APPLIED PHYSICS
I B.Tech., I SEM

Course Title: Applied Physics	Course Code: AS20-00BS08
Teaching Scheme (L:T:P): 3:1:0	Credits:3
Type of Course: Lecture +Tutorial	Total Contact Periods: 48Hrs : 16 Hrs
Continuous Internal Evaluation-30 Marks	Semester End Exams-70 Marks

Prerequisites:

- The student must have basic knowledge of units and dimension of physical quantities, principles of mechanics and laws of optics.
- The student must be aware of basics of waves and oscillations, fundamental principles of electromagnetic theory.
- The student must have fundamental knowledge of mathematical concepts like vector algebra, integration and differentiation.

Course Overview:

This course deals with quantum principles and explores their applications in studying the behaviour of fundamental entities of atom. It deals with semiconductor devices which are employed in designing electronic systems and in communication field. It deals with the fundamental properties of dielectric and magnetic materials and explore their application in all engineering streams.

Course Objective

- To explore the dual nature of the particle and applications of Schrodinger Equation.
- To identify the Concept of Energy band formation and analyze classification of solids.
- To distinguish the differences between Intrinsic and Extrinsic Semiconductors
- To explore the different applications of semiconductor devices.
- To identify the behaviour of solids under electric and magnetic field and Understand the concept of superconductivity
- To interpret the characteristics of Lasers, types of Lasers, Optical fiber principle and their applications.

Course Outcomes (s)

CO#	Course Outcomes
C112.1	Interprets the dual nature of matter waves using quantum principles.
C112.2	Differentiates the physical properties of conductors, insulators and semiconductors using energy band.
C112.3	Identifies the different types of semiconductors using Hall Effect
C112.4	Analyzes the different properties of semiconductor devices and their applications.
C112.5	Explores the different types of Dielectric and Magnetic materials and their applications in different fields.
C112.6	Identifies the different characteristics and applications of lasers and fiber optics

COURSE CONTENT (SYLLABUS)

Unit - I: QUANTUM MECHANICS
Introduction to Quantum Mechanics (Origin of QM), Dual nature of particles, De Broglie's hypothesis, Matter waves, Heisenberg's uncertainty principle, Photo-electric effect(qualitative), Davisson and Germer's experiment, G.P Thomson experiment, Schrodinger time-independent wave equation-significance of wave function, particle in one dimensional square well potential.

Unit – II: INTRODUCTION TO SOLIDS
Classical Statistics – Maxwell-Boltzmann Distribution(qualitative) Quantum Statistics – Bose-Einstein statistics(qualitative), Fermi – Dirac statistics(qualitative), Density of Energy states, Electrons in a periodic potential – Bloch theorem, Kronig – Penny Model(qualitative), Brillouin Zones (E-K curve), Concept of effective mass of electron, Energy band formation in solids, Classification of solids into Metals, Semiconductors and insulators.

Unit - III: SEMICONDUCTOR PHYSICS AND DEVICES
Semiconductor Physics: Intrinsic and Extrinsic semiconductors, Carrier concentration in intrinsic and extrinsic semiconductors. Dependence of Fermi level on carrier concentration and temperature, carrier transport: diffusion and drift, Hall Effect.
Semiconductor Devices: PN Junction Diode – Junction Formation, Energy Band Diagram, V-I characteristics of PN junction diode, Direct and Indirect band gap semiconductors, LED & Solar cell.

Unit - IV: DIELCTRICS AND MAGNETIC PROPERTIES OF MATERIALS
Dielectric properties: Introduction, Types of Polarizations (Electronic and Ionic) and Calculation of their polarizabilities, Internal fields in solids: (Lorentz Method), Clausius-Mossotti relation, Piezo-electricity, Ferroelectricity, Pyro-electricity and their applications.
Magnetic Properties: Introduction, Bohr magneton, classification of magnetic materials on the basis of magnetic moment, Hysteresis curve based on domain theory, Soft and hard magnetic materials, Applications.
Superconductors: Introduction, type – I and type – II Superconductors, Applications of Superconductors

Unit-V LASERS AND FIBER OPTICS
Lasers: Introduction, Characteristics of lasers, Absorption, Spontaneous and Stimulated emissions, Relation between Einstein's Coefficients, Population inversion, Metastable state, Pumping, Block Diagram of laser, Construction and working of Ruby Laser, Helium-Neon Laser, Applications of lasers in Defense, Medical field.
Fiber Optics: Introduction to optical fiber, Construction and working of an Optical Fiber, Acceptance angle, Numerical aperture, Types of Optical fibers –Mode & Propagation through Step and Graded index fibers, Attenuation, Applications of optical fibers in Communication System and Sensors**.**

Text Books:

1. Engineering Physics, B.K. Pandey, S. Chaturvedi - Cengage Learning.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Halliday and Resnick, Physics - Wiley

References Books:

1. Engineering physics 2nd edition –H.K.Malik and A.K. Singh Richard.
2. Introduction to Solid State Physics - Charles Kittel

Online Resources (SWAYAM/NPTEL/MOOCS/COURSERA):

1. https://onlinecourses.nptel.ac.in/noc20_ph24/preview
2. https://onlinecourses.nptel.ac.in/noc20_ph16/preview
3. https://www.coursera.org/learn/semiconductor-physics
4. https://www.coursera.org/lecture/leds-semiconductor-lasers/active-optical-devices-specialization-introduction-0jner

Web Reference/E-Books:

1. https://ocw.mit.edu/courses/physics/8-231-physics-of-solids-i-fall-2006/download-course-materials/
2. http://web.mit.edu/6.732/www/texts.html

LINEAR ALGEBRA AND ADVANCED CALCULUS
I B.Tech., I SEM

Course Title: LINEAR ALGEBRA AND ADVANCED CALCULUS	Course Code: AS20-00BS06
Teaching Scheme (L:T:P):3:1:0	Credits:3
Type of Course: Lecture +Tutorial	Total Contact Periods: 48Hrs : 16 Hrs
Continuous Internal Evaluation-30 Marks	Semester End Exams-70 Marks
Prerequisites: 1. Basic definitions of Matrices 2.Knowledge of Calculus 3.Differentiation and Integration rules	

Course Overview: Course include

- Types of matrices and their properties.
- Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
- Concept of Eigen values and eigenvectors and to reduce the quadratic form to canonical form.
- Concept of Sequence.
- Concept of nature of the series.
- Geometrical approach to the mean value theorems and their application to the mathematical problems.
- Evaluation of improper integrals using Beta and Gamma functions.
- Partial differentiation, concept of total derivative
- Finding maxima and minima of function of two and three variables.

Course Objective To learn

- Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations
- Concept of Eigen values and eigenvectors and to reduce the quadratic form to canonical form.
- Concept of nature of the series.
- Geometrical approach to the mean value theorems Evaluation of improper integrals using Beta and Gamma functions.
- Partial differentiation, concept of total derivative. Finding maxima and minima of function of two and three variables

Course Outcomes:

CO#	**Course Outcomes**
C111.1	Convert the set of linear equations in to matrix notation and analyse its solution
C111.2	Apply the concept of orthogonal transformation and reduce quadratic form to canonical form
C111.3	Analyze the nature of series.
C111.4	Describe the applications of the mean value theorems
C111.5	Evaluate the improper integrals using Beta and Gamma functions.
C111.6	Categorize the extreme values of functions of two variables with constraints and without constraints.

COURSE CONTENT (SYLLABUS)

UNIT I:MATRICES

Matrices: Types of Matrices(only definitions);rank of a matrix by Echelon form and Normal form; Inverse of Non-singular matrices by Gauss-Jordan method; System of linear equations: solving system of Homogeneous and Non-Homogeneous equations-consistency, Gauss elimination method; Gauss Jacobi Iteration Method. Gauss Seidel Iteration Method.

UNIT-II: EIGEN VALUES AND EIGEN VECTORS

Eigen values and Eigenvectors and their properties; Cayley-Hamilton Theorem (without proof): finding inverse and power of a matrix by Cayley-Hamilton Theorem; Diagonalization; Quadratic forms and Nature, Index and Signature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT-III: SEQUENCES & SERIES

Sequence: Definition of a Sequence, Convergence of a sequence (definitions and examples only).

Series: Convergent, Divergent and Oscillatory Series; Series of positive terms: Comparison test, p-test, D-Alembert's ratio test; Raabe's test; logarithmic test; Integral test. Alternating series: Leibnitz test; Alternating Convergent series: Absolute and Conditionally Convergence.

UNIT-IV: SINGLE VARIABLE CALCULUS

Mean value theorems(all the theorems without proof): Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem. Taylor's Series. Definition of Improper Integral: Beta and Gamma functions and their applications.

UNIT-V: MULTIVARIABLE CALCULUS

Partial Differentiation; Euler's Theorem; Total derivative; Jacobian;
Functional dependence
& independence, Maxima and minima of functions of two variables and three variables with constraints; without constraints; method of Lagrange's Multipliers.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43nd Edition, 2014.
2. R.K.Jain, S.R.K. Iyengar Advanced Engineering Mathematics, Narosa Publishing House Pvt.Ltd.,5 thEdition,2016

References Books:

1. **1.**N.P. Bali and Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

2. B.V.Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Online Resources (SWAYAM/NPTEL/MOOCS/COURSERA):

1.https://www.khanacademy.org/math/linear-algebra
2.https://onlinecourses.nptel.ac.in/noc20_ma27
3.https://www.mooc-list.com/course/calculus-two-sequences-and-series-coursera

Web Reference/E-Books:

1 www.ee.ic.ac.uk
2 http://en.m.wikipedia.org
3 www.math.odu.edu

LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS
I B.Tech., I-Sem., (Common to CSE, IT, CSM, AIDS & CSG)

Course Title: Linear Algebra and Differential Equations	Course Code: AS22-00BS05
Teaching Scheme (L:T:P): 3:1:0	Credits: 4
Type of Course: Lecture + Tutorial	Total Contact Periods: 48Hrs + 16Hrs
Continuous Internal Evaluation: 40 Marks	Semester End Exam: 60 Marks
Prerequisites: Intermediate Mathematics	

COURSEOBJECTIVES

- Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
- Concept of Eigen values and eigenvectors and to reduce the quadratic form to canonical form.
- Concept of nature of the series.
- Methods of solving the differential equations of first order.
- Methods of solving the differential equations of higher order.

COURSEOUTCOMES

CO#	Course Outcomes
C111.1	Convert the set of linear equations in to matrix notation and analyze its solution
C111.2	Apply the concept of orthogonal transformation and reduce quadratic form to canonical form
C111.3	Analyze the nature of quadratic forms.
C111.4	Analyze the nature of series.
C111.5	Determine whether the given differential equation of first order is exact or not.
C111.6	Apply the concept of higher order ODE to real world problems.

COURSECONTENT(SYLLABUS)

UNIT I: MATRICES
Rank of a matrix by Echelon form and Normal form, solving system of Homogeneous and Non-Homogeneous equations, Gauss Jacobi Iteration Method, Gauss Seidel Iteration Method.

UNIT-II: EIGEN VALUES AND EIGEN VECTORS
Eigen values and Eigenvectors and their properties; Cayley-Hamilton Theorem (without proof): finding inverse and power of a matrix by Cayley-Hamilton Theorem; Diagonalization; Quadratic forms and Nature, Index and Signature of the Quadratic Forms.

UNIT-III: INFINITE SERIES
Infinite Series: Convergent, Divergent and Oscillatory Series; Series of positive terms: Comparison test, p-test, D-Alembert's ratio test; Cauchy's nth root test, Raabe's test; Alternating series: Leibnitz test; Absolute and Conditionally Convergences.

UNIT IV: FIRST ORDER ODE
Exact equations; non-Exact equations; Linear equations; Bernoulli's equations; Newton's Law of Cooling; Law of Natural Growth and Decay.

UNIT V: HIGHER ORDER LDE
Higher Order Linear Differential Equations with Constant Coefficients; Solutions of Homogeneous and Non-Homogeneous Linear Differential Equations, Method of Variation of Parameters.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43nd Edition, 2014.
2. R.K.Jain, S.R.K. Iyengar Advanced Engineering Mathematics, Narosa Publishing House Pvt.Ltd.,5 thEdition,2016

References Books:

1. N.P. Bali and Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. B.V.Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.

ADVANCED ENGINEERING PHYSICS
I Year II- Sem.,

Course Title: ADVANCED ENGINEERING PHYSICS	**AS25-00BS02**
Teaching Scheme (L: T:P): 3:0:0	Credits: 3
Type of Course: Lecture	Total Contact Periods: 48 Hrs
Continuous Internal Evaluation: 40 Marks	Semester End Exam: 60 Marks

Course Objectives: To Learn

5. To study crystal structures, defects, and material characterization techniques like XRD and SEM.
6. To understand fundamental concepts of quantum mechanics and their applications in solids and nanomaterials.
7. To introduce quantum computing principles, quantum gates, and basic quantum algorithms.
8. To learn the properties and applications of magnetic and dielectric materials.
9. To explore the working and applications of lasers and fibre optics in modern technology.

Course Outcomes: After learning the contents of this paper the student must be able to

CO#	**Course Outcomes**
C122.1	Analyze crystal structures, identify defects, and apply XRD and SEM techniques for material characterization.
C122.2	Apply quantum mechanical principles to explain particle behaviour and energy band formation in solids.
C122.3	Understand quantum computing concepts, use quantum gates, and explain basic quantum algorithms
C122.4	Classify magnetic and dielectric materials and explain their properties, synthesis, and applications.
C122.5	Explain the principles of lasers and fibre optics and their applications in communication and sensing.

COURSE CONTENT (SYLLABUS)

UNIT I: Crystallography & Materials Characterization **8 Hours**

Introduction: Unit cell, space lattice, basis, lattice parameters; crystal structures, Bravais lattices, packing factor: SC, BCC, FCC; Miller indices, inter-planar distance; defects in crystals (Qualitative): point defects, line defects, surface defects and volume defects. Concept of nanomaterials: surface to volume ratio, X -ray diffraction: Bragg’s law, powder method, calculation of average crystallite size using Debye Scherrer’s formula, scanning electron microscopy (SEM): block diagram, working principle.

UNIT II: Quantum Mechanics **8 Hours**

Introduction-Photoelectric effect, de-Broglie hypothesis, Heisenberg uncertainty principle, physical significance of wave function, Schrödinger’s time independent wave equation, particle in a 1D box, Bloch’s theorem (qualitative), Kronig-Penney model (qualitative): E-k diagram, effective mass of electron, formation of energy bands, origin of bandgap, classification of solids, concept of discrete energy levels and quantum confinement in nanomaterials.

UNIT III: Quantum Computing **8 Hours**

Introduction, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits, multiple Qubit system, quantum computing system for information processing, evolution of quantum systems, quantum measurements, entanglement, quantum gates, challenges and advantages of quantum computing over classical computation, quantum algorithms: Deutsch-Jozsa, Shor, Grover.

UNIT IV: Magnetic and Dielectric Materials **8 Hours**

Introduction to magnetic materials, origin of magnetic moment-classification of magnetic materials, hysteresis, Weiss domain theory of ferromagnetism, soft and hard magnetic materials, applications: magnetic hyperthermia for cancer treatment, magnets for EV, Giant Magneto Resistance (GMR) device.
Introduction to dielectric materials, types of polarization (qualitative): electronics, ionic & orientation; ferroelectric, piezoelectric, pyroelectric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM), load cell and fire sensor.

UNIT V: Laser and Fibre Optics **08 Hours**

Introduction to laser, characteristics of laser, Einstein coefficients and their relations, metastable state, population inversion, pumping, lasing action, Ruby laser, He-Ne laser, semiconductor diode laser, applications: Bar code scanner, LIDAR for autonomous vehicle. Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fibres, losses in optical fibre, applications: optical fibre for communication system, sensor for structural health monitoring.

Text Books:

1. Walter Borchardt-Ott, Crystallography: An Introduction, Springer.
2. Charles Kittel, Introduction to Solid State Physics, John Wiley & Sons, Inc.
3. Thomas G. Wong, Introduction to Classical and Quantum Computing, Rooted Grove

References Books:

1. Jozef Gruska, Quantum Computing, McGraw Hill.
2. Michael A. Nielsen & Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press.
3. John M. Senior, Optical Fiber Communications Principles and Practice, Pearson Education Limited.

Useful Links:

- https://shijuinpallotti.wordpress.com/wp-content/uploads/2019/07/optical-fibercommunications-principles-and-pr.pdf
- https://www.geokniga.org/bookfiles/geokniga-crystallography_0.pdf
- https://dpbck.ac.in/wp-content/uploads/2022/10/Introduction-to-Solid-State-PhysicsCharlesKittel.pdf
- https://www.thomaswong.net/introduction-to-classical-and-quantum-computing-1e4p.pdf
- https://www.fi.muni.cz/usr/gruska/qbook1.pdf
- https://profmcruz.wordpress.com/wp-content/uploads/2017/08/quantum-computation-andquantum-information-nielsen-chuang.pdf

DISCRETE MATHEMATICS

II B.Tech., I-Sem., (Common to CSE, IT)

Course Title: Discrete Mathematics	Course Code: AS22-05ES09
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture + Tutorial	Total Contact Periods: 48Hrs + 16Hrs
Continuous Internal Evaluation: 40 Marks	Semester End Exam: 60 Marks
Prerequisites: Basic Mathematics and logic theory	

Course Overview:
This course helps the students to learn the concepts of set theory, graph theory, algebraic relation and color problems.

Course objectives:

- Introduces elementary discrete mathematics for computer science and engineering.
- Topics include formal logic notation, methods of proof, induction, sets, relations, algebraic structures, elementary graph theory, permutations and combinations, counting principles; recurrence relations and generating functions.

Course Outcomes:

CO#	Course Outcomes
C222.1	Understand and construct precise mathematical proofs
C222.2	Apply logic and set theory to formulate precise statements
C222.3	Analyze and solve counting problems on finite and discrete structures
C222.4	Understand the concept of binomial and multinomial theorems.
C222.5	Describe and manipulate sequences
C222.6	Apply graph theory in solving computing problems

COURSE CONTENT (SYLLABUS)

UNIT - I
MATHEMATICAL LOGIC: Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus.

UNIT - II
SET THEORY: Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.

UNIT - III
ALGEBRAIC STRUCTURES: Introduction, Algebraic Systems, Semi groups and Monoids, Lattices as Partially Ordered Sets, Boolean Algebra.

UNIT - IV
ELEMENTARY COMBINATORICS: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and Multinomial Theorems, The Principle of Exclusion.

UNIT - V
GRAPH THEORY: Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

TEXT BOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science: J.P. Tremblay, R. Manohar, McGraw-Hill, 1st ed.
2. Discrete Mathematics for Computer Scientists & Mathematicians: Joe l. Mott, Abraham Kandel, Teodore P. Baker, Prentis Hall of India, 2nd ed.

REFERENCE BOOKS:

1. Discrete and Combinatorial Mathematics - an applied introduction: Ralph.P. Grimald, Pearson education, 5th edition.
2. Discrete Mathematical Structures: Thomas Kosy, Tata McGraw Hill publishing co.

DISCRETE MATHEMATICS

L	T	P	C
3	0	0	3

Course Overview:
A general introduction to the language, reasoning techniques, and foundational structures of discrete mathematics. This course emphasizes mathematical reasoning, logical thinking, and proof techniques essential for computer science and engineering. Topics include sets, relations, functions, propositional and predicate logic, methods of proof, mathematical induction, sequences, counting principles, graph theory, and their applications to algorithms and computation.

Course Objectives:
1. Develop proficiency in mathematical reasoning, logic, and proof techniques.
2. Introduce formal languages for describing sets, relations, functions, and logical statements.
3. Strengthen problem-solving skills using induction, recursion, and counting methods.
4. Apply discrete mathematical structures to algorithms and graph-based models.
5. Expose students to advanced ideas in mathematics and computer science.

Course Outcomes: After completing this course, students will be able to:
1. Construct precise mathematical definitions and proofs.
2. Apply logical reasoning and set-theoretic concepts to formal problem solving.
3. Analyze sequences, recursive definitions, and induction-based arguments.
4. Solve counting problems using combinatorial principles.
5. Model and analyze problems using graphs and discrete structures.

COURSE CONTENT

UNIT – I
Logic and Mathematical Reasoning: Logical form of statements, logical equivalence, conditional statements, valid and invalid arguments, tautologies and contradictions, applications to number systems and circuits, predicates and quantified statements, statements with multiple quantifiers, arguments with quantified statements.

UNIT – II
Methods of Proof: Direct proofs and counterexamples, proofs involving rational numbers and divisibility, proof by cases, quotient–remainder theorem, proofs involving floor and ceiling functions, indirect proofs using contradiction and contraposition, classical theorems using indirect arguments, basic proof strategies involving mathematical induction.

UNIT – III

Set Theory, Relations, and Functions: Basic definitions of set theory, set identities, relations on sets, properties of relations (reflexive, symmetric, transitive), equivalence relations and partial orderings, functions defined on general sets, one-to-one and onto functions, inverse functions.

UNIT – IV

Sequences, Induction, and Counting: Sequences, mathematical induction, strong mathematical induction, recursive definitions of sequences, basic counting principles, multiplication rule, addition rule, pigeonhole principle, combinations, combinations with repetition, principle of inclusion–exclusion.

UNIT – V

Graph Theory: Trees and their basic properties, graphs and their properties, trails, paths, and circuits, matrix representations of graphs, applications of graphs in computation and algorithms.

TEXT BOOKS

1. J. P. Tremblay and R. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill.
2. J. L. Mott, A. Kandel, and T. P. Baker, Discrete Mathematics for Computer Scientists and Mathematicians, Prentice Hall of India.

REFERENCE BOOKS

1. Kenneth H. Rosen, Discrete Mathematics and Its Applications, Tata McGraw-Hill, Fifth Edition.
2. Thomas Koshy, Discrete Mathematics with Applications, Elsevier.
3. Grassmann and Tremblay, Logic and Discrete Mathematics, Pearson Education.
4. C. L. Liu and D. P. Nohapatra, Elements of Discrete Mathematics – A Computer-Oriented Approach, Tata McGraw-Hill, Third Edition.

Grading Policy

The majority of the topics covered in this course shall be taught directly from the prescribed textbooks and reference materials listed above. The course will assess student learning across all the modules outlined in the syllabus.

An in-class quiz shall be conducted after the completion of each module. Students will be permitted to make up for no more than two missed quizzes only by taking the quiz in person on a scheduled weekend, as determined by the instructor. No additional quiz make-ups will be allowed.

The course will include two midterm examinations and one comprehensive final examination. Homework assignments will be given on a weekly basis, and students are expected to submit all homework by the specified deadlines.

The weightage for assessment components is as follows:

1. **Homework – 10%**

2. **Quizzes – 20%**
3. **Midterm Examinations – 20% each**
4. **Final Examination – 30%**

Grade Scale

- 90–100%: A
- 80–89%: B
- 70–79%: C
- 60–69%: D

The passing grade for this course is a letter grade of C, corresponding to 70% or above.

Note: The midterm examinations and the final examination are cumulative, meaning that all previously covered material may be tested. A minimum of 80% attendance is mandatory to be eligible to appear for the final examination, with minor exceptions subject to approval. Although attendance does not carry a direct weightage in the final course grade, it is a critical component of this course. Students who fail to meet the attendance requirement must obtain permission from the Academic Head of the Department in order to sit for the final examination.

Course Timeline

The course timeline is dependent on the academic term in which the course is offered (regular semester or summer term). As a result, an exact schedule for the completion of individual modules may vary. A detailed course timeline, including the distribution of topics across instructional periods, important assessment dates, and examination schedules, will be shared with students prior to the commencement of classes. Each instructional period will be 90 minutes (1.5 hours) in duration. Lectures shall be conducted in accordance with the university's academic calendar and scheduling guidelines.

DISCRETE MATHEMATICS

II Year, I- Sem.,

Course Title: Discrete Mathematics	Course Code: AS25- 05PC01
Teaching Scheme(L: T: P):3:0:0	Credits:3
Type of Course: Lecture	Total Contact Periods: 48Hrs
Continuous Internal Evaluation-40Marks	Semester End Exams-60Marks
Prerequisites: Basic knowledge of set theory, logic, and fundamental mathematical concepts.	

Course Overview:

This course introduces mathematical structures and techniques essential for computer science, including logic, set theory, relations, functions, combinatory, graph theory, and algorithms, to support problem-solving and computational reasoning.

Course Objectives:

1. Introduces elementary discrete mathematics for computer science and engineering.
2. Topics include formal logic notation, methods of proof, induction, sets, relations, algebraic structures, elementary graph theory, permutations and combinations, counting principles; recurrence relations and generating functions.

Course Outcomes

CO#	Course Outcomes
C211.1	Understand and construct precise mathematical proofs
C211.2	Apply logic and set theory to formulate precise statements
C211.3	Analyze and solve counting problems on finite and discrete structures
C211.4	Describe and manipulate sequences
C211.5	Apply graph theory in solving computing problems

COURSE CONTENT (SYLLABUS)

UNIT - I

Mathematical logic: Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus.

UNIT - II

Set theory: Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.

UNIT - III

Algebraic Structures: Introduction, Algebraic Systems, Semi groups and Monoids, Lattices as Partially Ordered Sets, Boolean Algebra.

UNIT - IV

Elementary Combinatory: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and

Multinomial Theorems, The Principle of Exclusion.

UNIT - V

Graph Theory: Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits,
Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

TEXT BOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science: J.P. Tremblay, R. Manohar, McGraw-Hill, 1st ed.
2. Discrete Mathematics for Computer Scientists & Mathematicians: Joe l. Mott, Abraham Kandel,Teodore P. Baker, Prentis Hall of India, 2nd ed.

REFERENCE BOOKS:

1. Discrete and Combinatorial Mathematics - an applied introduction: Ralph. P. Grimald, Pearson education, 5th edition.
2. Discrete Mathematical Structures: Thomas Kosy, Tata McGraw Hill Publishing co.

LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS
I B.Tech., I-Sem., (Common to CSE, IT, CSM, AIDS & CSG)

Course Title: Linear Algebra and Differential Equations	Course Code: AS22-00BS05
Teaching Scheme (L:T:P): 3:1:0	Credits: 4
Type of Course: Lecture + Tutorial	Total Contact Periods: 48Hrs +16Hrs.
Continuous Internal Evaluation: 40 Marks	Semester End Exam: 60 Marks
Prerequisites: Intermediate Mathematics	

COURSEOBJECTIVES

- Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
- Concept of Eigen values and eigenvectors and to reduce the quadratic form to canonical form.
- Concept of nature of the series.
- Methods of solving the differential equations of first order.
- Methods of solving the differential equations of higher order.

COURSEOUTCOMES

CO#	Course Outcomes
C111.1	Convert the set of linear equations in to matrix notation and analyze its solution
C111.2	Apply the concept of orthogonal transformation and reduce quadratic form to canonical form
C111.3	Analyze the nature of quadratic forms.
C111.4	Analyze the nature of series.
C111.5	Determine whether the given differential equation of first order is exact or not.
C111.6	Apply the concept of higher order ODE to real world problems.

COURSECONTENT(SYLLABUS)

UNIT I: MATRICES

Rank of a matrix by Echelon form and Normal form, solving system of Homogeneous and Non-Homogeneous equations, Gauss Jacobi Iteration Method, Gauss Seidel Iteration Method.

UNIT-II: EIGEN VALUES AND EIGEN VECTORS

Eigen values and Eigenvectors and their properties; Cayley-Hamilton Theorem (without proof): finding inverse and power of a matrix by Cayley-Hamilton Theorem; Diagonalization; Quadratic forms and Nature, Index and Signature of the Quadratic Forms.

UNIT-III: INFINITE SERIES

Infinite Series: Convergent, Divergent and Oscillatory Series; Series of positive terms: Comparison test, p-test, D-Alembert's ratio test; Cauchy's nth root test, Raabe's test; Alternating series: Leibnitz test; Absolute and Conditionally Convergences.

UNIT IV: FIRST ORDER ODE

Exact equations; non-Exact equations; Linear equations; Bernoulli's equations; Newton's Law of Cooling; Law of Natural Growth and Decay.

UNIT V: HIGHER ORDER LDE

Higher Order Linear Differential Equations with Constant Coefficients; Solutions of Homogeneous and Non-Homogeneous Linear Differential Equations, Method of Variation of Parameters.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43nd Edition, 2014.
2. R.K.Jain, S.R.K. Iyengar Advanced Engineering Mathematics, Narosa Publishing House Pvt.Ltd.,5 thEdition,2016

References Books:

1. N.P. Bali and Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. B.V.Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.

PHYSICS I Laboratory

L	T	P	C
0	0	2	1

Pre-requisites: Calculus at the level of differential and integral calculus, including limits, derivatives, basic integration techniques, and vector components. Prior exposure to high school physics is recommended.

Course Objectives: The objectives of this laboratory course are to:

1. Reinforce fundamental principles of classical mechanics through systematic experimentation.
2. Develop proficiency in experimental measurement, graphical analysis, and model validation.
3. Apply uncertainty analysis and statistical methods to mechanical systems.
4. Investigate translational, rotational, and oscillatory motion experimentally.
5. Examine wave phenomena in mechanical systems using quantitative techniques.

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

1. Analyze two-dimensional motion and validate kinematic equations experimentally.
2. Verify Newtonian force laws using controlled mechanical systems.
3. Evaluate conservation of energy and momentum through quantitative experiments.
4. Determine rotational inertia and analyze rotational dynamics of rigid bodies.
5. Investigate translational and angular simple harmonic motion.
6. Measure mechanical wave velocity and analyze resonance behavior.
7. Estimate measurement uncertainties and apply error propagation to derived quantities.

LIST OF EXPERIMENTS:

UNIT I LABS – KINEMATICS AND DYNAMICS

1. **Measurement and Uncertainty Analysis**
   Determination of physical quantities (length, mass, time, force) and estimation of absolute, relative, and propagated uncertainties.
2. **Projectile Motion – Two-Dimensional Kinematics**
   Determination of launch velocity, range, and time of flight; experimental verification of parabolic trajectory equations.
3. **Verification of Newton's Second Law (Dynamic System Analysis)**
   Experimental investigation of force–acceleration relationship using inclined plane or pulley systems.

UNIT II LABS – CONSERVATION LAWS

4. **Conservation of Mechanical Energy in Translational Motion**
   Quantitative study of transformation between kinetic and potential energies.
5. **Conservation of Linear Momentum in Collisions**
   Experimental analysis of elastic and inelastic interactions in one dimension.

UNIT III LABS – ROTATIONAL DYNAMICS

6. **Rotational Motion and Determination of Moment of Inertia**
   Measurement of rotational inertia; verification of rotational energy conservation; comparison of theoretical and experimental inertia values.
7. **Rolling Motion and Energy Distribution**
   Investigation of coupled translational and rotational motion; validation of no-slip condition.

UNIT IV LABS – OSCILLATORY MOTION

8. **Simple Harmonic Motion – Spring–Mass System**
   Experimental verification of period–mass relationship and determination of spring constant.
9. **Torsional Oscillator – Angular SHM**
   Measurement of torsional restoring constant and analysis of angular oscillations.

UNIT V LABS – MECHANICAL WAVES

10. **Standing Waves on a Stretched String**
    Investigation of resonance modes, harmonic frequencies, and wave velocity dependence on tension.
11. **Velocity of Sound in Air**
    Determination of sound speed using resonance or pulse methods; comparison with theoretical predictions.

All listed experiments are mandatory and must be completed during the semester. If a laboratory session is missed due to valid and documented reasons, the student must promptly inform the lab instructor and arrange a make-up session.

PHYSICS I

L	T	P	C
3	0	1	4

Pre-requisites: Calculus at the level of differential and integral calculus, including limits, derivatives, basic integration techniques, and vector components. Prior exposure to high school physics is recommended.

Course Objectives: The objectives of this course are to enable students to:

1. Develop a calculus-based understanding of translational and rotational motion in one, two, and three dimensions.
2. Apply Newtonian mechanics systematically to analyze forces, constraints, and motion of particles and rigid bodies.
3. Formulate and utilize energy and momentum principles for solving complex physical systems.
4. Investigate oscillatory motion, gravitation, and foundational elements of modern physics within the framework of classical mechanics.
5. Cultivate structured problem-solving skills using mathematical modeling, vector analysis, and physical reasoning.

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

1. Analyze particle motion using vector kinematics and differential calculus.
2. Construct and interpret free-body diagrams to solve multi-force and multi-body dynamics problems.
3. Apply conservation laws of energy, linear momentum, and angular momentum to physical systems.
4. Examine rotational motion of rigid bodies including torque, angular acceleration, and gyroscopic behavior.
5. Model simple harmonic motion and damped oscillations mathematically and physically.
6. Evaluate gravitational interactions, orbital motion, and introductory relativistic corrections in high-speed systems.
7. Demonstrate clarity, coherence, and mathematical precision in solving analytical and conceptual mechanics problems.
8. Apply statistical and error analysis techniques including uncertainty propagation and discrepancy evaluation in experimental measurements.

UNIT – I: VECTOR KINEMATICS AND PARTICLE MOTION

Mathematical foundations of mechanics: Cartesian coordinate systems, unit vectors, vector algebra and differentiation. Displacement, velocity, and acceleration in one and two dimensions. Motion under constant and variable acceleration. Relative motion analysis. Projectile motion with and without air resistance (introductory treatment). Uniform circular motion, centripetal and tangential acceleration components. Motion in non-inertial reference frames (introductory discussion).

UNIT – II: NEWTONIAN DYNAMICS AND FORCE ANALYSIS
Newton's Laws of motion and inertial reference frames. Free-body diagram construction and systematic force identification. Contact forces including normal reaction, tension, spring forces, static and kinetic friction. Applications to systems involving pulleys, connected bodies, and constrained motion. Circular motion under force constraints. Introduction to variable mass systems including basic rocket propulsion analysis (introductory treatment). Applications to inclined planes and multi-body mechanical systems.

UNIT – III: WORK, ENERGY, AND LINEAR MOMENTUM
Work done by constant and variable forces; line integrals in work calculations. Kinetic energy and the Work–Energy Theorem. Conservative and non-conservative forces. Potential energy functions and energy conservation principles. Power and mechanical efficiency. Linear momentum, impulse, and the Impulse–Momentum Theorem. Conservation of linear momentum in isolated systems. Center of mass for discrete and continuous systems. Elastic and inelastic collisions in one and two dimensions.

UNIT – IV: ROTATIONAL DYNAMICS AND ANGULAR MOMENTUM
Angular kinematics and rotational variables. Torque and rotational analog of Newton's second law. Moment of inertia for discrete and continuous bodies; parallel-axis theorem. Rotational work and rotational kinetic energy. Rolling motion without slipping. Conservation of angular momentum. Rotational stability and gyroscopic motion. Coupled translational and rotational systems.

UNIT – V: OSCILLATIONS, GRAVITATION, AND INTRODUCTORY MODERN TOPICS
Simple harmonic motion: differential equation formulation and analytical solutions. Energy in oscillatory systems. Damped and driven oscillations (qualitative and quantitative treatment). Mechanical wave motion: transverse and longitudinal waves, wave parameters, wave speed in strings and fluids, superposition principle, standing waves and resonance in strings and air columns. Newton's law of universal gravitation. Gravitational potential energy and orbital motion. Kepler's laws (derivation outline). Introductory special relativity concepts including time dilation and length contraction (conceptual treatment). Brief overview of astrophysical applications within classical mechanics.

TEXTBOOKS:

1. H. D. Young and R. A. Freedman, *University Physics with Modern Physics*, 15th Edition, Pearson, 2020.
2. R. A. Serway and J. W. Jewett, *Physics for Scientists and Engineers*, 10th Edition, Cengage Learning, 2018.
3. D. Kleppner and R. Kolenkow, *An Introduction to Mechanics*, 2nd Edition, Cambridge University Press, 2014.

REFERENCE BOOKS:

1. J. R. Taylor, *Classical Mechanics*, University Science Books, 2005.
2. D. Morin, *Introduction to Classical Mechanics*, Cambridge University Press, 2008.
3. L. D. Landau and E. M. Lifshitz, *Mechanics*, 3rd Edition, Butterworth-Heinemann, 1976.

GRADING POLICY:
The instructional material for this course will be primarily derived from the prescribed textbook and supporting reference materials. Student performance will be assessed based on conceptual understanding, analytical problem-solving ability, and application of mathematical methods to physical systems across all units of the syllabus. Homework assignments will be assigned regularly to reinforce lecture content. Students are required to submit all assignments by the specified deadlines. Periodic midterm examinations will be conducted, typically following the completion of major units, to evaluate comprehension of recently covered topics. The course will include three midterm examinations and one comprehensive final examination conducted in person.

A minimum attendance requirement of 90% of all scheduled instructional sessions is mandatory for eligibility to sit for the final examination. Although attendance does not directly contribute to the final numerical course grade, consistent participation is considered essential for academic success in this course. Students who do not meet the minimum attendance requirement may be required to obtain formal approval from the Head of the Academic Department in order to be permitted to take the final examination. Exceptions, if any, will be considered only under documented and officially recognized circumstances.

GRADE BREAKDOWN:

- Homework Assignments: 10%
- Laboratory: 15%
- Midterm Examination I: 15%
- Midterm Examination II: 15%
- Midterm Examination III: 15%
- Final Examination: 30%

GRADE SCALE:

- A: 90 – 100
- B: 80 – 89
- C: 70 – 79
- D: 60 – 69
- F: Below 60

The passing grade for this course is letter grade C which is 70% or above.

Note: All midterm examinations and the comprehensive final examination are cumulative in nature. Students are expected to demonstrate mastery of concepts from all previously covered units, as material introduced earlier in the course may be assessed in subsequent examinations.

COURSE TIMELINE:

Each instructional session shall be 90 minutes (1.5 hours) in duration. Lectures will be conducted strictly in person in accordance with the university’s academic calendar and scheduling guidelines. The course timeline is dependent on the academic term in which the course is offered. The distribution of topics across instructional weeks may vary based on institutional scheduling requirements. A detailed instructional schedule, including assessment dates and examination periods, will be communicated to students prior to the commencement of the term.

PHYSICS II Laboratory

L	T	P	C
0	0	2	1

Pre-requisites: PHYSICS I. Calculus II including techniques of integration, basic differential equations, and elementary vector calculus (gradient, divergence, curl).

Course Objectives

The objectives of this laboratory course are to:

1. Experimentally investigate electric and magnetic field phenomena introduced in the lecture component.
2. Develop competency in electrical instrumentation and signal analysis techniques.
3. Apply mathematical modeling to experimental data including exponential and harmonic fitting.
4. Validate Maxwellian relationships through observation of electromagnetic induction and wave behavior.
5. Strengthen quantitative reasoning through structured uncertainty and residual analysis.

Course Outcomes

Upon successful completion, students will be able to:

1. Map electric potential distributions and determine corresponding electric field configurations.
2. Analyze energy storage in capacitive systems.
3. Measure magnetic fields generated by steady currents and magnetic dipoles.
4. Verify Biot–Savart and Ampère relationships experimentally.
5. Analyze transient and oscillatory behavior in electrical circuits.
6. Measure induced EMF and validate Faraday's Law.
7. Observe interference and polarization of electromagnetic radiation.
8. Perform uncertainty propagation and model-based regression analysis.

LIST OF EXPERIMENTS:

UNIT I LABS – ELECTROSTATICS AND FIELD ENERGY

1. **Electric Field Mapping and Equipotential Analysis**
   Experimental mapping of two-dimensional potential distributions; determination of electric field vectors; verification of orthogonality between field lines and equipotentials; analysis of dipole and parallel-plate geometries.
2. **Capacitive Energy and Field Distribution Study**
   Measurement of capacitance for different geometries; investigation of dielectric effects; experimental estimation of stored electric energy.

UNIT II LABS – CONSERVATION AND FIELD RELATIONS

3. **Charge Conservation and Transient Charge Redistribution**
   Experimental verification of charge conservation in closed circuits; measurement of transient redistribution behavior using time-resolved voltage data.

UNIT III LABS – MAGNETIC FIELDS AND MAGNETOSTATICS

4. **Magnetic Field Measurement Using Hall Sensor**
   Measurement of magnetic field due to straight conductor and circular loop; investigation of inverse-distance dependence; qualitative examination of magnetic dipole fields.
5. **Charge-to-Mass Ratio of the Electron**
   Determination of e/m via magnetic deflection; comparison to accepted values; uncertainty evaluation.

UNIT IV LABS – CURRENT AND CIRCUIT DYNAMICS

6. **Resistive Circuit Analysis and Instrumentation**
   Verification of Ohm's Law; application of Kirchhoff's rules; linear regression analysis of I–V characteristics; introduction to digital measurement instrumentation.
7. **RC and RL Transient Response Analysis**
   Measurement of exponential charging/discharging curves; extraction of time constants; comparison with theoretical predictions.
8. **LCR Oscillations: Damped and Driven Response**
   Measurement of resonance frequency; analysis of damping ratio; forced oscillation amplitude study.

UNIT V LABS – ELECTROMAGNETIC INDUCTION AND WAVE PHENOMENA

9. **Electromagnetic Induction and Induced EMF**
   Investigation of changing magnetic flux; measurement of induced voltage; validation of Faraday–Lenz relationship.
10. **Wave Interference and Polarization**
    Observation of optical interference patterns; determination of wavelength using interferometric techniques; verification of polarization intensity dependence ($\cos^2$ law).

All listed experiments are mandatory and must be completed during the semester. If a laboratory session is missed due to valid and documented reasons, the student must promptly inform the lab instructor and arrange a make-up session.

PHYSICS II

L	T	P	C
3	0	1	4

Pre-requisites: PHYSICS I. Calculus II including techniques of integration, basic differential equations, and elementary vector calculus (gradient, divergence, curl).

Course Objectives: The objectives of this course are to enable students to:

1. Develop a rigorous understanding of electric and magnetic fields using vector calculus.
2. Analyze charge and current distributions and determine the fields they generate.
3. Apply Maxwell's framework to unify electrostatics, magnetostatics, and electromagnetic induction.
4. Investigate circuit behavior from both macroscopic and microscopic perspectives.
5. Explore electromagnetic wave propagation and its physical significance.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Compute electric fields and potentials due to discrete and continuous charge distributions.
2. Apply Gauss's Law to systems exhibiting symmetry.
3. Analyze capacitors, dielectric media, and electrostatic energy storage.
4. Solve DC and transient circuit problems using Kirchhoff's laws and differential equations.
5. Determine magnetic fields generated by steady currents using Biot–Savart and Ampère's Law.
6. Analyze electromagnetic induction and inductive circuit behavior.
7. Interpret Maxwell's equations in integral and differential form.
8. Describe electromagnetic wave propagation and its relation to the speed of light.

UNIT – I: ELECTRIC FIELDS, FLUX, AND ELECTROSTATIC ENERGY

Electric charge and Coulomb's law. Superposition principle. Electric field and field-line representation. Continuous charge distributions: line, surface, and volume densities. Electric flux and Gauss's Law in integral form. Applications to symmetric charge configurations. Differential form of Gauss's Law. Electrostatic energy density in electric fields. Boundary conditions for electric fields at dielectric interfaces.

UNIT – II: ELECTRIC POTENTIAL, FIELD RELATIONS, AND DIELECTRICS

Work and electrostatic potential energy. Electric potential and equipotential surfaces. Relation between electric field and potential (gradient formulation). Poisson's and Laplace's equations (introductory treatment). Capacitance of isolated conductors and parallel-plate systems. Energy stored in capacitors. Dielectric materials and polarization. Electric displacement field. Conservation of charge and the continuity equation.

UNIT – III: MAGNETIC FIELDS AND MAGNETOSTATICS

Magnetic force on moving charges and current-carrying conductors. Lorentz force law. Motion of charged particles in uniform magnetic fields. Magnetic dipole moment and torque on current loops. Biot–Savart Law. Ampère's Law in integral and differential forms. Magnetic flux. Magnetic boundary conditions (introductory treatment). Energy density in magnetic fields. Qualitative introduction to magnetic materials.

UNIT – IV: ELECTRIC CURRENT AND CIRCUIT DYNAMICS
Electric current and current density. Microscopic model of conduction and drift velocity. Ohm's law and resistivity. Kirchhoff's laws and systematic circuit analysis. Power and energy considerations in circuits. RC and RL circuits using differential equation methods. Qualitative introduction to RLC circuits and resonance behavior. Energy storage in electric and magnetic circuit elements.

UNIT – V: ELECTROMAGNETIC INDUCTION, MAXWELL'S EQUATIONS, AND WAVE PROPAGATION
Faraday's Law of electromagnetic induction. Lenz's Law and induced EMF. Motional EMF. Self-inductance and mutual inductance. Displacement current and modification of Ampère's Law. Maxwell's equations in integral and differential forms. Derivation of the electromagnetic wave equation in vacuum. Propagation of electromagnetic waves and relation to the speed of light. Radiation pressure (introductory treatment). Basic properties of electromagnetic radiation and polarization.

TEXTBOOKS:
1. H. D. Young and R. A. Freedman, *University Physics with Modern Physics*, 15th Edition, Pearson, 2020.
2. R. A. Serway and J. W. Jewett, *Physics for Scientists and Engineers*, 10th Edition, Cengage Learning, 2018.
3. D. J. Griffiths, *Introduction to Electrodynamics*, 4th Edition, Cambridge University Press, 2017.

REFERENCE BOOKS:
1. E. M. Purcell and D. Morin, *Electricity and Magnetism*, 3rd Edition, Cambridge University Press, 2013.
2. J. R. Reitz, F. J. Milford, and R. W. Christy, *Foundations of Electromagnetic Theory*, Addison-Wesley.
3. J. D. Jackson, *Classical Electrodynamics*, 3rd Edition, Wiley (advanced reference).

GRADING POLICY:

The instructional material for this course will be primarily derived from the prescribed textbook and supporting reference materials. Student performance will be assessed based on conceptual understanding, analytical problem-solving ability, and application of mathematical methods to physical systems across all units of the syllabus. Homework assignments will be assigned regularly to reinforce lecture content. Students are required to submit all assignments by the specified deadlines. Periodic midterm examinations will be conducted, typically following the completion of major units, to evaluate comprehension of recently covered topics. The course will include three midterm examinations and one comprehensive final examination conducted in person.

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GRADE BREAKDOWN:

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- Laboratory: 15%
- Midterm Examination I: 15%
- Midterm Examination II: 15%
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GRADE SCALE:

- A: 90 – 100
- B: 80 – 89
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The passing grade for this course is letter grade C which is 70% or above.

Note: All midterm examinations and the comprehensive final examination are cumulative in nature. Students are expected to demonstrate mastery of concepts from all previously covered units, as material introduced earlier in the course may be assessed in subsequent examinations.

COURSE TIMELINE:

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APPLIED PHYSICS

I B.Tech., I Sem., (Common to CSE, CSM & CSD)

Course Title: Applied Physics	Course Code: AS22-00BS11
Teaching Scheme (L:T:P): 3:0:0	Credits: 3
Type of Course: Lecture + Tutorial	Total Contact Periods: 48Hrs +16Hrs
Continuous Internal Evaluation-30 Marks	Semester End Exams-70 Marks

Prerequisites:

- The student must have basic knowledge of units and dimension of physical quantities, principles of mechanics and laws of optics.
- The student must be aware of basics of waves and oscillations, fundamental principles of electromagnetic theory.
- The student must have fundamental knowledge of mathematical concepts like vector algebra, integration and differentiation.

Course Overview:

This course deals with quantum principles and explore their applications in studying the behavior of fundamental entities of atom. It deals with semiconductor devices which are employed in designing electronic systems and in communication field. It deals with the fundamental properties of dielectric and magnetic materials and explore their application in all engineering streams. Also, it introduces to the concept of Quantum computing

Course Objective

1. Understand the basic principles of quantum physics and band theory of solids.
2. Understand the underlying mechanism involved in construction and working principles of various semiconductor devices.
3. Study the fundamental concepts related to the dielectric materials.
4. Study the fundamental concepts related to the magnetic and superconducting materials
5. Identify the importance of nanoscale, quantum confinement and various fabrications techniques.
6. Study the characteristics of lasers and optical fibres.

Course Outcomes(s)

CO#	Course Outcomes
C112.1	Understand physical world from fundamental point of view by the concepts of Quantum mechanics and visualize the difference between conductor, semiconductor, and an insulator by classification of solids.
C112.2	Identify the role of semiconductor devices in science and engineering Applications.
C112.3	Explore the fundamental properties of dielectrics and their applications.
C112.4	Explore the fundamental properties of magnetic, superconductivity materials and their applications.
C112.5	Appreciate the features and applications of Nanomaterials.
C112.6	Understand various aspects of Lasers and Optical fiber and their applications in diverse fields.

COURSE CONTENT (SYLLABUS)

UNIT-I:QUANTUMPHYSICSANDSOLIDS

Quantum Mechanics: Introduction to quantum physics, - photoelectric effect- deBroglie hypothesis - Davisson and Germerexperiment–Heisenberguncertaintyprinciple-Borninterpretationofthewavefunction–timeindependentSchrodinger waveequation-particleinonedimensionalpotentialbox.

Solids:Symmetryinsolids,freeelectrontheory(Drude&Lorentz,Sommerfeld)-Fermi-Diracdistribution - Bloch's theorem -Kronig-Penney model – E-K diagram- effective mass of electron-originofenergybands-classification ofsolids.

UNIT-II:SEMICONDUCTORSANDDEVICES

Intrinsic and extrinsic semiconductors – Hall effect - direct and indirect band gap semiconductors -

construction, principle of operation and characteristics of P-N Junction diode, Zener diode and bipolarjunctiontransistor(BJT)– LED,PINdiode,avalanchephotodiode(APD)andsolarcells,theirstructure,materials,working principle and characteristics.

UNIT-III:DIELECTRIC,MAGNETICANDSUPERCONDUCTING MATERIALS
DielectricMaterials:Basicdefinitions-typesofpolarizations(qualitative)- ferroelectric,piezoelectric,andpyroelectricmaterials– applications– liquidcrystal displays(LCD)andcrystal oscillators.
Magnetic Materials: Hysteresis- soft and hard magnetic materials -magnetostriction,magnetoresistance - applications - bubble memory devices, magnetic field sensors and multiferroics Superconductors: Introduction, Meissner effect, type – I and type – II Superconductors, Applications of Superconductors

UNIT-IV:NANOTECHNOLOGY
Nanoscale, quantumconfinement,surfacetovolumeratio,bottom-upfabrication:sol-gel,precipitation,combustion methods – top-down fabrication: ball milling - physical vapor deposition (PVD) - chemicalvapordeposition(CVD)-characterizationtechniques-XRD,SEM&TEM-applicationsofnanomaterials.

UNIT-V:LASERAND FIBEROPTICS
Lasers: Laser beam characteristics-three quantum processes-Einstein coefficients and their relations-lasing action - pumping methods- ruby laser, He-Ne laser , CO2 laser, Argon ion Laser, Nd:YAG laser-semiconductorlaser-applicationsoflaser.
Fiber Optics:Introduction to optical fiber- advantages ofoptical Fibers - total internal reflection-construction of optical fiber - acceptance angle - numerical aperture- classification of optical fibers-lossesin optical fiber-optical fiberforcommunicationsystem-applications.

TEXTBOOKS:

1. M.N.Avadhanulu,P.G.Kshirsagar & TVSArunMurthy" ATextbookofEngineeringPhysics"- S.ChandPublications,11th Edition2019.
2. EngineeringPhysicsbyShatendraSharmaandJyotsnaSharma,PearsonPublication,2019
3. SemiconductorPhysicsandDevices-BasicPrinciple–DonaldA,Neamen,McGrawHill,4th Edition,2021.
4. B.K.PandeyandS.Chaturvedi, EngineeringPhysics,CengageLearning, 2nd Edition,2022.
5. EssentialsofNanoscience&NanotechnologybyNarasimhaReddyKatta,TypicalCreativesNANODIGEST,1st Edition,2021.

REFERENCEBOOKS:

1. QuantumPhysics, H.C.Verma,TBSPublication, 2nd Edition2012.
2. FundamentalsofPhysics–Halliday,ResnickandWalker,JohnWiley&Sons,11th Edition,2018.
3. IntroductiontoSolidStatePhysics,CharlesKittel,WileyEastern,2019.
4. ElementarySolidStatePhysics,S.L.GuptaandV.Kumar,PragathiPrakashan,2019.
5. A.K.Bhandhopadhya- NanoMaterials,NewAgeInternational, 1st Edition, 2007.

Online Resources (SWAYAM/NPTEL/MOOCS/COURSERA):

1. https://onlinecourses.nptel.ac.in/noc20_ph24/preview
2. https://onlinecourses.nptel.ac.in/noc20_ph16/preview
3. https://www.coursera.org/learn/semiconductor-physics
4. https://onlinecourses.nptel.ac.in/noc21_cs103/preview
5. https://www.coursera.org/lecture/leds-semiconductor-lasers/active-optical-devices-specialization-introduction-0jner

Web Reference/E-Books:

1. https://ocw.mit.edu/courses/physics/8-231-physics-of-solids-i-fall-2006/download-course-materials/
2. http://web.mit.edu/6.732/www/texts.html
3. https://nptel.ac.in/courses/115/105/115105099/
4. https://nptel.ac.in/courses/115/104/115104109/