2026

# BMS UNIVERSITY

## BULL TEMPLE ROAD, BENGALURU – 19

*(A state Private University Established in Karnataka State by Act No. 15 of 2023)*

*[Bull Temple Road, Bengaluru, Karnataka - 560019]*

# BACHELOR OF TECHNOLOGY (B.TECH.)

# REGULATIONS - 2026

# CURRICULUM AND SYLLABI FOR I & II SEMESTERS

# B.Tech. in Computer Science Engineering (Data Science) and Artificial Intelligence & Robotics

| S.No. | Course Code | Course Title | Credit Distribution Summary | | | | Maximum Marks | | | CAT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ETE | Total | |
| **SEMESTER I (Physics Cycle)** | | | | | | | | | | |
| 1 | 26BMAT101 | Matrices and Calculus | 3 | 1 | 0 | 4 | 50 | 50 | 100 | BS |
| 2 | 26BPHI101 | Foundations Of Applied and Quantum Physics | 3 | 0 | 1 | 4 | 50 | 50 | 100 | BS |
| 3 | 26BART101 | Introduction to Artificial Intelligence | 3 | 0 | 0 | 3 | 50 | 50 | 100 | ET |
| 4 | 26BCDI101 | Problem solving using C Programming | 3 | 0 | 1 | 4 | 50 | 50 | 100 | PC |
| 5 | 26BXXT11X | Interdisciplinary Course –I(Elective Basket) | 3 | 0 | 0 | 3 | 50 | 50 | 100 | ES |
| 6 | 26BARL101 | Computer-Aided Engineering Drawing lab | 0 | 0 | 2 | 2 | 50 | 50 | 100 | ES |
| 7 | 26BHET101 | Technical writing | 1 | 0 | 0 | 1 | 50 | 50 | 100 | HS |
| 8 | 26BHKT101/102 | kannada parichaya-1/ kannada parichaya-2 | 1 | 0 | 0 | 0 | 50 | 50 | 100 | HS |
| 9 | 26BSDL101 | Career Skill Development I | 0 | 0 | 1 | 0 | 100 | - | 100 | SD |
| | | | Total credits | | | 21 | | | | |

| S.No. | Course Code | Course Title | Credit Distribution Summary | | | | Maximum Marks | | | CAT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ETE | Total | |
| **SEMESTER II (Chemistry Cycle)** | | | | | | | | | | |
| 1 | 26BMAT201 | Differential Equations and Numerical Methods | 3 | 1 | 0 | 4 | 50 | 50 | 100 | BS |
| 2 | 26BCH I201 | Chemistry of Smart Materials | 3 | 0 | 1 | 4 | 50 | 50 | 100 | BS |
| 3 | 26BECI201 | Introduction to Electronics Engineering | 3 | 0 | 1 | 4 | 50 | 50 | 100 | ES |
| 4 | 26BCDI201 | Python Data Analysis & Visualization | 3 | 0 | 1 | 4 | 50 | 50 | 100 | PC |
| 5 | 26BXXT21X | Interdisciplinary Course – II (Elective Basket) | 3 | 0 | 0 | 3 | 50 | 50 | 100 | ES |
| 6 | 26BARL202 | Design Thinking for Innovation | 0 | 0 | 1 | 1 | 50 | 50 | 100 | SD |
| 7 | 26BHST201 | India Constitution and Professional Ethics | 1 | 0 | 0 | 0 | 50 | 50 | 100 | HS |
| 8 | 26BSDL201 | Career Skill Development II | 0 | 0 | 1 | 0 | 100 | - | 100 | SD |
| | | | Total credits | | | 20 | | | | |

Elective Basket

| Interdisciplinary Courses | | | |
|---|---|---|---|
| **Sl. No.** | **Course Title** | **Credits** | **Not Applicable for** |
| 1 | Introduction To Electrical Engineering | 3-0-0 | |
| 2 | Introduction To Mechanical Engineering | 3-0-0 | |
| 3 | Foundations of Data Science & Engineering | 3-0-0 | |
| 4 | Introduction To Digital Systems | 3-0-0 | |
| 5 | Introduction To Object Oriented Programming | 2-0-1 | CSE(DS) |
| 6 | Introduction To Sensors | 3-0-0 | AI&R |

Nomenclature -

BS - Basic Science; HS - Humanities and Social Sciences; ES - Engineering Sciences; PC - Professional Core; PE - Professional Elective;OE - Open Elective;ET: Emerging TechnologyCourse;SD-Skill Development Course; NCMC – Noncredit Mandatory Course; L-Lecture; T-Tutorial; P-Practical; C-Credits.

| **MATRICES AND CALCULUS**<br>(Common to CSE-DS and AI&R Branches) | | Semester | I |
|---|---|---|---|
| Course Code | 26BMAT101 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:2:0:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 42 Hours Theory+28 Hours Tutorial + 50 Hours Team Work (TW)and Self Learning(SL) | Total Marks | 100 |
| Credits | 4 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

**Course Objectives**

1. Impart the knowledge of Calculus and Matrix theory concepts to implement them effectively within their core areas of specialization.
2. To understand the concept of Partial Differentiation, Maxima & Minima of a function of several variables.
3. To compute area of closed surface and volume of solids using multiple integrals.
4. To analyze vector fields to model physical phenomena in fluid dynamics, electromagnetism, and force fields.

## Course Outcomes

| At the end of the course, students will be able to | |
|---|---|
| CO 1 | Explain the concepts related to Calculus, Differential Equations and Vector Calculus |
| CO 2 | Apply the techniques of Matrices, Calculus, and Vector Calculus to solve engineering problems. |
| CO 3 | Analyze the solutions of engineering problems employing Matrices, Calculus, and Vector Calculus. |
| CO 4 | Use modern tools to solve engineering problems with the help of matrix theory, Calculus, and Vector Calculus. |

**UNIT I: MATRICES AND SYSTEM OF LINEAR EQUATIONS (08 HOURS)**

Elementary row transformations of a matrix, Echelon form, rank of a matrix. Consistency and solution of system of linear equations: Gauss elimination method, LU decomposition method, engineering applications.

Eigenvalues and Eigenvectors of a real matrix, Properties of Eigenvalues and Eigenvectors, Rayleigh power method to find the dominant eigenvalue and eigenvector. Diagonalization of Square matrix

**UNIT II: DIFFERENTIAL CALCULUS (08 HOURS)**

Basics of polar coordinates, polar curves, angle between the radius vector and tangent. Curvature, radius of curvature-Cartesian, polar & parametric forms, centre and circle of curvature and problems. Taylor's and Maclaurin's series for a function of a single variable and problems.

**UNIT III: MULTIVARIABLE CALCULUS (08 HOURS)**

Introduction to partial derivatives, Partial derivatives and their geometrical interpretation, Total derivative and implicit function, Chain rule and Jacobians, Euler's theorem on homogeneous functions. Extreme of functions of two variables. Lagrange's multiplier method

**UNIT IV: MULTIPLE INTEGRALS (10 HOURS)**

Double integrals–introduction and method of evaluation-problems. Change of order of integration and change of variables to polar coordinates-problems. Applications–area. Triple integrals-introduction and method of evaluation and problems. Applications-volume of a solid.

**UNIT V: VECTOR CALCULUS (08 HOURS)**

Vector differentiation, Gradient and directional derivative, Divergence and curl, Irrotational and Solenoidal vector fields. evaluation of scalar potential using vector fields. Curvilinear coordinates: Scale factors, base vectors, Cylindrical polar coordinates, Spherical polar coordinates, transformation between cartesian and curvilinear systems, orthogonality.

**TEXTBOOKS**

1. Grewal B S, "Higher Engineering Mathematics", Khanna Publishers, 45th Edition, 2024.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition,2016.

**REFERENCE BOOKS**

1. D. Zill, W. S. Wright and M. R. Cullen, Advanced Engineering Mathematics, 4th edition, Jones & Bartlett Learning, 2011.
2. T. M. Apostol, Calculus vol. I & II, 2nd edition, Wiley, 2022.
3. J. E. Marsden and A. Tromba, Vector Calculus, 5th edition, W. H. Freeman, 2009.
4. M.J. Strauss, G.L. Bradley and K.J. Smith, Multivariable Calculus, 3rd edition, Prentice Hall,2002.
5. W. Cheney and D. Kincaid, Linear Algebra: Theory and Applications, 2nd edition, Jones and Bartlett Publishers, 2012.

**ACTIVITIES**

1. Demonstration and visualization of matrices and eigenvalues and eigenvectors.
2. Demonstration and visualization of curvature, radius of curvature and centre of curvature.
3. Demonstration and visualization of extremum of the functions.
4. Demonstration and visualization of volume integrals
5. Demonstration and visualization of vector fields
6. Solving of Competitive Examination questions (Ex. GATE).

| **FOUNDATIONS OF APPLIED AND QUANTUM PHYSICS** (Common to CSE-DS and AI&R Branches) | | Semester | I |
|---|---|---|---|
| Course Code | 26BPHI101 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:1:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 42 Hours Theory+30 Hours practical + 48 Hours Team Work (TW)and Self Learning(SL) | Total Marks | 100 |
| Credits | 4 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

**Course Objectives:**

1. To impart the knowledge of concept and applications of quantum mechanics and quantum computation
2. To provide insight to the electrical properties of metals, semiconductors,and superconductors, and their engineering applications
3. To understand the principles of LASERs and optical fibers, and explore their practical implications

**Courseoutcomes:**

On completion of the course, the student will have the ability to:

| | |
|---|---|
| **CO1** | Understand and Apply the principles of quantum mechanics, quantum computing, transport phenomena in metals, semiconducting and superconducting materials, construction and working principle of LASERs and optical fibers. |
| **CO2** | Use appropriate Tools to develop the concept of physics, perform as a member of team to design a model and make an oral presentation. |
| **CO3** | Conduct, Analyze and Interpret the data and results from Physics experiments. |

**UNIT I:QUANTUM MECHANICS [8 HOURS]**

de-Broglie hypothesis – derivation by analogy. Definition of phase velocity and group velocity. Relation between group velocity and phase velocity, relation between group velocity and particle velocity, relation between group velocity, phase velocity and velocity of light (qualitative). Heisenberg's uncertainty principle - statement and physical significance. Application of uncertainty principle – non-existence of electron in the nucleus.

Wavefunction-properties,physicalsignificance.BornInterpretation,expectationvalue,andits physicalsignificance.Probabilitydensityandnormalizationofwavefunction.Settingupofone-dimensional time independent Schrödinger's wave equation. Particle in a one-dimensional

potentialwellofinfiniteheightandfinitewidth(particleinabox)-Eigenfunctions,probability density and Eigen values for the first two states. Problems.

**UNIT II : ELECTRICAL PROPERTIES OF METALS AND SEMICONDUCTORS [8 HOURS]**

Introductiontoclassicalfreeelectrontheoryanditsfailures.Mechanismsofelectronscattering in solids, Matheissen's rule. Assumptions of Quantum Free Electron Theory, density of states (qualitative), Fermi energy, expression for Fermi energy (qualitative), Fermi velocity, Fermi temperature. Fermi factor, variation of Fermi factor with temperature and energy. Merits of quantum free electron theory.

IntroductiontoSemiconductors,expressionforconcentrationofelectronsinconductionband, expressionforhole-concentrationinvalanceband(qualitative).Expressionforintrinsiccarrier concentration. Fermi level for intrinsic (derivation) and extrinsic semiconductor (qualitative), expression for electrical conductivity of semiconductors and energy band gap. Hall effect, expressions for Hall voltage, Hall coefficient, and its applications.Numerical.

**UNIT III : SUPERCONDUCTIVITY [8 HOURS]**

Introduction to superconductors – Zero resistance state, temperature dependence of resistivity, persistent current, three critical parameters - critical temperature, critical magnetic field and critical current: Silsbee effect. Derivation of critical current for a cylindrical wire using ampere's law. Meissner effect. Type-I and Type-II superconductors. Formation of vortices.

BCS Theory - two-fluid model, formation of Cooper pairs, phase coherent state. Limitations of BCS theory, examples of systems with low and high electron-phonon coupling. Cooper pair tunneling (Andreev reflection). Josephson junction, flux quantization, DC and AC SQUIDs (qualitative), MAGLEV vehicle. Numerical.

**UNIT IV : PHOTONICS[8 HOURS]**

LASERs: Introduction, characteristics of LASERs. Interaction of radiation with matter – Einstein's A and B coefficients. Expression for energy density of a system under thermal equilibrium in terms of Einstein's A and B coefficients. Conditions for Laser action. Requisites of a LASER system. Construction and working of He-Ne LASER. Applications of LASERs: Mach-Zehnder interferometer.

Optical Fiber: Introduction, principle of propagation, angle of acceptance, and numerical aperture. Expression for numerical aperture and condition for propagation. Number of modes: V-number. Classification of optical fibers. Attenuation- attenuation coefficient (qualitative), causes of attenuation. Applications of optical fibers: fiber optic displacement sensor and fiber optic temperature sensor. Numerical.

**UNIT V :QUANTUM COMPUTATION [8 HOURS]**

Introduction, Moore's law - limitation of VLSI. Difference between classical and quantum computation. Bit, Qubit and its properties. Bloch sphere (qualitative).

Dirac Notation: Matrix form of wave function, identity operator (I), determination of I |0 and 0|1, Pauli matrices and its operations on $|0\rangle$ and $|1\rangle$ states. Mention of conjugate, transpose and unitary matrix. Inner product of 2x2 matrices. Probability and orthogonality.

Quantum Gates: Single qubit gates: quantum NOT gate, Pauli Z gate, Hadamard gate, Phase gate (or S Gate), T gate. Multiple Qubit Gates: Controlled gate - CNOT Gate, (discussion of 4 different input states). Representation of swap gate, controlled - Z gate, Toffoli gate. Numerical.

**Laboratorycomponent:** Any **ten** experiments have to be completed from the following list of experiments

| S.No. | Name of the experiment |
|---|---|
| 1 | Wavelength of LASER by diffraction |
| 2 | Divergence angle of a LASER |
| 3 | Numericalapertureofanoptical fiber |
| 4 | WavelengthofLEDs/Planck'sconstant |
| 5 | Fermienergyof copper |
| 6 | Dielectricconstantofamaterialbychargingganddischargingofacapacitor |
| 7 | Energygapofasemiconductorusingfourprobemethod |
| 8 | V-Icharacteristicsofaphotodiode |
| 9 | FrequencyresponseofseriesandparallelLCRcircuits |
| 10 | Blackbox |
| 11 | AttenuationcoefficientofOFC |
| 12 | GNUstepinteractivesimulations |
| 13 | Studyofmotionusingspreadsheet |
| 14 | PHET Interactive Simulations (https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype) |
| 15 | QuantumExperimentsusingQiskit |

**Textbooks:**


1. Satyendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson, 2018.
2. S. L. Kakani and Shubra Kakani, "Engineering Physics", CBS Publishers & Distributors Pvt. Ltd., 3rd Edition, 2020.
3. S. O. Pillai, "Solid State Physics", New Age International, 2022.
4. Parag K. Lala, "Quantum Computing", McGraw Hill, 2020.


**Referencebooks/Manuals:**


1. D. J. Griffiths, "Introduction to Quantum Mechanics", Pearson, 2nd/3rd Edition, 2018.
2. M. Tinkham, "Introduction to Superconductivity", Dover Publications, 2nd Edition, 2004.
3. P. K. Mishra, "Superconductivity – Basics and Applications", Ane Books, 2009.
4. B. E. A. Saleh and M. C. Teich, "Fundamentals of Photonics", Wiley, 3rd Edition, 2019.
5. M. A. Nielsen and I. L. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 10th Anniversary Edition, 2010

| **3.INTRODUCTION TO ARTIFICIAL INTELLIGENCE** (Common to CSE-DS and AI&R Branches) | | Semester | I |
|---|---|---|---|
| Course Code | 26BAIT101/26BAIT201 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:0:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 42 Hours Theory+48 Hours Team Work (TW)andSelf Learning(SL) | Total Marks | 100 |
| Credits | 3 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

**Course Objectives**

This course aims to:

1. To understand the fundamentals, history, and applications of Artificial Intelligence.
2. To apply AI search and problem-solving techniques to real-world problems.
3. To understand knowledge representation, reasoning, and planning techniques.
4. To analyze uncertainty, decision-making, and multi-agent AI systems.
5. To explore NLP, computer vision, Generative AI, and emerging AI technologies.

**Course Outcomes (COs)**

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

CO1: Understand the fundamentals of AI and apply AI techniques to solve problems.

CO2: Apply search, reasoning, planning, and knowledge representation techniques to real-world problems.

CO3: Analyze decision-making techniques under uncertain circumstances.

CO4: Understand the fundamentals and applications of NLP, computer vision

CO5: Apply prompt engineering techniques to effectively interact with Generative AI systems and related applications.

**UNIT I: FOUNDATIONS OF ARTIFICIAL INTELLIGENCE AND PROBLEM SOLVING**

**[8 HOURS]**

Artificial Intelligence - History of Artificial Intelligence – Concepts and foundations of AI – Risk and benefits of AI – Intelligent agents and environments – Structure of agents.

Problem-solving agents – Uninformed search – Informed search – Local search in continuous spaces – Online search agents and unknown environments – Adversarial search – Optimal decision making in games – Heuristic search – Alpha-Beta pruning.

**UNIT II: KNOWLEDGE REPRESENTATION, REASONING AND PLANNING [8 HOURS]**

Logical Agents: Knowledge-based agents – Propositional logic – First-Order Logic – Representation of knowledge - Inference in First-Order Logic – Forward chaining – Backward chaining – Logical reasoning -

Planning problems – Planning algorithms – Heuristics for planning – Planning and acting in nondeterministic domains – Hierarchical planning.

**UNIT III: UNCERTAINTY, DECISION MAKING AND MULTI-AGENT SYSTEMS[8 HOURS]**

Quantifying uncertainty – Naive Bayes models – Probabilistic reasoning – Representing knowledge in uncertain domains - Simple decisions – Decision networks – Complex decisions – Sequential decision problems - Multi-Agent Decision Making: Cooperative and non-cooperative game theory – Multi-agent decision making – Collective decisions.

**UNIT IV: NATURAL LANGUAGE PROCESSING AND COMPUTER VISION [8 HOURS]**

Introduction to NLP – Language models – Grammar – Parsing – Syntactic and semantic aspects of language understanding - Introduction to computer vision – Image formation – Image features – Image representation – Image classification – Object/image detection.

Applications: AI-based language understanding – AI-based visual perception – Applications of NLP and computer vision.

**UNIT V: GENERATIVE ARTIFICIAL INTELLIGENCE AND CONTEMPORARY TOPICS [8 HOURS]**

Introduction to Generative AI – Generative AI models and applications – Prompt engineering – Principles of effective prompting – Crafting effective prompts for AI applications. Generative AI Applications: GenAI as a writing assistant – GenAI as a visual assistant – AI-assisted content generation – Responsible use of Generative AI.

Contemporary Topics: Emerging trends in Artificial Intelligence – Recent developments and applications of AI – Societal impact of AI – Ethical considerations in AI.

**Suggested Textbooks**

1. Russell, S. and Norvig, P., "Artificial Intelligence - A Modern Approach", Prentice Hall, 4th Edition, 2022
2. Pam baker, "Generative AI for dummies", Wiley and sons , 1st Edition, 2025
3. Reema Thareja, “Artificial Intelligence: Beyond Classical AI”, Pearson, 2023.
4. SaptarsiGoswami et al., “AI for Everyone”, Pearson, 2024.
5. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson.

| **4. PROBLEM SOLVING USING C PROGRAMMING** (Common to CSE-DS and AI&R Branches) | | Semester | I |
|---|---|---|---|
| Course Code | 26BCDI101 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:1:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 42 Hours Theory+30 Hours practical + 48 Hours Team Work (TW)and Self Learning(SL) | Total Marks | 100 |
| Credits | 4 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

**Course Objectives**

This course aims to:

1. To understand the fundamentals of C programming and program design.
2. To develop programs using control and looping statements.
3. To apply arrays and strings for data processing.
4. To implement functions and structures for modular programming.
5. To use pointers and file handling for efficient data management.

**Course Outcomes (COs)**

Upon successful completion of the course, the students will be able to:
CO1: Develop basic C programs using data types, operators, and I/O operations.
CO2: Apply conditional and looping statements to solve programming problems.
CO3: Implement array and string operations for data processing.
CO4: Develop modular programs using functions, recursion, and structures.
CO5: Apply pointers and file handling techniques in C programs.

**UNIT I :INTRODUCTION TO C [8 HOURS]**

Basic Organization of a Computer, Program design tools (Algorithms, Flowcharts), Introduction to C, Structure of C program, Writing the first C Program, Compiling and Executing C Programs, C Tokens, Basic Data Types in C, Operators in C, Evaluating Expressions, Type Conversion, Input and Output, Formatted Input/Output.

**UNIT II :CONTROL AND LOOPING STATEMENTS [8 HOURS]**

Introduction to Control Statements, Conditional Branching Statements (if, if-else, if-else-if, switch), Iterative Statements (while, do-while, for), Nested Loops, Break and Continue Statements.

**UNIT III :ARRAYS AND STRINGS HANDLING [8 HOURS]**

**Arrays:** Introduction, Declaration of Arrays, Accessing the elements of an Array, Storing values in Arrays, Operations on Arrays (Insertion, Deletion, Searching-Binary search, Linear search), Two-Dimensional Arrays, Operations on Two- Dimensional arrays, Multi-Dimensional Arrays.

**Strings:** String Standard Libraries (Length of a String, Converting Lowercase to Uppercase and Vice Versa, String Concatenation, String Comparison Using built in functions).

**UNIT IV :STRUCTURES AND FUNCTIONS [8 HOURS]**

**Structures:** Defining Structures, Accessing Structure members, Arrays of Structures, Array within structure, Structure within structure.
**Functions:** Components of Functions (Function Declaration, Function Definition, Function Call), Passing Parameters to Functions, Recursive Function.

## UNIT V – POINTERS AND FILE HANDLING [8 HOURS]

**Pointers:** Introduction to Pointers, Declaring Pointer variables, Pointer Expressions and Pointer Arithmetic, Passing Arguments to Functions using Pointers.
**File Handling**: File declarations, File modes, Create and access Files.

**TEXT BOOKS**

1. Reema Thareja, "Computer Fundamentals and Programming in C", 2nd Edition, Oxford Higher Education, 2016
2. E. Balaguruswamy, "Programming in ANSI C", 7th Edition, McGraw-Hill Education, 2018.
3. J. R. Hanly and E. B. Koffman, "Problem Solving and Program Design in C", 7th Edition, Pearson Education, 2013.

**REFERENCE BOOKS**

1. YashavantKanetkar, "Let Us C", BPB Publications, 19th Edition, 2024.

2. Byron Gottfried, "Programming with C", McGraw-Hill, 4th Edition, 2018.

**List of Lab activities**

### Part A

1. Implement a C program to find the distance between two points.
2. Illustrate conditional branching statements to find the smallest of three numbers.
3. Develop a C program to solve simple arithmetic calculations, using arithmetic expressions and use of each operator leading to simulation of a commercial calculator. (No built-in math function).
4. Develop a C program to find all possible roots of a quadratic equation.
5. Develop a C program to print the sum of even numbers from M to N.
6. Develop a C program to compute the GCD of two numbers.

### Part B

1. Develop a C program to search a Book ID from an organized bookshelf that has N number of books using appropriate searching technique.
2. Develop a C program to read a matrix and print the diagonalelements.
3. Write functions to implement String operations such as concatenation and String length using built-in functions.
4. Develop a C program for swapping values of two variables by using Parameter Passing techniques (Call by Value and Call by reference).
5. Develop a C program to read and display the student details using Structures.
6. Develop C program to test whether a number is positive, negative, or equal to zero using pointers.
7. Develop C Program to create text file.
8. Develop C Program to copy the content of one file in to another file.

### Additional Programs

1. Develop a C program to convert Fahrenheit to Celsius.

2. A company decides to give a bonus to its employees on Diwali. A 5% bonus on salary is given to the Male workers and a 10% bonus on salary to the female workers. Write a program to enter the salary and gender of the employee if the salary of the employee is less than Rs.10,000 then the employee gets an extra 2% bonus on salary. Write a C program to calculate the bonus that has to be given to the employee and display the salary the employee will get.
3. Develop a C Program to display the following by reading the number of rows as input.

1

121

12321

1234321

4. Develop a C program to find the factorial of a number using functions.
5. Develop a program using pointers to compute the sum, mean and standard deviation of all elements stored in an array of N real numbers.
6. Develop a C Program to Count the Number of Vowels, Consonants, digits, and special characters in a string. Implement structures to read, write and compute the average salary of the employees, and list the employees earning a salary above and below the average salary for a department of N employees.

| **6.COMPUTER AIDED ENGINEERING DRAWING LAB** (Common to CSE-DS and AI&R Branches) | | Semester | I |
|---|---|---|---|
| Course Code | 26BARL101/26BARL201 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 0:0:4:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 40 Hours practical + 20 Hours Team Work (TW)and Self Learning(SL) | Total Marks | 100 |
| Credits | 2 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

**Course Objectives**

This course aims to:

1. To understand the basic principles and conventions of engineering drawing
2. To use drawing as a communication mode
3. To generate pictorial views using CAD software
4. To understand the development of surfaces
5. To visualize engineering components

**Course Outcomes (COs):**

At the end of the course the student will be able to:

1. Demonstrate the usage of suitable software for creating basic and applied engineering drawings.
2. Conceptually sketch and draw developments for typical lateral surfaces.
3. Exhibit the knowledge of orthographic and isometric projections of typical solids.

**Unit I:** Introduction

Significance of Engineering drawing, BIS Conventions of Engineering Drawing, Free hand sketching of engineering drawing, Scales. Introduction to Computer Aided Drafting software, Co-ordinate system and reference planes HP, VP and RPP & LPP of 2D environment. Commands and creation of Lines, coordinate points, axes, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet and curves. Orthographic Projections of Points, Lines and Planes:

Orthographic projections: Definitions - Planes of projection, reference line and conventions employed, Projections of points in First and Third quadrants (No problems), Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes (No problems).

Orthographic Projections of Planes viz triangle, square, rectangle, pentagon, hexagon, and circular laminae (Placed in First quadrant only using change of position method).

**Unit II**

Orthographic Projection of Solids:
Orthographic projection of right regular solids (Solids Resting on HP only): Prism & Pyramid (triangle, square, rectangle, pentagon, hexagon), Cylinder, Cone and Cube ( No freely suspended problems).

**Unit III**

Development of Lateral Surfaces of Solids: Development of sectioned (Section plane perpendicular to VP and inclined to HP bisecting the axis only) lateral surfaces of right regular prism, cylinder, pyramid and cone resting with base on HP only.

**Unit IV**

Isometric Projections:
Isometric scale, Isometric projection of hexahedron (cube), right regular prism, pyramid, cylinder, cone, sphere and frustum of solid. Isometric projection of combination of two simple solids (Co-axial only).

**Unit V**

Multidisciplinary Applications & Practice: (For CIE only)
Free hand Sketching: True free hand, Guided Free hand, Roads.
Drawing Simple Mechanisms: Bicycles, Tricycles, Gear trains.
Electric Wiring and lighting diagrams: Like, Automatic fire alarm.
Basic Building Drawing: Architectural floor plan, basic foundation drawing.
Electronics Engineering Drawings: Simple Electronics Circuit Drawings, practice on layers concept.

**Text books:**

1. Sudhir Gopalakrishna & K. R. Gopalakrishna - A Textbook of Engineering Graphics, Techno Series, 2024.
2. N. D. Bhatt - Engineering Drawing, Charotar Publishing house Pvt. Ltd, 2024.

**Reference books:**

1. M H Annaiah- Computer Aided Engineering Drawing, New Age International Private Limited, 7th edition, 2022.

| **7.TECHNICAL WRITING SKILLS** (Common to CSE-DS and AI&R Branches) | | Semester | I |
|---|---|---|---|
| Course Code | 26BHET101 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 1:0:0:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 15 Hours Theory +15 Hours Team Work (TW)andSelf Learning(SL) | Total Marks | 100 |
| Credits | 1 | Exam Hours | 1 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

**Course Objectives**

This course aims to:

1. Develop effective verbal, non-verbal, and interpersonal communication skills for academic and professional environments.
2. Enhance listening, speaking, reading, and writing competencies through structured communication activities.
3. Improve critical reading, vocabulary, and comprehension skills for effective information processing.
4. Build professional writing skills for preparing reports, letters, emails, resumes, and other workplace documents.
5. Foster confidence in presentations, interviews, workplace communication, and professional ethics.

**Course Outcomes (COs)**

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

- CO1: Apply the principles of effective technical writing.
- CO2: Prepare technical documents using appropriate structure, style, and formatting.
- CO3: Write professional correspondence and workplace documents.
- CO4: Create reports, proposals, and technical documentation using digital tools.
- CO5: Demonstrate ethical and responsible practices in technical writing, including proper citation and the use of AI-assisted writing tools.

## UNIT 1: Fundamentals of Technical Writing

Introduction to Technical Writing, Characteristics of Technical Writing, Writing Process, Audience Analysis, Purpose, Organization of Information, Clarity, Conciseness, Coherence, Grammar and Style in Technical Writing.

## UNIT 2: Professional and Workplace Writing

Professional E-mails, Memorandum, Notices, Circulars, Meeting Minutes, Technical Instructions, Standard Operating Procedures (SOPs), Resume, Cover Letter, LinkedIn Profile.

## UNIT 3: Technical Reports and Documentation

Technical Report Writing, Laboratory Reports, Project Reports, Feasibility Reports, Progress Reports, Abstract Writing, Executive Summary, Tables, Figures, Charts, Referencing and Citations.

## UNIT 4: Digital Technical Writing

Documentation using Word Processors, Collaborative Writing Tools, Technical Presentations, Writing with AI Tools, Prompting for Technical Writing, Editing, Proofreading, Plagiarism Checking, Version Control of Documents.

## UNIT 5: Technical Writing for Research and Industry

Research Paper Structure, Literature Review, Proposal Writing, Technical Specifications, Product Documentation, User Manuals, Patent Basics, Ethics in Technical Writing, Intellectual Property, Future Trends in Technical Documentation.

## Text Books

1. Meenakshi Raman and Sangeeta Sharma, “Technical Communication”, Oxford University Press, 2nd Edition, 2015.

| **8.KANNADA PARICHAYA** | | Semester | I |
|---|---|---|---|
| Course Code | 26BHKT101 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 1:0:0:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 15 Hours Theory | Total Marks | 100 |
| Credits | - | Exam Hours | 1 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

**ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:**

1. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಸ್ಕೃತಿಕವಾಗಿ ಪರಿಚಯಿಸುವುದು.
3. ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.
4. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳು ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
5. ಸಾಂಸ್ಕೃತಿಕ, ಜನಪದ ಹಾಗೂ ಪುವಾಸ ಕಥನಗಳ ಪರಿಚಯ ಮಾಡಿಕ ಘಟಕ -1 ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಮತ್ತು ಭಾಷೆ ಕುರಿತಾದ ಲೇಖನಗಳು.

**ಘಟಕ: 1 ಕನ್ನಡ ಸಂಸ್ಕೃತಿ ಮತ್ತು ಭಾಷೆ ಕುರಿತಾದ ಲೇಖನಗಳು** **(3 ಘಂಟೆ)**

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ – ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ: ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ್ ಮತ್ತು ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ

**ಘಟಕ -2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ** **(3 ಘಂಟೆ)**

1. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆತ್ಮಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರ ದಾಸಿಮಯ್ಯ,ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ
2. ಕೀರ್ತನೆಗಳು ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ ತಾಳು ಮನವೇ ಕನಕದಾಸರು
3. ತತ್ತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು - ಸಂತ ಶಿಶುನಾಳ ಶರೀಫ.

**ಘಟಕ - 3 ಆಧುನಿಕ ಕಾವ್ಯ ಭಾಗ, 2001** **(3 ಘಂಟೆ)**

1. ಡಿ.ವಿ.ಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗದಿಂದ ಆಯ್ದ ಕೆಲವು ಭಾಗಗಳು
2. ಕುರುಡು ಕಾಂಚಾಣ: ದ.ರಾ ಬೇಂದ್ರೆ
3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು

**ಘಟಕ - 4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ** **(3 ಘಂಟೆ)**

1. ಡಾ.ಸರ್. ಎಂ.ವಿಶ್ವೇಶ್ವರಯ್ಯ ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್
2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ - ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ

**ಘಟಕ - 5 ಸಾಂಸ್ಕೃತಿಕ ಜನಪದ ಕಥೆ ಮತ್ತು ಪತ್ರ ವ್ಯವಹಾರ** **(3 ಘಂಟೆ)**

1. ಯುಗಾದಿ - ವಸುದೇಂದ್ರ
2. ಪತ್ರ ವ್ಯವಹಾರ / ಪತ್ರ ಅರ್ಜಿಯ ವಿವಿಧ ಬಗೆಗಳು

| **8.KANNADA PARICHAYA** | | Semester | I |
|---|---|---|---|
| Course Code | 26BHKT102 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 1:0:0:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 15 Hours Theory | Total Marks | 100 |
| Credits | - | Exam Hours | 1 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

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**MODULE 2** **(03 hrs)**

1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - Possessive forms of nouns, dubitive question and relative nouns.
2. ಗುಣ ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣ ಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು Qualitative, Quantitative and Colour Adjectives, Numerals.
3. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು - ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ -(ಅ, ಅದು, ಅವು, ಅಲ್ಲಿ) – Predictive Forms, locative Case.

**MODULE-3** **(03 hrs)**

1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾ ವಾಚಕಗಳು - Dative Cases, and Numerals.
2. ಸಂಖ್ಯಾ ಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು - Ordinal numerals and Plural markers.
3. ನ್ಯೂನ / ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು - Defective/ Nagative Verbs & Colour Adjectives.

**MODULE-4** **(03 hrs)**

1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಅರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು permission, commands, encouraging and urging words. (imperative words and sentences)
2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು Accusative Cases and Potential Forms used in General Communication.

**MODULE-5** **(03 hrs)**

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು - Different types of Tense, Time and Verbs.
2. ದ್,-ತ್- ತು - ಇತ್ತು - ಆಗಿ, - ಅಲ್ಲ, ಗ್, ಕ್,- ಇದ ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ – Formation of Past, Future and Present Tense sentences with verbs forms.
3. Kannada Vocabulary List - ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು

# SEMESTER-II

| **1.DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS**(Common to CSE-DS and AI&R Branches) | | Semester | II |
|---|---|---|---|
| Course Code | 26BMAT 201 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:2:0:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 42 Hours Theory+28 Hours Tutorial + 50 Hours Team Work (TW)andSelf Learning(SL) | Total Marks | 100 |
| Credits | 4 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

## Course Objectives

•Develop the Mathematical Models of Physical Systems using Differential Equations
• Acquire the knowledgeof Differential Equations, Number theory and Numerical methods to implement them effectively within their core areas of specialization.
• Enhance the comprehensive understanding of numerical methods gained to demonstrate the problems arising in real-world situations.

## Course Outcomes

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

CO 1 Apply the foundational knowledge of differential equations, sequences, and Numerical methods to solve engineering problems.
CO 2 Analyse complex engineering problems using appropriate mathematical techniques from differential equations, sequences, and Numerical methods
CO 3 Evaluate engineering problems by identifying suitable mathematical methods from differential equations, sequences, and Numerical methods
CO 4 Enhance the comprehensive understanding of differential equations, sequences, and Numerical methods gained to demonstrate the problems arising in real world situations

## UNIT I – ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER [8 hours]

Bernoulli's differential equations. Exact and reducible to exact differential equations- Integrating factors on $\frac{1}{M}(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y})$and $\frac{1}{N}(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x})$. Orthogonal trajectories, Newton's law of cooling. Non-linear differential equations - Introduction to general and singular solutions, solvable for p and Clairaut's equations.

## UNIT II – LINEAR ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER [10 hours]

Standard form of a higher-order linear differential equation with constant coefficients. Solution of homogeneous equations–complementary functions. Nonhomogeneous equations-concept of inverse differential operator, methods of finding particular integral based on input function (force function), method of variation of parameters. Equations with functional coefficients–Legendre's and Cauchy linear differential equation. LRC circuits

## UNIT III – SEQUENCES AND SERIES [8 HOURS]

Sequences, Series – Types of Convergence, Series of positive terms, Tests of convergence – Comparison test, Integral test and D'Alembert's ratio test, Alternating series – Leibnitz's test, Series of positive and negative terms, Absolute and conditional convergence.

## UNIT IV – NUMERICAL METHODS -1 [8 HOURS]

Solution of algebraic and transcendental equations: Newton-Raphson method. Finite differences, Newton's forward and backward interpolation. Lagrange's interpolation and Lagrange's inverse Interpolation. Numerical integration: Simpson's (1/3)rd rule, Simpson's (3/8)th rule and Weddle's rule. Estimating the velocity, acceleration, area, volume.

## UNIT V – NUMERICAL METHODS -2 [8 HOURS]

Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Picard's method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector method. Finding approximate solution of ODEs related to engineering field.

## TEXTBOOKS

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, 2016.
2. M.K. Jain, S.R.K. Iyenger and R.K Jain,"Numerical Methods for Scientific and Engineering Computation" New Age International Publishers, 6th Edition, 2012.
3. Grewal B S, "Higher Engineering Mathematics", Khanna Publishers, 45th Edition, 2024.

## REFERENCE BOOKS

1. Bali N P, Manish Goyal, "A Textbook of Engineering Mathematics", Ninth Edition, Laxmi Publications Pvt Ltd, 2016.
2. Boyce W E, DiPrima R C, "Elementary Differential Equations and Boundary Value Problems", 11th Edition, Global Edition, Wiley, 2017.
3. Dennis Zill, "A First course in Differential Equations with modelling applications", Cengage Publishers, 11th Edition, 2018.

## ACTIVITIES

1. Demonstration and visualization of the solution of ordinary differential equations.
2. Demonstration of the Convergence of the sequences and series
3. Computational Analysis of Differential Equations Using Software Tools
4. Solving of Competitive Examination questions (Ex. GATE).

| **2.CHEMISTRY OF SMART MATERIALS** (Common to CSE-DS and AI&R Branches) | | Semester | II |
|---|---|---|---|
| Course Code | 26BCH I201 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:2:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 42 Hours Theory+30 Hours practical + 48 Hours Team Work (TW)and Self Learning(SL) | Total Marks | 100 |
| Credits | 4 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

**Course Outcomes**

After completing the course, the students will be able to

**CO1:** Apply the principles of chemistry to understand and address issues in corrosion, energy systems, polymer materials, quantum dots, semiconductors and sensors for emerging electronics.
**CO2:** Analyze engineering problems using concepts of chemistry and draw meaningful inferences.
**CO3:** Develop and implement sustainable solutions in materials, energy, and electronic devices through applied chemistry.
**CO4:** Engage in self-directed learning and effectively present the contributions of chemistry to society.
**CO5:** Apply knowledge of chemistry to synthesize and analyze engineering materials using analytical techniques.

## UNIT-1: ELECTROCHEMISTRY, CORROSION AND SENSORS [8 HOURS]

Electrochemistry-Introduction,Classification of cells - primary, secondary and concentration cells with numerical; Reference electrodes – Silver/silver chloride electrode; Ion-selective electrodes - Glass electrode, determination of pH using glass electrode.
Corrosion - Definition, Electrochemical theory of corrosion, Types of corrosion - differential metal and differential aeration; Factors affecting the rate of corrosion; Corrosion Penetration Rate (CPR), numerical. Corrosion control: Cathodic protection; corrosion inhibition-vapor phase corrosion inhibitors for the protection of electronic components. Metal finishing - Introduction, technological importance; Electroless plating of PCB.
Electrochemical Sensors: Introduction, screen printed electrodes, designing of electrochemical sensors. Potentiometric sensors, conductometric sensors, electrochemical gas sensors for the detection of NOx, biochemical sensor (glucose sensor).

## UNIT -2: SUSTAINABLE ENERGY SYSTEMS [8 HOURS]

Batteries: Introduction and classification of batteries. Construction, working and applications of Li-ion battery.

Next generation energy systems: Introduction, construction and working of sodium ion battery and redox flow battery for EV applications. Introduction to supercapacitors, construction and working of ultra-small asymmetric super capacitor in IoT/wearable device applications.

Clean energy: Introduction, fuel cell, difference between fuel cell and battery. Construction, working, applications and limitations of solid-oxide fuel cell (SOFCs). Production of green hydrogen by photocatalytic water splitting using $TiO_2$ and its advantages.

Quantum Dots: Introduction, size dependent properties - quantum confinement effect, surface-to-volume ratio & band gap. Quantum dot sensitized solar cells (QDSSCs)-construction, working and applications.

## UNIT -3: POLYMERS FOR ADVANCED SYSTEMS [8 HOURS]

Polymer: Introduction, terminology, molecular weight of polymers - number and weight average molecular weight of polymers, numerical. Glass transition temperature (Tg), factors affecting $T_g$.
Synthesis, properties and applications of chloro-polyvinyl chloride (CPVC), polymethyl methacrylate (PMMA).
Conducting polymers: Introduction, synthesis, conduction mechanism and applications of polyaniline in electronic devices. Synthesis, properties and applications of polydimethylsiloxane (PDMS) in RFID

(radio frequency identification). Synthesis, properties and applications of polyvinylidene fluoride (PVDF) in E-nose devices.

Polymeric semiconductors: Introduction, n-type and p-type polymeric semiconductor materials, organic photovoltaics - poly(3-hexylthiophene) (P3HT) as a donor and phenyl C61-butyric acid methyl ester (PCBM) as an acceptor.

Polymer Composites: Introduction, synthesis of Kevlar Fiber Reinforced Polymer (KFRP)-properties and smart electronic devices applications.

**UNIT -4:MATERIALS FOR MEMORY AND DISPLAY SYSTEMS[8 HOURS]**

Memory devices: Introduction: Concept of electronic memory, volatile and non-volatile memory, classification of memory devices based on working principle and materials. Difference between organic and inorganic memory devices, Organic semiconductors; types of organic semiconductors - p-type semiconductors and n- type semiconductors. Construction, working and advantages of organic semiconductor chip.

Resistive RAM (ReRAM) materials: Introduction, synthesis of nano-$TiO_2$ by sol-gel method, properties and applications in ReRAM.

Display systems: Introduction to optoelectronics, liquid crystals (LCs) - classification, properties and their applications in Liquid Crystal Displays (LCDs), Jablonski diagram. Construction, working and applications of OLEDs, and Quantum Light Emitting Diodes (QLEDs).

**UNIT -5: GREEN MATERIALS AND E-WASTE MANAGEMENT [8 HOURS]**

Green materials: 12 principles of green chemistry (numerical on atom economy), properties and applications of green solvents for server heat management. Biosynthesis and properties of glycerol trioleate ester for server and IT infrastructure applications. Green synthesis of ZnO nanoparticles for magnetic radio frequency identification (RFID) & Internet of Nano Things (IONT) system applications.

E-waste: Introduction, sources, composition of e-waste, effects of e-waste on environment and human health. Extraction of metals from e-waste – gold by bioleaching method, copper by hydrometallurgical method. Direct recycling method of lithium-ion batteries.

## TEXTBOOKS:

1. S. Vairam and Suba Ramesh, “Engineering Chemistry”, Wiley, 2nd Edition, 2013.
2. Jain and Jain, “Engineering Chemistry”, DhanpatRai Publishing Company, 17th Edition, 2015.
3. Basuchandra, “Applied Chemistry”, New Edition, 2025.

**REFERENCE BOOKS**

1. Deepak Verma, “Semiconducting Materials and Devices”, Agrotech Publishing Academy, 2022.
2. Prasanna Chandrasekhar, “Conducting Polymers, Fundamentals and Applications: Including Carbon Nanotubes and Graphene”, Springer, 2nd Edition, 2019.
3. M. G. Fontana and R. W. Staettle, “Advances in Corrosion Science and Technology”, Springer, 2012.

**List of Lab Experiments:**

1. Synthesis of Quantum dots (QDs) through wet chemical techniques.
2. Spectroscopic determination of hazardous materials from e- waste.
3. Synthesis of conducting polymers for electronic applications.
4. Electroless plating of copper for Printed Circuit Board (PCB) applications.
5. Conductometric Determination of Acid Strength in a Binary Mixture

6. Determination of amount of iron in rust solution through Potentiometric sensor method.
7. Synthesis and characterization of N-RAM materials.
8. Synthesis and characterization of nano zinc oxide through co-precipitation method.
9. Determine the pKa value of weak acids using a pH sensor.
10. Determination of total hardness of water.

Virtual Experiments

1. Virtual experiment for concentration cell- construction and working

2. Virtual experiment for measurement of single electrode potential.

Open-ended experiments:

1. Green synthesis of copper nanoparticles for conductive ink applications.
2. Determination of viscosity coefficient of lubricant using Ostwald's viscometer.
3. Determination of corrosion penetration rate (CPR) by weight-loss method.
4. Smartphone based colorimetric estimation of total phenolic content in beverages.
5. Chemical structure drawing using software: Chem Draw/ Chem Sketch.

| **3.INTRODUCTION TO ELECTRONICS ENGINEERING** (Common to CSE-DS and AI&R Branches) | | Semester | II |
|---|---|---|---|
| Course Code | 26BECI201/26BECI101 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:1:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 42 Hours Theory+30 Hours practical + 48 Hours Team Work (TW)and Self Learning(SL) | Total Marks | 100 |
| Credits | 4 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

**Course Objectives**

This course aims to:

1. Introduce the fundamentals of digital electronics, number systems, Boolean algebra, and basic logic circuits.
2. Develop an understanding of semiconductor diodes and their applications in electronic circuits.
3. Explain the basic operation and applications of BJTs as electronic switches and amplifiers.
4. Introduce operational amplifiers and their basic applications in analog signal processing.
5. Provide an overview of communication systems, modulation techniques, and modern communication technologies.

**Course Outcomes (COs)**

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

CO1: Apply number systems, Boolean algebra, logic gates, and basic combinational logic concepts to analyze digital circuits.

CO2: Explain the characteristics and applications of semiconductor diodes in rectifiers, voltage regulators, clippers, and clampers.

CO3: Explain the operation and applications of BJTs as electronic switches and amplifiers.

CO4: Analyze basic operational amplifier circuits and explain their applications in analog signal processing.

CO5: Explain the basic architecture of communication systems and the principles and applications of major analog modulation techniques.

**UNIT I: DIGITAL ELECTRONICS AND NUMBER SYSTEMS[8HOURS]**

Number systems (Binary, Octal, Decimal and Hexadecimal), Number base conversion, Binary arithmetic, 1's and 2's complement, BCD, Excess-3 code, 8421 code, Boolean algebra, Boolean functions, Canonical and Standard forms, Logic gates, Universal gates (NAND and NOR), Combinational logic circuits, Half adder, Full adder.

**UNIT II: SEMICONDUCTOR DIODE & APPLICATIONS [8HOURS]**

PN junction diode, V-I characteristics, Diode parameters and specifications, Shockley's diode equation, Half-wave and Full-wave bridge rectifiers, Ripple factor, Rectification efficiency, Peak inverse voltage, Capacitor filter, Zener diode characteristics and voltage regulation, Regulated power supply, Clippers, Clampers.

**UNIT III: BJT [8 HOURS]**

Bipolar Junction Transistor (BJT): Construction and working principle; CB, CC and CE configurations; Input and output characteristics; BJT as a switch and amplifier; BJT biasing: Fixed bias and Voltage-divider bias; DC load line and Q-point.

**UNIT IV: OPERATIONAL AMPLIFIERS [8 HOURS]**

Introduction to operational amplifiers; Ideal and practical op-amps; Functional block diagram; Open-loop and closed-loop configurations; Op-amp characteristics and parameters: Gain, Input resistance, Output resistance, Bandwidth, Slew rate, CMRR, Input bias current and offset voltage; Inverting and Non-inverting amplifiers; Voltage follower; Summing amplifier; Difference amplifier; Integrator and Differentiator.

**UNIT V: COMMUNICATION [8 HOURS]**

Basic communication system; Information source; Input transducer; Transmitter; Communication channel: Wired and Wireless; Noise; Receiver; Multiplexing; Types of communication systems; Amplitude Modulation (AM), Frequency Modulation (FM) and Phase Modulation (PM); Basic waveforms and applications; Introduction to cellular communication and computer communication networks.

**Textbooks:**

1. Adel S. Sedra, Kenneth C. Smith, Tony Chan Carusone and Vincent Gaudet, “Microelectronic Circuits”, Oxford University Press, 8th Edition, 2020.
2. M. Morris Mano and Michael D. Ciletti, “Digital Design”, Pearson Education, 6th Global Edition, 2024.
3. John G. Proakis and MasoudSalehi, “Fundamentals of Communication Systems”, Pearson, 2nd Edition, 2022.

## Reference books:

1. Ramakant A. Gayakwad, “Op-Amps and Linear Integrated Circuits”, Pearson, Revised 4th Edition, 2021.
2. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson, 11th Edition, 2013.
3. Thomas L. Floyd, “Electronic Devices”, Pearson, 10th Edition, 2018.

**Web links and Video Lectures (e-Resources):**

1. https://www.elsevier.com/books/basic-electronics/holbrook/978-0-08-006865-7
2. http://www.worldcat.org/title/basic-electronics/oclc/681543319
3. http://nptel.ac.in/courses/117103063/
4. https://nptel.ac.in/courses/108101091

**List of Experiments**

1. Verification of Logic gates
2. Implementation of Half Adder & Full Adder
3. Resistor Coding, Series and Parallel Circuits
4. PN junction diode characteristics
5. Zener diode voltage regulation
6. Clipper and Clamper
7. Half-wave and full-wave rectifiers
8. Transistor characteristics (CE mode)
9. Inverting Amplifier using Opamp
10. Non-Inverting Amplifier using Opamp

| **4.PYTHON DATA ANALYSIS AND VISUALIZATION** (Common to CSE-DS and AI&R Branches) | | Semester | II |
|---|---|---|---|
| Course Code | 26BCDI201 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:1:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 42 Hours Theory+30 Hours practical + 48 Hours Team Work (TW)and Self Learning(SL) | Total Marks | 100 |
| Credits | 4 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

## Course Objectives

This course aims to:

1. To understand the fundamentals and programming constructs of Python.
2. To develop programs using Python data structures, functions, modules, and object-oriented concepts.
3. To apply Python libraries for data processing, statistical analysis, and visualization.
4. To use Python tools and libraries for machine learning, deep learning, and natural language processing.
5. To develop Python-based solutions for data analytics and real-world applications.

## Course Outcomes (COs)

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

CO1: Develop Python programs using basic syntax, data types, operators, control statements, and loops.

CO2: Implement solutions using strings, lists, tuples, dictionaries, sets, functions, and object-oriented programming.

CO3: Apply modules, packages, file handling, and exception handling in Python applications.

CO4: Perform data processing, statistical analysis, and visualization using Python libraries.

CO5: Apply Python-based machine learning, deep learning, and NLP libraries to data analytics problems.

**UNIT I: PYTHON PROGRAMMING FUNDAMENTALS [8 HOURS]**

Introduction to Python – History and Features of Python – Setting up Python Path – Working with Python Interpreter – Basic Syntax – Variables and Data Types – Operators and Expressions – Input and Output – Conditional Statements: if, if-else, nested if-else – Looping Statements: for, while, nested loops – Control Statements: break, continue, pass – Sequential Programming – Problem-Solving using Python.

**UNIT II: STRINGS AND DATA STRUCTURES [8 HOURS]**

String Manipulation – Accessing Strings – Basic String Operations – String Slicing – String Functions and Methods – Regular Expressions – Lists: Introduction, Creating and Accessing Lists – List Operations – List Functions and Methods – Tuples: Introduction – Accessing Tuples – Tuple Operations – Tuple Functions and Methods – Dictionaries: Introduction – Accessing Dictionary Values – Dictionary Properties – Dictionary Functions and Methods – Sets and Set Operations.

**UNIT III: FUNCTIONS, MODULES AND OBJECT-ORIENTED PROGRAMMING [8 HOURS]**

Functions – Defining and Calling Functions – Function Arguments – Types of Functions – Anonymous/Lambda Functions – Global and Local Variables – Recursion – Modules – Importing Modules – Built-in Modules: random, time, datetime, calendar, sys – User-Defined Modules – Packages – Predefined and User-Defined Packages – Classes and Objects – User-Defined Data Types – Creating Classes and Objects – Variables and Methods – Constructors – Inheritance – Single, Multilevel, Multiple, Hybrid and Hierarchical Inheritance – IS-A and HAS-A Relationships.

**UNIT IV: FILE HANDLING, EXCEPTION HANDLING AND DATA ANALYSIS LIBRARIES [8 HOURS]**

File Handling – File Operations – Reading and Writing Files – File Modes – Working with Files – Python Exceptions – Common Exceptions – Exception Handling using try-except-else – Multiple Exceptions – try-finally – Custom Exceptions – assert Statement – Introduction to NumPy – Arrays and Array Operations – SciPy – Pandas – DataFrames and Series – StatsModels – Statistical Analysis using Python

.

**UNIT V: DATA VISUALIZATION, MACHINE LEARNING AND AI LIBRARIES [8 HOURS]**

Introduction to Data Visualization – Matplotlib – Seaborn – Plotly – Data Representation and Visualization – Data Modelling using Scikit-learn – Introduction to XGBoost and Eli5 – Deep Learning using TensorFlow, PyTorch and Keras – Natural Language Processing using NLTK, SpaCy and Gensim – Applications of Python in Data Analytics – Emerging Trends and Challenges in Python Programming and Analytics.

**Textbooks**

1. Python for Everybody: Exploring Data Using Python 3, Charles R. Severance, Fourth Edition, University of Michigan, 2016
2. Learning to Program using Python, Cody Jackson, Second Edition, Packt Publishing, 2018

**Reference books:**

1. Programming Python,MarkLutz,FirstEdition,O'Reilly Media,2010
2. Python Essential Reference,David M. Beazley,Fourth Edition,Pearson,2009
3. Core Python Applications Programming,Wesley J Chun,ThirdEdition,Pearson,2015.

**List of Lab activities:**

1. Write a program that asks the user how many Fibonacci numbers to generate and then generates them. Make sure to ask the user to enter the number of numbers in the sequence to generate.
2. Write a program that asks the user for a number and then prints out a list of all the divisors of that number.
3. Write a program to compute distance between two points taking input from the user (Pythagorean Theorem).
4. Write a Program for checking whether the given number is a even number or not.
5. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
6. Write a program to find the sum of all primes below two million.
7. a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure.
7. b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.
8. a) Write a Python program that takes this list and makes a new list that has only the even elements of this list in it.
   b) Write a function that takes an ordered list of numbers (a list where the elements are in order from smallest to largest) and another number. The function decides whether or not the given number is inside the list and returns (then prints) an appropriate Boolean.
9. a) Write a program to combine lists that combines these lists into a dictionary.
   b) Write a program to print each line of a file in reverse order.
10. a) Write a program to count frequency of characters in a given file.
    b) Write a program to compute the number of characters, words and lines in a file.
11. Write a Python program for Statistical Analysis : NumPy, SciPy, Pandas, Stats Models.
12. Write a Python program for Data Visualization- Matplotlib, Seaborn, Plotly.
13. Write a Python program for Data Modelling and Machine Learning- Scikit-learn, XGBoost, Eli5
14. Write a Python program for Deep Learning- TensorFlow, Pytorch, Keras.
15. Write a Python program for Natural Language Processing (NLP)- NLTK, SpaCy, Gensim

| **6.DESIGN THINKING FOR INNOVATION**<br>(Common to CSE-DS and AI&R Branches) | | Semester | II |
|---|---|---|---|
| Course Code | 26BARL202/26BARL202 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 0:0:1:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 30 Hours practical | Total Marks | 100 |
| Credits | 1 | Exam Hours | 1 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

## PART-I (Common to All Programmes)

1. Introduction to Design thinking: Brief about five stages of Design thinking: Empathise, Define, Ideate, Prototype and Test (Lecture/Presentation).

2. Introduction to social Entrepreneurship, Innovation Vs Invention (Lecture/Presentation).

3. Team Formation (5 students/team), defining roles of team members and warm up activities

4. Interaction with industry, public, institutes, NGO's, Stakeholders and senior students

5. Interaction with industry, public, institutes, NGO's, Stakeholders and senior students

6. Problem Framing: Define the problem statement/s, objectives, and expected outcomes Based on "How Might We" Approach.

## PART-II (Programme Specific)

1. Presentation by the teams on problem statement/s with brainstorming interactions & Mind mapping.
2. Idea Filtering: Selection of suitable idea for designing / structuring of prototype model
3. Model design using domain specific tools (Idea Lab Facility may be used).
4. Feedback collection and refinements
5. Poster presentation and final Demo with pitching the idea.
6. Ideathon Competition announcement (Institute level)

## Reference Book:

1. David Lee, "Design Thinking in the Classroom", Ulysses Press, 2018.

| **7.INDIA CONSTITUTION AND PROFESSIONAL ETHICS** (Common to CSE-DS and AI&R Branches) | | Semester | II |
|---|---|---|---|
| Course Code | 26BHST201 | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 1:0:0:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 15 Hours Theory | Total Marks | 100 |
| Credits | 0 | Exam Hours | 1 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

## Course Outcomes (COs):

At the end of the course the student will be able to:
1. Identify the fundamental principles of Indian constitution.
2. Examine various provisions of the fundamental duties and directives of government.
3. Understand the powers & functions of executive, Legislature and judicial system at thecenter and state level
4. Identify the role of government. Understand about Amendment procedure
5. Understand about Ethical values in engineering profession.

### Unit I :INTRODUCTION TO THE CONSTITUTION OF INDIA

Meaning and Significances of the Constitution, and its salient features, Preamble of the Constitution, Fundamental Rights and relevant cases.

### Unit II :RELEVANCE OF DIRECTIVE PRINCIPLES OF STATE POLICY -PART-IV

Fundamental Duties & their significance. Special constitutional provisions for the betterment of Women, Children and backward classes in India.

## Unit III :UNION EXECUTIVE AND STATE EXECUTIVE

The organs of government -Union executive- the President of India, Vice President, Prime Minister, & Council of Ministers. The Union Legislature, Compositions & the functions of Parliament and the Supreme court of India - composition & Jurisdictions

State Executive-Governor, Chief Minister& council of Ministers, State legislature- composition & functions of Legislative assembly& legislative council and State Judiciary.

## Unit IV :EMERGENCY PROVISIONS, ELECTORAL PROCESS & MAJOR CONSTITUTIONAL AMENDMENTS

Emergency provisions and election commission of India & Electoral process, Amendment procedure and Major Constitutional amendments.

## Unit V :PROFESSIONAL ETHICS

Scope and Aim of professional ethics, Responsible attitude, impediments to Responsibility, Trust & Reliability in Engineering

## Text Books:

1. “A Primer on Constitution of India & Professional Ethics”, VTU Publication, 2007.

## Reference Books:

1. Durga Das Basu, “Introduction to the Constitution of India”, 19th/20th Edition, 2001.
2. M. V. Pylee, “An Introduction to the Constitution of India”, 4th Edition, 2008.
3. Dr. K. R. Phaneesh, “Constitution of India & Professional Ethics”, Sudha Publications, 10th Revised Edition, 2018.

# Interdisciplinary Courses (Elective Basket)

| **1.BASIC ELECTRICAL ENGINEERING** (Common to CSE-DS and AI&R Branches) | | Semester | I |
|---|---|---|---|
| Course Code | 26BECT11X | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:0:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 40 Hours Theory + 50 Hours Team Work (TW)andSelf Learning(SL) | Total Marks | 100 |
| Credits | 3 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

**Course Objectives**

This course aims to:

1. Introduce the basic concepts of electrical quantities, DC circuits, and electrical network analysis.
2. Develop an understanding of AC circuits, phasor representation, power, and power factor.
3. Explain electromagnetic induction, and the working principles of transformers.
4. Familiarize students with the operating principles and applications of DC and AC electrical machines.
5. Introduce electrical wiring, earthing, safety practices,

**Course Outcomes (COs)**

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

- CO1: Analyze basic DC and single phase AC circuits using Ohm's law, Kirchhoff's laws, and network theorems.
- CO2: Apply the principles of electromagnetic induction and discuss the working principle of single-phase transformers.
- CO3: Discuss the operating principles, characteristics, and applications of DC and AC electrical machines.
- CO4: Describe electrical wiring, earthing, safety practices

**UNIT I – DC CIRCUITSAND NETWORK THEOREMS** **[8 HOURS]**

DC Circuits: Ohm's Law; Series and parallel circuits; Kirchhoff's Current and Voltage Laws; Voltage and current division; Power and energy calculations,

Network theorems: Superposition Theorem, Thevenin's Theorem, Maximum Power Transfer Theorem.

**UNIT II – AC CIRCUITS** **[8 HOURS]**

Generation of sinusoidal voltage, frequency of generated voltage, average value, RMS value, form factor and peak factor of sinusoidal voltage and currents. Phasor representation of alternating quantities.

Analysis of R, L, C, R-L, R-C and R-L-C circuits with phasor diagrams, Real power, reactive power, apparent power, and Power factor, Series and Parallel circuits.

**UNIT III – ELECTROMAGNETIC INDUCTION AND SINGLE PHASE TRANSFORMERS** **[8 HOURS]**

Electromagnetic Induction: Faraday's laws of electromagnetic induction; Self and mutual inductance; Self and Mutually induced EMF, coefficient of coupling, energy stored in an inductor.

Transformers: Introduction to transformers, Principle of operation, constructional features, types (shell and core) of single phase transformers. EMF equation, losses, variation of losses with respect to load. Calculation of efficiency at different loads, condition for maximum efficiency.

**UNIT IV – ELECTRICAL MACHINES** **[8 HOURS]**

DC motors—Principle of operation, construction, back emf and its significance. Torque equation, Types (series and shunt) and characteristics and applications

Induction Motors - Concept of rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and wound rotor, slip and problems on the slip, applications

BLDC motor- working principle, constructional details and applications

**UNIT V – ELECTRICAL INSTALLATIONS AND SAFETY** **[8 HOURS]**

Domestic Wiring: Wiring for two-way and three-way control of load.

Equipment Safety Measures: Working principles of fuse and miniature circuit breaker (MCB), the merits and demerits of fuse and MCB. Definition for current rating, fusing current and fusing factor.

Personal safety measures: Electric shock, possible effects of shocks. Safety precautions to avoid personal shock while dealing with electricity.

Earthing: Pipe and plate earthing.

## Text Books

1. B. L. Theraja and A. K. Theraja, A Textbook of Electrical Technology, Volume I: Basic Electrical Engineering, S. Chand Publishing, 2024.
2. Edward Hughes, revised by John Hiley, Keith Brown and Ian McKenzie, Hughes Electrical and Electronic Technology, 12th Edition, Pearson, 2025.

## Reference Books

3. D. P. Kothari and I. J. Nagrath, Basic Electrical Engineering, 4th Edition, McGraw Hill Education, 2019.
4. R. Muthusubramanian and S. Salivahanan, Basic Electrical and Electronics Engineering, 2nd Edition, McGraw Hill Education, 2025.

| **2.INTRODUCTION TO MECHANICAL ENGINEERING** (Common to CSE-DS and AI&R Branches) | | Semester | I |
|---|---|---|---|
| Course Code | 26BART11X | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:0:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 40 Hours Theory + 50 Hours Team Work (TW)andSelf Learning(SL) | Total Marks | 100 |
| Credits | 3 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

### Course Objectives

This course aims to:

1. Introduce the role, scope, and major areas of Mechanical Engineering and its applications in modern industries.
2. Familiarize students with engineering materials and basic manufacturing processes.
3. Introduce the fundamentals of thermal systems, energy conversion, and mechanical power transmission.
4. Develop an understanding of mechatronics, sensors, actuators, robotics, and automation.
5. Familiarize students with modern mechanical technologies including additive manufacturing, electric vehicles, and smart manufacturing.

### Course Outcomes (COs)

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

CO1: Explain the role of Mechanical Engineering and identify major engineering materials and their applications.

CO2: Describe basic manufacturing processes and modern manufacturing technologies used in industry.

CO3: Explain the basic principles and applications of thermal systems, energy conversion devices, and mechanical power transmission.

CO4: Explain the basic components and working principles of mechatronic and robotic systems.

CO5: Identify the applications of modern mechanical technologies such as 3D printing, smart manufacturing, electric vehicles, and automation.

**UNIT I – INTRODUCTION TO MECHANICAL ENGINEERING AND ENGINEERING MATERIALS [8 HOURS]**

Introduction to Mechanical Engineering; Role of Mechanical Engineering in Industry and Society; Major areas of Mechanical Engineering; Applications in Automotive, Aerospace, Manufacturing, Energy, Healthcare and Robotics.

Engineering Materials: Metals and Alloys; Ferrous and Non-ferrous Materials; Ceramics; Polymers; Composites; Smart Materials; Selection of materials for engineering applications; Basic mechanical properties of materials.

**UNIT II – MANUFACTURING PROCESSES[8 HOURS]**

Introduction to Manufacturing; Classification of Manufacturing Processes; Casting; Forming Processes: Forging, Rolling and Extrusion; Joining Processes: Welding, Brazing and Soldering; Machining: Turning, Drilling and Milling; CNC Machines; Introduction to Automation in Manufacturing; Additive Manufacturing and 3D Printing; Introduction to Smart Manufacturing.

**UNIT III – THERMAL ENGINEERING AND ENERGY SYSTEMS [8 HOURS]**

Basic Concepts of Thermodynamics; Heat and Work; Energy Conversion; Heat Engines; Internal Combustion Engines: SI and CI Engines; Two-Stroke and Four-Stroke Engines; Boilers and Steam Power Plants; Refrigeration and Air Conditioning; Renewable Energy Systems; Introduction to Electric and Hybrid Vehicles.

**UNIT IV – MECHANICAL SYSTEMS AND POWER TRANSMISSION[8 HOURS]**

Basic Mechanical Systems; Forces and Motion in Mechanical Systems; Mechanical Power Transmission; Belt Drives; Chain Drives; Gear Drives; Shaft, Bearings and Couplings; Brakes and Clutches; Hydraulic and Pneumatic Systems; Applications of Mechanical Transmission Systems.

**UNIT V – MECHATRONICS, ROBOTICS AND MODERN MECHANICAL SYSTEMS[8 HOURS]**

Introduction to Mechatronics; Basic Components of Mechatronic Systems; Sensors and Actuators; Introduction to Control Systems; Robotics: Joints, Links and Robot Configurations; Industrial Robots; Applications of Robotics; Human-Robot Interaction; Introduction to Autonomous Systems; Electric Vehicles and Autonomous Vehicles; Smart Manufacturing and Industry 4.0.

## Textbooks:

1. Jonathan Wickert and Kemper Lewis, An Introduction to Mechanical Engineering, 4th Edition, Cengage Learning, 2017.

2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 7th Edition, Wiley, 2020.

**Reference books:**

1. Pravin Kumar, Basic Mechanical Engineering, 2nd Edition, Pearson Education, 2018.
2. Vinkel Kumar Arora, Gurjeet Singh, Krishan Verma and Lalit Batra, Basics of Mechanical Engineering, 1st Edition, New India Publishing Agency, 2023.
3. L. Jyothish Kumar and Pulak M. Pandey, 3D Printing & Additive Manufacturing Technology, Springer.

| **3.**FOUNDATIONS OF DATA SCIENCE<br>(Common to CSE-DS and AI&R Branches) | | Semester | II |
|---|---|---|---|
| Course Code | 26BCDT21X | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:0:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 40 Hours Theory + 50 Hours Team Work (TW)andSelf Learning(SL) | Total Marks | 100 |
| Credits | 3 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

**Course Objectives**

1. To understand the fundamental concepts and foundations of Data Science.
2. To apply mathematical, statistical, and optimization techniques in Data Science.
3. To perform data preprocessing and exploratory data analysis.
4. To develop effective data visualization techniques.
5. To familiarize with tools and libraries used in Data Science.

**Course Outcomes**

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

CO1: Explain the mathematical, statistical, and algorithmic foundations of Data Science.

CO2: Apply statistical and optimization techniques to analyze data.

CO3: Perform data preprocessing and exploratory data analysis using appropriate tools.

CO4: Create suitable visualizations for representing and interpreting data.

CO5: Apply Data Science tools and libraries for solving analytical problems.

**UNIT I – FOUNDATIONS OF DATA SCIENCE [9 HOURS]**

Introduction – Typology of Problems – Importance of Linear Algebra – Statistics and Optimization from a Data Science Perspective – Approaches in Solving Data Science Problems – Structured and Unstructured Data – Linear Algebra – Matrices and their Properties – Eigenvalues and Eigenvectors – Matrix Factorizations – Inner Products – Markov Chain Monte Carlo Algorithms – Learning – PAC Learning.

**UNIT II – STATISTICAL FOUNDATIONS AND OPTIMIZATION TECHNIQUES[9 HOURS]**Descriptive Statistics – Statistical Features – Summarizing the Data – Outlier Analysis – Understanding Distributions and Plots – Univariate Statistical Plots and Its Usage – Bivariate and Multivariate Statistics – Dimensionality Reduction Techniques – Unconstrained Optimization – Necessary and Sufficiency Conditions for Optima – Gradient Descent Methods.

**UNIT III – EXPLORATORY DATA ANALYSIS [8 HOURS]**

Data Acquisition – Data Pre-Processing and Preparation – Data Quality and Transformation – Data Analytics Life Cycle – NumPy and Pandas – Exploratory Data Analysis (EDA) – Steps in Data Exploration – Basic Tools of EDA.

**UNIT IV – DATA VISUALIZATION [8 HOURS]**

Introduction to Data Visualization – Visualization Workflow – Describing Data Visualization Workflow – Analysis – Four Levels for Validation – Data Representation – Chart Types – Categorical, Hierarchical, Relational, Temporal and Spatial Visualization.

**UNIT V – DATA SCIENCE TOOLS AND TECHNIQUES [6 HOURS]**

Outline and Demonstration of Open Source Tools such as R, Octave, Scilab – Python Libraries – SciPy and Sci-Kit-learn – Pybrain – Pylearn2 – Weka Tool.

## Textbooks:

1. R. V. Hogg, J. W. McKean and A. Craig, Introduction to Mathematical Statistics, 7th Edition, Pearson Education, India, 2019.
2. Avrim Blum, John Hopcroft, Ravindran Kannan, Foundations of Data Science, Cambridge University Press, 2020.

## Reference books:

1. Ani Adhikari and John DeNero, Computational and Inferential Thinking: The Foundations of Data Science, GitBook, 2019.
2. Hossein Pishro-Nik, Introduction to Probability, Statistics, and Random Processes, Kappa Research, LLC, 2014.
3. Carl Shan, Henry Wang, William Chen, Max Song, The Data Science Handbook: Advice and Insight from 25 Amazing Data Scientists, The Data Science Bookshelf, 2016.
4. James G., Witten, D. T., Tibshirani, R., An Introduction to Statistical Learning with Applications in R, Springer, 2013.

| 4.DIGITAL SYSTEM DESIGN | | Semester | I/II |
|---|---|---|---|
| Course Code | 26BECT21X | CIA Marks | 50 |

| | | | |
|---|---|---|---|
| Teaching Hours/Week (L:T:P: S) | 3:0:0:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 40 Hours Theory + 50 Hours Team Work (TW)andSelf Learning(SL) | Total Marks | 100 |
| Credits | 3 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

## Course Objectives

This course aims to:

1. Develop an understanding of Boolean functions and techniques for minimizing and implementing digital logic circuits.
2. Develop the ability to analyze and design combinational digital circuits using standard logic building blocks.
3. Explain the operation and applications of flip-flops, registers, and counters used in digital systems.
4. Develop skills in analyzing sequential circuits using state tables, state diagrams, and characteristic equations.
5. Introduce systematic design techniques for synchronous sequential circuits used in digital and VLSI systems.

## Course Outcomes (COs)

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

**CO1:** Simplify and implement Boolean functions using canonical forms, Karnaugh maps, and the Quine-McCluskey method.

**CO2:** Analyze and design combinational digital circuits including adders, subtractors, multiplexers, decoders, encoders, comparators, and code converters.

**CO3:** Analyze and apply flip-flops, registers, and counters in digital system design.

**CO4:** Analyze sequential circuits using state tables, state diagrams, state equations, and characteristic equations.

**CO5:** Design synchronous sequential circuits and counters using state reduction, state assignment, and systematic design procedures.

## UNIT I –BOOLEAN FUNCTION MINIMIZATION AND LOGIC DESIGN [8 HOURS]

Boolean functions and their representation; Canonical and standard forms; Minterms and maxterms; Sum of Products (SOP) and Product of Sums (POS); Don't-care conditions; Boolean function minimization using Karnaugh Maps; Three-variable and four-variable K-Maps; Quine-McCluskey tabulation method; Implementation of minimized Boolean functions using basic and universal gates.

## UNIT II – COMBINATIONAL LOGIC CIRCUITS[8 HOURS]

Introduction to combinational logic; Adders: Half Adder, Full Adder, Parallel Adder and Ripple Carry Adder; Subtractors; Parallel Subtractor using Adder; Code Converters; Magnitude Comparator; Decoders; Encoders; Multiplexers; Demultiplexers; Implementation of combinational functions using Multiplexers and Decoders.

## UNIT III – FLIP-FLOPS AND SEQUENTIAL LOGIC[8 HOURS]

Introduction to Sequential Logic; Basic Flip-Flop; Clocked Flip-Flops; SR, JK, D and T Flip-Flops; Triggering of Flip-Flops; Master-Slave Flip-Flops; Edge-Triggered Flip-Flops; Characteristic Tables and Characteristic Equations; Excitation Tables; Conversion of Flip-Flops.

**UNIT IV – REGISTERS AND COUNTERS[8 HOURS]**

Shift Registers; Serial-in Serial-out (SISO); Serial-in Parallel-out (SIPO); Parallel-in Serial-out (PISO); Parallel-in Parallel-out (PIPO); Asynchronous/Ripple Counters; Synchronous Counters; Up Counters; Down Counters; Up/Down Counters; MOD-N Counters; BCD Counters; Ring Counters.

**UNIT V – SYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN[8 HOURS]**

Analysis of Clocked Sequential Circuits; State Tables; State Diagrams; State Equations; State Reduction; State Assignment; Sequential Circuit Design Procedure; Design of Synchronous Counters; Design using State Equations and State Diagrams; Applications of Sequential Circuits.

## Textbooks:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", Pearson Education, 6th Global Edition, 2024.
2. John F. Wakerly, "Digital Design: Principles and Practices", Pearson Education, 5th Edition, 2021.

## Reference books:

1. Charles H. Roth Jr. and Larry L. Kinney, "Fundamentals of Logic Design", Cengage Learning, 7th Edition, 2020.
2. Thomas L. Floyd, "Digital Fundamentals", Pearson Education, 11th Edition, 2015.
3. Donald P. Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications", McGraw Hill Education, 8th Edition, 2014.

## E-Books:

1. https://easyengineering.net/digital-logic-and-computer-design-by-morris-mano/
2. https://www.sciencedirect.com/book/monograph/9780750645829/digital-logic-design

## MOOCs:

1. https://www.nptel.ac.in/courses/108106177
2. https://nptel.ac.in/courses/106105185/

| 5. OBJECT ORIENTED PROGRAMMING | | Semester | I/II |
|---|---|---|---|
| Course Code | 26BCDT21X | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 2:0:1:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 40 Hours Theory + 50 Hours Team Work (TW)andSelf Learning(SL) | Total Marks | 100 |
| Credits | 3 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

### Course Objectives

1. To teach the student the concepts of object oriented and procedure programming
2. To differentiate between functions, classes and objects
3. To learn to overload functions and operators
4. To design applications using dynamic memory management techniques
5. To teach the student to implement generic programming and exception handling

### Course Outcomes:

1. To differentiate object oriented programming and procedural programming.
2. To construct classes, functions and objects
3. To implement the constructors, destructors and inheritance
4. To develop programs using dynamic memory management techniques
5. To apply exception handling and generic programming.

### UNIT I:INTRODUCTION TO OBJECT ORIENTED PROGRAMMING[8 HOURS]

Object oriented paradigm-Differences between Object Oriented Programming and Procedure oriented programming, Basic concepts of Object Oriented Programming, Encapsulation, Inheritance and Polymorphism, Benefits of OOP, Structure of a C++ program, namespace, Data types, C++ tokens, Identifiers, Variables, Constants, Operators,Control structures & Loops.

### UNIT II:FUNCTIONS, CLASSES AND OBJECTS [8 HOURS]

Introduction of Classes, Class Definition, Defining a Members,Objects,Access Control, Class Scope, Scope Resolution Operator, Inline functions, Memory Allocation for Objects, Static Data Members, Static Member Functions, Arrays of Objects, Objects as Function Arguments, Friend Functions.

### UNIT III:CONSTRUCTORS, DESTRUCTORS, INHERITANCE[8 HOURS]

Introduction to Constructors, Default Constructors, Parameterized Constructors, Copy Constructors, Multiple Constructors in a Class, Destructors. Inheritance : Introduction to inheritance, Defining Derived Classes, Single Inheritance, Multiple Inheritance, Multi level Inheritance, Hierarchical Inheritance, Hybrid Inheritance.

### UNIT IV:POINTERS, VIRTUAL FUNCTIONS AND POLYMORPHISM[8 HOURS]

Introduction to Memory management, new operator and delete operator, Pointers to objects, Pointers to Derived Classes, Polymorphism, Compile time polymorphism, Run time polymorphism, Virtual Functions, Overloading- Function Overloading, Operator overloading.

### UNIT V:TEMPLATES AND EXCEPTION HANDLING[8 HOURS]

Introduction to Templates, Class Templates, Class Templates with Multiple Parameters, Function Templates, Function Templates with Multiple Parameters. Exception handling: Basics of Exception Handling, Types of exceptions, Exception Handing Mechanism, Throwing and Catching Mechanism, Rethrowing an Exception, Specifying Exceptions.

### Text Books:

1. E. Balagurusamy, “Object Oriented Programming with C++”, McGraw Hill Education, 7th Edition, 2023.
2. Herbert Schildt, “C++: The Complete Reference”, McGraw Hill, 4th Edition, 2003.

### References:

1. S. B. Lippman and J. Lajoie, “C++ Primer”, Pearson Education, 3rd Edition, 1998.
2. B. Stroustrup, “The C++ Programming Language”, Pearson Education, 3rd Edition, 1997.

| 6. INTRODUCTION TO SENSORS | | Semester | I/II |
|---|---|---|---|
| Course Code | 26BECT21X | CIA Marks | 50 |
| Teaching Hours/Week (L:T:P: S) | 3:0:0:0 | ETE Marks | 50 |
| Total Hours of Pedagogy | 40 Hours Theory + 50 Hours Team Work (TW)andSelf Learning(SL) | Total Marks | 100 |

| | | | |
|---|---|---|---|
| Credits | 3 | Exam Hours | 3 Hours |
| Scheme | 2026 | Academic Year | 2026-27 |
| Examination type | Theory | | |

**Course Objectives**

This course aims to:

1. Introduce the basic principles, classification, and characteristics of sensors.
2. Explain the working principles of commonly used electrical, magnetic, thermal, optical, and mechanical sensors.
3. Familiarize students with semiconductor, piezoelectric, and MEMS-based sensors.
4. Introduce basic sensor signal conditioning and interfacing techniques.
5. Familiarize students with smart sensors, IoT-based sensing, and applications of sensors in engineering systems.

**Course Outcomes (COs)**

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

**CO1:** Explain the basic principles, classification, and characteristics of sensors and transducers.

**CO2:** Describe the operating principles and applications of commonly used electrical, magnetic, thermal, optical, and mechanical sensors.

**CO3:** Explain the working principles and applications of semiconductor, piezoelectric, and MEMS-based sensors.

**CO4:** Explain basic signal conditioning and interfacing techniques used with sensors.

**CO5:** Identify suitable sensors for basic engineering applications and explain their use in smart and IoT-based systems.

**UNIT I – SENSOR FUNDAMENTALS AND CHARACTERISTICS [8 HOURS]**

Introduction to Sensors and Transducers; Sensing Principles; Classification of Sensors; Active and Passive Sensors; Analog and Digital Sensors; Contact and Non-contact Sensors; Sensor Materials; Static Characteristics: Range, Sensitivity, Resolution, Accuracy, Precision, Linearity, Hysteresis and Repeatability; Dynamic Characteristics; Response Time and Stability; Sources of Error.

**UNIT II – ELECTRICAL, MAGNETIC AND THERMAL SENSORS [8 HOURS]**

Resistive Sensors: Potentiometer, Strain Gauge, Thermistor and RTD; Capacitive Sensors: Principle and Applications; Inductive Sensors: LVDT; Magnetic Sensors: Hall Effect and Magnetoresistive Sensors; Thermal Sensors: Thermocouple, RTD and Thermistor; Applications in temperature, displacement, pressure and position measurement.

**UNIT III – OPTICAL, PIEZOELECTRIC AND SEMICONDUCTOR SENSORS [8 HOURS]**

Optical Sensors: LDR, Photodiode and Photovoltaic Sensors; Fiber Optic Sensors; Piezoelectric Sensors: Materials, Principle and Applications; Semiconductor Sensors; Diode and Transistor-based Temperature Sensors; Pressure Sensors; Introduction to Chemical and Biosensors.

**UNIT IV – MEMS SENSORS AND SENSOR SIGNAL CONDITIONING [8 HOURS]**

Introduction to MEMS; MEMS Materials and Fabrication Overview; MEMS Sensors; MEMS Accelerometer; MEMS Gyroscope; MEMS Pressure Sensors; Basic Sensor Signal Conditioning; Wheatstone Bridge; Amplification and Filtering; Offset and Compensation; Analog-to-Digital Conversion for Sensor Signals.

**UNIT V – SMART SENSORS AND APPLICATIONS [8 HOURS]**

Smart Sensors; Basic Architecture of Smart Sensors; Sensor Interfacing; Digital and Wireless Sensors; Sensors for IoT; Sensor Networks; Applications of Sensors in Automotive Systems, Healthcare, Home Automation, Manufacturing and Environmental Monitoring; Emerging Sensor Technologies.

**Textbooks:**

1. W. Bolton, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, 7th Edition, Pearson, 2021.
2. D. Patranabis, Sensors and Transducers, 2nd Edition, Prentice Hall India, 2003.

**Reference books:**

1. Ramón Pallás-Areny and John G. Webster, Sensors and Signal Conditioning, 2nd Edition, Wiley, 2012.
2. Jacob Fraden, Handbook of Modern Sensors: Physics, Designs, and Applications, 5th Edition, Springer, 2016.
3. John G. Webster and Halit Eren (Eds.), Measurement, Instrumentation, and Sensors Handbook, 2nd Edition, CRC Press, 2014.