemann equations and of results on harmonic and entire functions including the fundamental theorem of algebra, also Be able to prove simple results in elementary transformations namely Translation, rotation, magnification and inversion.

Students will be able to find the approximate solutions of algebraic expressions, differential equations and integral equations by using various methods like method of false position, Newton-Raphson method, Gauss Jacobi and Gauss seidel, Taylor's series, Euler's and Euler's modified method and Runge-Kutta 4th ordered method. At the outset they can identify which method is more appropriate to solve the equations.

COURSE OUTCOME OF MATHEMATICS PRACTICALS

On successful completion of the mathematics practical, students can efficiently work with math softwares such as SCILAB, MAXIMA, PYTHON. They can recognize the difference between these softwares and they can visualise algebraic and analytical results geometrically. Students are now expected to write the program and to check whether the result is matching practically and theoretically. Three dimensional concepts can only be conceived by three dimensional models in the laboratory, where as it is very difficult to understand these concepts on a black board, they can also plot 2D and 3D graphs which helps them in better understand of the concepts. At the outset students will have good programming capability.

COMPUTER SCIENCE

I Semester

1. **Programming Concepts using C**

   Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future. Ability to work with textual information, characters and strings, to work with arrays of complex objects. Understanding a concept of object thinking within the framework of functional model. After the completion of this course, the students will be able to develop applications.

II Semester

1. **Data Structures:**

   The students will be able to do a good algorithm that comes together with a set of good data structures that allow the algorithm to manipulate the data efficiently. The data structures are used in various computational problems. It adds the fundamental building blocks for arrays and linked list, from there we build up two important data structures like stack and queues. The students will be able to implement this data structures practically and apply the necessary algorithms to the programming language. Its strengthn the ability to the student to identify and apply the suitable data structurefor the given real world problem.

   At the end of this lab session the student will be able to design and analyse the time and space efficiency of the data structure, capable to identify the appropriate data structure for given problem.

III Semester

1. **DBMS and SE**
   Students will be able to broaden knowledge of Software Process Models. They will become aware of the Software Product. They will be able to increase proficiency in Software Project Management and gain practical experience in Requirements Engineering. Students will be able to gain practical experience in UML tools. They will acquire the background of Software Architecture and understand and be able to explain Software Metrics and Software Reliability. They will learn concepts associated with Software Construction and learn about Software Verification

IV Semester

1. **Operating System & UNIX:**

Students will be able to describe and explain the fundamental components of a computer operating system, define and state the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems, able to describe and extrapolate the interactions among the various components of computing systems. Design and construct

the following OS components: System calls, Schedulers, Memory management systems, Virtual Memory and Paging systems.

V Semester:

1. **Visual Programming:**

Visual programming provides the students with skills and knowledge required to use essential features and capabilities of Visual BASIC, a programming system used to produce Graphical User Interfaces and applications in a Windows environment. It includes basic programming concepts, problem solving, programming logic, and the design of event-driven programming. The students will be able to explain the concepts of windows programming, write pseudo code for windows program, develop program using Visual Basic, develop program using VC++ and develop real time applications using VB and VC++.

2. **Java Programming:**

Students gain extensive experience with Java and its object-oriented features. They learn to design and program Stand-alone Java applications. They also learn Graphical user Interface, multithreading, Exception handling, Wrapper classes, vectors, and read and write files in Java. They will also learn to design Applet Programming. This course help students to develop small Java application Projects.

VI Semester:

1. **Web Programming:**
Students will learn HTML tags and JavaScript Language programming concepts and techniques, develop the ability to logically plan and develop web pages. Students will be able to write scripts using JavaScript in a web page, Effectively incorporate JavaScript in a web page, Create forms and check for data accuracy, use JavaScript system objects, embed objects in a web page, effectively use decision and looping statements in JavaScript programs, manipulate strings, use array processing. Students learn to write, test, and debug web pages using HTML and JavaScript. Students develop various Web applications and gain knowledge of current and emerging technologies and practices.

2. **Computer Networks:**

Students will learn an overview of the concepts and fundamentals of data communication and computer networks. The students will be able to demonstrate the knowledge and ability to independently understand basic computer network technology, identify the different types of network topologies and protocols. The students will be able to visualise in building up the skills of subnetting and routing mechanisms. It allows the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

3. Project Lab:

Demonstrate knowledge on programming. It helps individual learning process, by which the students can deepen their learning, applying their knowledge in new situations and various learning activities. Demonstrate knowledge on creating windows based applications by using a vastly used IDE in the industry. It emphasizes student engagement, collaboration and hands-on learning through engagement with complex tasks based on real-life applications