ROBOTICS & AUTOMATION
B.TECH. I YEAR - COURSE STRUCTURE & SYLLABUS

SEMESTER-I						
Sl. No.	**Course Code**	**Course**	**L**	**T**	**P**	**Credits**
TWO- WEEK COMPULSORY INDUCTION PROGRAM						
1	26MA101BS	Mathematics–I (Calculus & Linear Algebra)	3	1	0	4
2	26CH102BS	Engineering Chemistry	3	0	0	3
3	26CS103ES	Programming for Problem Solving	3	0	0	3
4	26ME105ES	Computer Aided Engineering Graphics	1	0	4	3
5	26EE103ES	Basic Electrical Engineering	2	0	0	2
6	26CH107BS	Engineering Chemistry Lab	0	0	2	1
7	26CS107ES	Programming for Problem Solving Lab using C	0	0	2	1
8	26EE109ES	Basic Electrical Engineering Lab	0	0	2	1
9	26MS110HS	Design Thinking	0	1	2	2
10	26PE102AU	Sports and Yoga	3^	0	0	0
		Total	**15**	**2**	**12**	**20**

SEMESTER-II						
Sl. No.	**Course Code**	**Course**	**L**	**T**	**P**	**Credits**
1	26MA201BS	Mathematics–II (Ordinary Differential Equations and Vector Calculus)	3	1	0	4
2	26PH202BS	Applied Physics	3	0	0	3
3	26ME206PC	Engineering Mechanics	3	1	0	4
4	26EN204HS	Communication Skills	1	0	0	1
5	26EC205ES	Electronics Devices and Circuits	2	0	0	2
6	26PH206BS	Applied Physics Lab	0	0	2	1
7	26CS208ES	Python Programming Lab	0	1	2	2
8	26EN209HS	Communication Skills Lab	0	0	2	1
9	26ME108ES	Engineering Workshop / Makers Lab	1	0	2	2
		Total	**13**	**3**	**8**	**20**

^ represents related to Audit Course.

Mathematics − I (Calculus & Linear Algebra)

Sl. No.	Course Code	Course	L	T	P	Credits
1	26MA101BS	Mathematics − I (Calculus & Linear Algebra)	3	1	0	4

Prerequisites: Basic knowledge of Intermediate Mathematics.

Course Objectives: Enable the students to:

1. Apply techniques in matrix operations, including calculating rank and inverses, and solving systems of linear equations.
2. Utilize eigenvalues and eigenvectors to reduce quadratic forms to canonical form.
3. Apply a geometrical approach to mean value theorems and their application to mathematical problems.
4. Evaluate improper integrals by effectively applying Beta and Gamma function properties.
5. Evaluate multiple integrals and their applications.

Course Outcomes:

1. Solve systems of linear equations using matrix techniques and determine matrix properties such as rank and inverse.
2. Analyze eigenvalues, eigenvectors, and the Cayley–Hamilton theorem to reduce quadratic forms into canonical forms.
3. Apply mean value theorems, Taylor series expansions, Beta and Gamma functions to solve engineering problems involving areas and volumes.
4. Evaluate multivariable functions using partial derivatives, Jacobians, and Lagrange multipliers for optimization problems.
5. Compute double and triple integrals in different coordinate systems to determine areas and volumes in engineering applications.

COURSE CONTENTS:

UNIT-I: Matrices

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 Non−Homogeneous equations by Gauss elimination method and Rank Method and Homogeneous equations.

UNIT-II: Eigenvalues and Eigenvectors

Eigenvalues, Eigenvectors and their properties, Cayley−Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley−Hamilton Theorem, Diagonalization of a matrix, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT-III: Calculus

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series. Applications of definite integrals to evaluate surface areas and volumes of revolutions of

curves (Only in Cartesian coordinates), Definition of Improper Integral: Beta and Gamma functions and their applications.

UNIT-IV: Multivariable Calculus (Partial Differentiation and applications)

Definitions of Limit and continuity. Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration)

Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (Cartesian to Cylindrical polar coordinates) for triple integrals.

Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals).

TEXT BOOKS:

1. B. S. Grewal, Higher Engineering Mathematics, 42nd Ed., Khanna Publishers, New Delhi, 2012
2. R. K. Jain, S. R. K. Iyengar, Advanced Engineering Mathematics, 4th Ed., Narosa Publishing House, NewDelhi, 2014.
3. G. Strang, Linear Algebra and Its Applications, 5th ed. Boston, MA: Cengage Learning, 2016.

REFERENCE BOOKS:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th Ed., Wiley, 2012
2. B. V. Ramana, Engineering Mathematics, 4th Ed., Tata McGraw Hill, New Delhi, 2009
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint 2002.
4. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
5. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

Engineering Chemistry

Sl. No.	Course Code	Course	L	T	P	Credits
2	26CH102BS	Engineering Chemistry	3	0	0	3

COURSE OBJECTIVES: The course aims

1. To analyse water for its various parameters for sustainable living and interpret different problems involved in industrial utilization of water.
2. To acquire the knowledge on fundamental aspects of battery chemistry, significance of corrosion and it's control to protect the metallic structures.
3. To identify different types of polymers and their applications in various engineering fields.
4. To apply the concepts of fuels, energy sources, and fuel quality analysis to evaluate conventional and emerging energy technologies.
5. To analyse the properties and engineering applications of advanced functional materials and modern spectroscopic techniques in industrial and environmental fields.

COURSE OUTCOMES: At the end of the course, students will be able

1. To identify water as an engineering material and develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.
2. To relate the knowledge of operating principles of batteries, fuel cells and different corrosion control techniques for engineering applications.
3. To recognize the significance of polymeric compounds in various engineering applications and biodegradable polymers to reduce environmental pollution.
4. To analyse the importance of various energy resources in day to day life.
5. To analyse the characteristics and applications of composite materials, smart materials, and spectroscopic techniques for solving engineering, environmental, and biomedical problems.

COURSE CONTENTS

UNIT 1: Water and its treatment

Introduction - Hardness of water - Causes of hardness; Types of hardness - Temporary and Permanent - Expression and units of hardness - Numerical problems on hardness; Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and Break - point chlorination. Defluoridation - Removal of F^- ion by Nalgonda method.

Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods - Softening of water by ion - exchange processes. Desalination of water - Reverse osmosis.

UNIT 2: Battery Chemistry & Corrosion

Introduction - Classification of batteries - Primary, Secondary and Reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications

of Lithium- ion battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells - Differences between battery and a fuel cell, Construction and applications of Methanol Oxygen fuel cell.

Corrosion: Causes and effects of corrosion - theories of chemical and electrochemical corrosion - mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods - Cathodic protection - Sacrificial anode and impressed current methods.

UNIT 3: Polymeric materials

Definition – Classification of polymers with examples - Types of Polymerizations -
Addition (free radical addition) and Condensation Polymerization with examples – Nylon 6:6, Terylene

Plastics: Definition and characteristics - thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC and Bakelite, Teflon.

Rubbers: Natural rubber and its Vulcanization.

Elastomers: Characteristics - Preparation, Properties and Applications of Buna-S, Butyl and Thiokol rubber.

Conducting polymers: Characteristics and Classification with examples - Mechanism of Conduction in Trans - Polyacetylene and applications of conducting polymers.

Biodegradable polymers: Concept and advantages - Polylactic acid and its applications.

UNIT 4: Energy Sources

Introduction, Calorific value of fuel - HCV, LCV - Dulong's formula. Classification – Solid fuels: Coal - Analysis of coal - Proximate and Ultimate analysis and their significance. Liquid fuels Petroleum and its Refining, Cracking - Moving bed Catalytic Cracking. Knocking-Octane and Cetane rating, Synthetic Petrol: Fischer-Tropsch's process; Gaseous fuels: Composition and uses of Natural gas, LPG and CNG. Introduction and applications of Hythane and Green Hydrogen.

UNIT 5: Advanced Functional Materials

Composite materials: Introduction-Fiber reinforced plastics (FRPs) - Glass fiber reinforced plastics, Carbon fiber reinforced plastics and their applications.

Smart materials: Introduction, Classification with examples - Shape Memory Alloys - Nitinol, Piezoelectric materials - Quartz and their engineering applications.

Interpretative spectroscopic applications of UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision-security, Raman spectroscopy (application) - Tumour detection in medical applications.

TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, 2016.
3. A text book of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K.

Shashikala, Pearson Publications, 2021.

4. Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley Publications.
5. Engineering Analysis of Smart Material Systems by Donald J. Leo, Wiley, 2007.
6. Materials Science and Engineering; an Introduction by William D. Callister Jr.

REFERENCE BOOKS:

1. **Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015).**
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi (2011).
3. Engineering Chemistry, by S. S. Dara, S. Chand & Company Ltd, New Delhi.
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8thedition (2006).
5. Pavia, Lampman, Kriz and Vyvyan**,** Introduction to Spectroscopy, Cengage Learning.

Programming for Problem Solving

Sl. No.	Course Code	Course	L	T	P	Credits
3.	26CS103ES	Programming for Problem Solving	3	0	0	3

Course Objectives:

1. To introduce the fundamental concepts of computer systems and the process of writing and executing a program using algorithms and flowcharts.
2. To develop logical thinking through problem − solving using conditional statements, loops, and arrays, and to implement basic algorithms for searching and sorting.
3. To familiarize students with modular programming techniques using functions, including recursion and parameter passing methods.
4. To explain structured data handling using structures and pointers, including the basics of dynamic memory allocation and the concept of linked data structures.
5. To introduce file handling and preprocessor directives in C, enabling students to manage data input/output through files and use macros and conditional compilation.

Course Outcomes: The student will learn following through lectures:

1. Explain the basic components of a computer system and design algorithms and flowcharts for simple problems.
2. Develop C programs using operators, control structures, arrays, strings, searching and sorting techniques.
3. Apply pointers, structures and dynamic memory allocation in C programs.
4. Implement functions, parameter passing, and recursion to solve programming problems.
5. Create C programs using preprocessor directives and file handling operations for data processing.

COURSE CONTENTS:

UNIT I:

Introduction to Programming**;** Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart with examples.

From algorithms to programs: data types, variables and memory locations, source code, Syntax and Logical Errors in compilation, object and executable code.

UNIT II:

Operators, Expressions and precedence.

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching. Iteration and loops.

Arrays: Arrays (1−D, 2−D), Character arrays and Strings.

Basic Algorithms: Searching (Linear and Binary), Sorting Algorithms (Bubble, Insertion and Selection).

UNIT III:

Pointers: Idea of pointers, Definition and Implementation of pointers, Example programs using pointer. Structures: Defining structures and Array of Structures, Self−referential structures, notion of linked list (no implementation), Example programs using Structures.
Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types.

UNIT IV:
Functions: Built-in Library Functions, User defined functions, Parameter passing mechanisms - call by value, call by reference.

Recursion: Recursion as a different way of solving problems. Examples such as Factorial, Fibonacci series, Binary Search.

UNIT V:
Preprocessor Directives: Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef
Files: Text and Binary files, Create, Read and write operations on files, Appending data to files, Writing and reading structures using files, Random access files using fseek(), ftell() and rewind() functions

TEXT/REFERENCE BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw−Hill.
2. R.S. Salaria, Programming for Problem Solving, Khanna Publishing House.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw−Hill.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

Computer Aided Engineering Graphics

Sl. No.	Course Code	Course	L	T	P	Credits
4	26ME105ES	Computer Aided Engineering Graphics	1	0	4	3

Course Objectives:

1. To introduce the fundamental principles, conventions, standards, and practices of engineering graphics for effective technical communication.
2. To develop skills in constructing engineering curves, scales, and conic sections using conventional graphical techniques.
3. To develop proficiency in orthographic projection and sectional representation of points, lines, planes, and regular solids.
4. To familiarize students with surface development techniques for right regular solids and their engineering applications.
5. To develop competency in preparing, interpreting, and converting orthographic and isometric views using conventional methods and computer-aided drafting tools.

Course Outcomes:

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

1. Apply computer aided drafting tools to create 2D and 3D objects
2. sketch conics and different types of solids
3. Appreciate the need of Sectional views of solids and Development of surfaces of solids
4. Read and interpret engineering drawings
5. Conversion of orthographic projection into isometric view and vice versa manually and by using computer aided drafting

COURSE CONTENTS:

UNIT I: Introduction to Engineering Graphics: Principles of Engineering Graphics and their Significance, Scales – Plain & Diagonal, Conic Sections including the Rectangular Hyperbola – General method. Cycloid, Epicycloid and Hypocycloid, Introduction to Computer Aided drafting – Views, Commands and Conic sections.

UNIT II: Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane, Regular geometric figures. Computer Aided orthographic projections – points, lines and planes.

UNIT III : Projections of Regular Solids, Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone and their Auxiliary views, Computer aided projections of solids – sectional views.

UNIT IV: Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone, Development of surfaces using computer aided drafting.

UNIT V: Isometric Projections: Principles of Isometric Projection, Isometric Scale, Isometric Views, Conventions, Isometric Views of Lines, Plane Figures, Simple and Compound Solids, Isometric Projection of objects having non-isometric lines.
Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice−versa, Conventions. Conversion of orthographic projection into isometric view using Computer Aided Drafting.

TEXT BOOKS:

1. Engineering Drawing N.D. Bhatt, Charotar Publication.
2. Engineering Drawing and graphics Using AutoCAD Third Edition, T. Jeyapoovan, Vikas: S. Chand and company Ltd.

REFERENCE BOOKS:

1. Engineering Drawing, Basant Agrawal and C M Agrawal, Third Edition McGraw Hill
2. Engineering Graphics and Design, WILEY, Edition 2020
3. Engineering Drawing, M. B. Shah, B.C. Rane / Pearson.
4. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford
5. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

Basic Electrical Engineering

Sl. No.	Course Code	Course	L	T	P	Credits
5	26EE103ES	Basic Electrical Engineering	2	0	0	2

Course Objectives:

1. To understand and analyze basic DC circuits, network theorems, and first-order RL and RC circuits.
2. To explain single-phase and three-phase AC circuits, power, power factor, RLC circuits, and resonance.
3. To demonstrate the construction, operation, losses, regulation, and efficiency of transformers.
4. To demonstrate the working principles and performance of DC machines, induction motors, and synchronous generators.
5. To understand electrical installations, switchgear, cables, earthing, batteries, energy consumption, and power factor improvement.

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

1. Understand DC circuits using Kirchhoff's laws, network theorems, and RL and RC concepts.
2. Describe AC circuits using phasors, power concepts, power factor, and resonance.
3. Apply transformer concepts to evaluate losses, efficiency, regulation, and connections.
4. Demonstrate the working and performance of DC machines, induction motors, and synchronous generators.
5. Analyze electrical installation practices, including switchgear, cables, earthing, batteries, and power factor improvement.

UNIT-I:

D.C. Circuits: Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT-II:

A.C. Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III:

Transformers: Ideal and practical transformer, equivalent circuit, losses in transformers,

regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT-IV:

Electrical Machines: Construction and working principle of dc machine, performance characteristics of dc shunt machine. Generation of rotating magnetic field, Construction and working of a three-phase induction motor, Significance of torque-slip characteristics. Single- phase induction motor, Construction and working. Construction and working of synchronous generator.

UNIT-V:

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

TEXT BOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCE BOOKS:

1. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker, "Basic Electrical Engineering", S. Chand, 2nd Edition, 2019.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2nd Edition, McGraw Hill, 2021.
5. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
6. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
7. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Engineering Chemistry Laboratory

SL.NO	Course Code	Course	L	T	P	Credits
6	26CH106BS	**Engineering Chemistry Laboratory**	**0**	**0**	**2**	**1**

Course Objectives

The course aims

1. To understand the fundamental principles of volumetric, conductometric, potentiometric and pH-metric analysis used for the estimation of chemical quantities.
2. To develop practical skills in the preparation and characterization of polymers.
3. To determine important physicochemical properties of lubricants, such as acid value and viscosity, and understand their engineering significance.
4. To analyse the factors influencing corrosion and evaluate the effectiveness of corrosion inhibitors.
5. To understand and demonstrate the working principles of fuel cells, electric vehicle batteries, and solar cells through virtual laboratory experiments.

Course Outcomes:

After successful completion of the course, the student will be able

1. To apply volumetric, conductometric, potentiometric and pH-metric methods to estimate the concentration or quantity of chemical species in given samples.
2. To perform the preparation of Bakelite and Nylon-6 using appropriate experimental procedures and techniques.
3. To determine and analyse the acid value and viscosity of lubricating oils and relate the results to their suitability for engineering applications.
4. To analyse the rate of corrosion of mild steel under different conditions and evaluate the effectiveness of corrosion inhibitors.
5. To explain and demonstrate the operating principles of fuel cells, electric-vehicle batteries and solar cells using virtual laboratory platforms.

List of Experiments:

1. **Volumetric Analysis:** Estimation of Hardness of water by EDTA Complexometric method.
2. **Conductometry:** Estimation of the concentration of an acid by Conductometry.
3. **Potentiometry:** Estimation of the amount of Fe^{+2} by Potentiometry.
4. **pH Metry:** Determination of an acid concentration using pH meter.

5. **Preparations:**
    a. Preparation of Bakelite.

b. Preparation Nylon – 6.

6. **Lubricants:**
    a. Estimation of acid value of given lubricant oil.
    b. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.
7. **Corrosion:** Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.

8. **Virtual lab experiments**
    a. Construction of Fuel cell and its working.
    b. Smart materials for Biomedical applications.
    c. Batteries for electrical vehicles.
    d. Functioning of solar cell and its applications.

Reference books:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)
2. Vogel's text book of practical organic chemistry 5th edition
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).

Programming for Problem Solving Lab using C

Sl. No.	Course Code	Course	L	T	P	Credits
7	26CS107ES	Programming for Problem Solving Lab using C	0	0	2	1

Course Objectives:

The student will learn following through Lab:

1. To formulate the algorithms for simple problems.
2. To translate given algorithms to a working and correct program.
3. To be able to correct syntax errors as reported by the compilers.
4. To be able to identify and correct logical errors encountered at run time.
5. To be able to write iterative as well as recursive programs.
6. To be able to represent data in arrays, strings and structures and manipulate them through a program.
7. To be able to declare pointers of different types and use them in defining self− referential structures.
8. To be able to create, read and write to and from simple text files.

Course Outcomes:

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

1. Apply basic control structures, loops, and conditional statements to solve elementary computational and mathematical problems
2. Construct C programs using 1D, 2D arrays, and matrices to perform searching, basic sorting, and arithmetic matrix operations.
3. Develop programs to manipulate strings without standard library functions and solve text-processing tasks.
4. Implement modular programs using user-defined functions and recursive techniques for algorithmic problem-solving.
5. Build programs utilizing pointers, user-defined structures, nested structures, and file I/O operations for data management.

List of Experiments:

1. Write a c program for Calculate Area and Perimeter of a Rectangle
2. Write a C program to Calculate Area and Circumference of a Circle
3. Write a C program to convert Temperature Celsius to Fahrenheit
4. Write a C program to Compute Simple Interest and Compound Interest
5. Write a C program to Check Whether a Number is Even or odd
6. Write a program to print the smallest of three given numbers?
7. Write a C program to find the roots and determine the nature of the roots of a quadratic equation of the form: $ax^2+bx+c=0$
8. Write a C program Check whether a year is leap year or not
9. Write a C program to print multiplication table for a given number using for loop
10. Write a C program to print multiplication table for a given number using while.
11. Write a C program to compute the sum of n numbers
12. Write a C program to compute $1+x+x^2+x^3+\ldots+x^n$

13. Write a C program to find the sum of the digits of a positive integer.
14. Write a C program to find the reverse of a given number
15. Write a C program Read and print elements of a 1D array
16. Write a C program Find the sum of elements in a 1D array
17. Write a C program Find the maximum and minimum elements in an array
18. Write a C program Search an element in an array (Linear Search)
19. Write simple C program to Count even and odd numbers in an array
20. Write simple C program Reverse the elements of an array
21. Write a c program Sort the array in ascending or descending order
22. Write a c program sort the array using bubble sort
23. Write a c program sort the array using insertion sort
24. Write a c program sort the array using selection sort
25. Write a c program for matrix multiplication
    a. Write a C program to implement the operations of matrices – addition, subtraction
    b. Write a program to find whether a given matrix is symmetric, lower triangular, upper triangular, diagonal, scalar, or unit matrix.
26. Write a c program Find the length of a string (without using strlen())
27. Write a c program to Copy one string to another (without using strcpy())
28. Write a c program to check Strings are equal
29. Write a c program to Compare two strings (without using strcmp())
30. Write a C program to Concatenate two strings (without using strcat())
31. Write a C program to reverse the string
    a) Convert a string to uppercase
    b) Convert a string to lowercase
    c) Count the number of vowels and consonants in a string
    d) Check whether a string is a palindrome
    e) Count the number of words in a string
    f) Count the frequency of each character in a string
    g) Remove vowels from a string
    h) Remove white spaces from a string
    i) Replace a character in a string with another
    j) Find the occurrence of a substring in a string
    k) Sort characters in a string in alphabetical order
    l) Find duplicate characters in a string
    m) Swap two strings without using a third string
32. Write C program to calculate the sum of two numbers using a function
33. Write a C Program to find Factorial of a Number Using Function
34. Write a C program to check whether a number is prime using a user-defined function
35. Write a C program to generate the Fibonacci series using a function.
36. Write a C program to calculate GCD of two numbers
37. Write a C program to calculate LCM of two numbers
38. A function that takes a real number x and a positive integer n as arguments and returns

x^n.

39. Calculate the factorial of a non-negative integer for using recursive function
40. Using recursion write C programs for the following:
    a) Number of combinations of n things taken r at a time.
    b) Greatest Common Divisor of two integers.
    c) Least Common Multiple of two integers.
    d) Merge sort
    e) Ackerman function
41. Write a C Program to define and display structure (Student Example)
42. Write a C Program to implement Array of Structures (Employee Example)
43. Write a C Program to implement Structure with Function Parameter
44. Write a C Program to implement Nested Structures
45. Write a C program for Pointer Declaration and Access
46. Write a C program to Swap Two Numbers Using Pointers
47. Write a C program to assign pointer to array and access its elements
48. Write a C program to find String Length Using Pointers (Without `strlen()`)
49. Write a C Program to Copy Contents from One File to Another
50. Write a C Program to append data to an existing file

TEXT BOOKS:

1. Design Thinking: A Beginner's Guide – by Uijun Park
2. Creative Confidence – by Tom Kelley & David Kelley 3 The Art of Thinking Clearly – by Rolf Dobelli

REFERENCE BOOKS:

1. Thinking, Fast and Slow – by Daniel Kahneman
2. Emotional Intelligence – by Daniel Goleman
3. Design Thinking for Strategic Innovation_ What They Can't Teach You at Business or Design School

WEB LINKS:

1. IDEO Design Thinking Resources https://designthinking.ideo.com
2. Interaction Design Foundation https://www.interaction-design.org
3. Stanford.school https://dschool.stanford.edu
4. Coursera (Design Thinking & Creativity Courses) https://www.coursera.org

Basic Electrical Engineering Laboratory

Sl. No.	Course Code	Course	L	T	P	Credits
8	25EE109ES	Basic Electrical Engineering Laboratory	0	0	2	1

Course Objectives:

1. To understand and verify the fundamental laws, theorems, and principles of electrical circuits using DC and AC experiments.
2. To study and analyze the transient response and steady-state behavior of R, L, and C circuits under different excitation conditions.
3. To investigate the characteristics of series RLC circuits, including resonance, impedance, current, and power in AC circuits.
4. To determine and evaluate the performance parameters of single-phase and three- phase transformers using various testing methods.
5. To study and analyze the performance characteristics of DC shunt motors, three- phase induction motors, alternators, and balanced three-phase circuits.

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

1. Understand and verify KVL, KCL, Superposition, Thevenin's, and Norton's theorems for analyzing electrical circuits.
2. Describe the transient response of series RL and RC circuits and the steady-state performance of RL, RC, and RLC circuits.
3. Apply circuit analysis techniques to determine and interpret resonance, impedance, current, active power, and reactive power in single-phase and balanced three-phase AC circuits.
4. Demonstrate experimental testing of single-phase and three-phase transformers to evaluate voltage-current relationships, efficiency, and voltage regulation.
5. Analyze the performance characteristics of DC shunt motors, three-phase induction motors, and three-phase alternators through experimental testing.

List of experiments:

1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorem
3. Transient Response of Series RL and RC circuits for DC excitation
4. Resonance in series RLC circuit
5. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single−Phase Transformer

7. Performance Characteristics of a DC Shunt Motor
8. Torque−Speed Characteristics of a Three−phase Induction Motor.
9. Verification of Superposition theorem.
10. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star−Delta, Delta−Delta, Delta−star, Star−Star)
11. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
12. Measurement of Active and Reactive Power in a balanced Three−phase circuit
13. No−Load Characteristics of a Three−phase Alternator

TEXT BOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCE BOOKS:

1. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker, "Basic Electrical Engineering", S. Chand, 2nd Edition, 2019.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2nd Edition, McGraw Hill, 2021.
5. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
6. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
7. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

DESIGN THINKING

Sl. No.	Course Code	Course	L	T	P	Credits
9	26DT110HS	DESIGN THINKING	0	1	2	2

COURSE OBJECTIVES:

1. To introduce the foundational concepts of learning, memory, and emotional intelligence as essential tools for personal and professional development.
2. To cultivate empathy and emotional awareness as central to understanding user needs and enhancing team collaboration.
3. To provide a comprehensive understanding of the Design Thinking process and its application in solving real–world, user–centric problems.
4. To develop creative and critical thinking skills for innovative problem–solving through brainstorming, prototyping, and iterative testing.
5. To encourage appreciation of individual differences and promote inclusive thinking while aligning customer expectations with product design.

COURSE OUTCOMES:

Student will able to

1. Compare and classify the various learning styles and memory techniques and Apply them in their engineering education
2. Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products
3. Develop new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products
4. Propose real-time innovative engineering product designs and Choose appropriate frameworks, strategies, techniques during prototype development.
5. Perceive individual differences and its impact on everyday decisions and further Create a better customer experience

COURSE CONTENTS:

UNIT 1: Learning And Memory for Innovation

An Insight to Learning: Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting

Remembering Memory: Understanding the Memory process, Problems in retention, Memory enhancement techniques

Activity: Learning Style Assessment and Memory Enhancement Exercise

Case Study:3M Post-it Notes

Source: https://www.3m.com

UNIT 2: Emotional Intelligence and Empathy

Emotions: Experience & Expression: Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers

Basics of Design Thinking: Definition of Design Thinking, Need for Design Thinking,

Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples)
– Empathize, Define, Ideate, Prototype, Testing
Activity: Empathy Mapping Exercise
Case Study: Airbnb
Source:https://www.thepresentpixel.com/how-airbnb-used-design-thinking-to-create-a-powerful-brand/

UNIT 3: Creative Thinking and Product Design
Being Ingenious & Fixing Problem: Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving
Process of Product Design: Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions
Activity: Brainstorming and Idea Generation Exercise
Case Study: How Apple Successfully Leveraged Design Thinking in Product Innovation.
Source: https://www.mygreatlearning.com/blog/design-thinking-is-apples-success-mantra/

UNIT 4: Prototyping and Testing
Prototyping & Testing: What is Prototype? Why Prototype? Rapid Prototype Development process. Testing: Examples, Test Group Marketing Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences
Activity: Paper Prototype Development and User Feedback Session
Case Study: IBM Design Thinking
Source: https://www.ibm.com/design/thinking

UNIT 5: Customer Experience and User-Centric Design
Design Thinking & Customer Centricity: Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Design, Feedback loop, Re-Design
Focus on User Experience, Address ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation – Solving Practical Engineering Problem through Innovative Product Design & Creative Solution
Activity: Customer Journey Mapping
Case Study: PepsiCo Design Innovation
Source: https://hbr.org/2015/09/how-indra-nooyi-turned-design-thinking-into-strategy

TEXT BOOKS:

1. Design Thinking: A Beginner's Guide – by Uijun Park
2. Creative Confidence – by Tom Kelley & David Kelley 3 The Art of Thinking Clearly – by Rolf Dobelli

REFERENCE BOOKS:

1. Thinking, Fast and Slow – by Daniel Kahneman
2. Emotional Intelligence – by Daniel Goleman
3. Design Thinking for Strategic Innovation_ What They Can_t Teach You at Business or Design School

WEB LINKS:

1. IDEO Design Thinking Resources
   https://designthinking.ideo.com
2. Interaction Design Foundation
   https://www.interaction-design.org
3. Stanford d.school
   https://dschool.stanford.edu
4. Coursera (Design Thinking & Creativity Courses)
   https://www.coursera.org

Sports and Yoga

Sl. No.	Course Code	Course	L	T	P	Credits
10	26PE102AU	Sports and Yoga	3^	0	0	0

Course Objectives:

Th is course aims to:

1. Understand the fundamentals, objectives, and significance of physical education, sports, fitness, wellness, and yoga in daily life.
2. Gain knowledge of the Olympic movement, sports awards, anatomy, physiology, kinesiology, and biomechanics related to physical activity.
3. Develop awareness of correct posture, postural deformities, yoga practices, and healthy lifestyle habits for disease prevention and overall well-being.
4. Understand the principles of sports training, planning, sports psychology, stress management, motivation, and doping awareness.
5. Acquire basic knowledge of sports injuries, first aid, and the rules, techniques, and equipment of a selected sport/game.

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

1. Explain the concepts, objectives, and importance of physical education, fitness, wellness, and the Olympic movement.
2. Describe the structure and functioning of major body systems and apply basic principles of kinesiology and biomechanics in sports activities.
3. Identify common postural deformities and demonstrate suitable yoga practices and lifestyle measures for health promotion.
4. Apply fundamental principles of sports training, tournament planning, psychological preparation, and anti-doping awareness in sports.
5. Demonstrate basic knowledge of first aid, sports injury management, and the rules and skills of a chosen sport/game for active participation and lifelong fitness.

COURSE CONTENTS:

Introduction to Physical Education

- Meaning & definition of Physical Education
- Aims & Objectives of Physical Education
- Changing trends in Physical Education

Olympic Movement

- Ancient & Modern Olympics (Summer & Winter)
- Olympic Symbols, Ideals, Objectives & Values
- Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)

Physical Fitness, Wellness & Lifestyle

- Meaning & Importance of Physical Fitness & Wellness
- Components of Physical fitness
- Components of Health related fitness
- Components of wellness
- Preventing Health Threats through Lifestyle Change
- Concept of Positive Lifestyle

Fundamentals of Anatomy & Physiology in Physical Education, Sports and Yoga

- Define Anatomy, Physiology & Its Importance
- Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respiratory System, Neuro−Muscular System etc.)

Kinesiology, Biomechanics & Sports

- Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports
- Newton's Law of Motion & its application in sports.
- Friction and its effects in Sports.

Postures

- Meaning and Concept of Postures.
- Causes of Bad Posture.
- Advantages & disadvantages of weight training.
- Concept & advantages of Correct Posture.
- Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis.
- Corrective Measures for Postural Deformities

Yoga

- Meaning & Importance of Yoga
- Elements of Yoga
- Introduction − Asanas, Pranayama, Meditation & Yogic Kriyas
- Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Shashankasana)
- Relaxation Techniques for improving concentration − Yog−nidra

Yoga & Lifestyle

- Asanas as preventive measures.
- Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana.
- Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana.

- Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.
- Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana.
- Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.

Training and Planning in Sports

- Meaning of Training
- Warming up and limbering down
- Skill, Technique & Style
- Meaning and Objectives of Planning.
- Tournament – Knock−Out, League/Round Robin & Combination.

Psychology & Sports

- Definition & Importance of Psychology in Physical Edu. & Sports
- Define & Differentiate Between Growth & Development
- Adolescent Problems & Their Management
- Emotion: Concept, Type & Controlling of emotions
- Meaning, Concept & Types of Aggressions in Sports.
- Psychological benefits of exercise.
- Anxiety & Fear and its effects on Sports Performance.
- Motivation, its type & techniques.
- Understanding Stress & Coping Strategies.

Doping

- Meaning and Concept of Doping
- Prohibited Substances & Methods
- Side Effects of Prohibited Substances Sports Medicine
- First Aid – Definition, Aims & Objectives.
- Sports injuries: Classification, Causes & Prevention.
- Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries

Sports / Games

Following subtopics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc.

- History of the Game/Sport.
- Latest General Rules of the Game/Sport.
- Specifications of Play Fields and Related Sports Equipment.
- Important Tournaments and Venues.
- Sports Personalities.
- Proper Sports Gear and its Importance.

Text Books/References:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light On Yoga by B.K.S. Iyengar.

Mathematics–II (Ordinary Differential Equations and Vector Calculus)

Sl. No.	Course Code	Course	L	T	P	Credits
1	26MA201BS	Mathematics–II (Ordinary Differential Equations and Vector Calculus)	3	1	0	4

Pre-requisites: Mathematical Knowledge at pre–university level

Course Objectives: Enable the students to:

1. Methods of solving the differential equations of first and higher order.
2. Solving ordinary differential equations using Laplace transforms techniques.
3. Concept, properties of Laplace transforms
4. The physical quantities involved in engineering field related to vector valued functions
5. The basic properties of vector valued functions and their applications to line, surface and volume integrals

Course Outcomes: After undergoing this course, the students are able to

1. Solve first-order differential equations using appropriate analytical techniques.
2. Apply higher-order differential equations to model and solve engineering problems.
3. Use Laplace transform techniques to solve ordinary differential equations and initial value problems.
4. Analyze vector-valued functions using gradient, divergence, curl, and directional derivatives.
5. Evaluate line, surface, and volume integrals using Green's, Gauss's, and Stokes' theorems.

COURSE CONTENTS:

UNIT-I: First Order Ordinary Differential Equations

Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

UNIT-II: Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non–Homogeneous terms of the type e^{ax}, sin (ax+b), cos(ax+b), polynomial x^n, e^{ax} V, and xV, method of variation of parameters, Applications: Electric Circuits.

UNIT-III: Laplace transforms

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without

proof). Applications: Solving Initial value problems by Laplace Transform method.

UNIT-IV: Vector Differentiation

Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Tangent plane and normal line, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration

Line, Surface and Volume Integrals, Theorems of Green, Gauss and Stokes (without proofs) and their applications.

TEXT BOOKS:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley& Sons, 2006.
2. G. B. Thomas and R. L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
3. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.
4. N.P.Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

APPLIED PHYSICS

Sl. No.	Course Code	Course	L	T	P	Credits
2	26PH202BS	Applied Physics	3	0	0	3

Course Objectives:

1. To develop a fundamental understanding of quantum mechanics and band theory to explain the behavior of electrons in solids.
2. To understand the principles of semiconductor materials and electronic devices used in modern electronic and optoelectronic applications.
3. To explain the properties, classifications and engineering applications of dielectric and magnetic materials.
4. To introduce the concepts, fabrication methods, characterization techniques and applications of nanomaterials.
5. To understand the principles of lasers and optical fibers and their significance in communication, sensing, and industrial applications.

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

1. Explain the fundamental concepts of quantum mechanics and band theory to analyze the behavior of electrons in solids and classify engineering materials based on their electrical properties.
2. Analyze the operating principles and characteristics of semiconductor materials and electronic devices for engineering applications.
3. Differentiate dielectric and magnetic materials based on their properties and evaluate their suitability for sensing, energy, and electronic applications.
4. Explain nanotechnology concepts, fabrication techniques, characterization methods and evaluate the applications of nanomaterials in science and engineering.
5. Illustrate the principles of laser operation and optical fiber communication systems and analyze their applications.

COURSE CONTENTS:

UNIT 1: QUANTUM PHYSICS AND BAND THEORY OF SOLIDS

Quantum Mechanics: Introduction to quantum physics, blackbody radiation spectrum − photoelectric effect − Davisson and Germer experiment –Heisenberg uncertainty principle − Born interpretation of the wave function – time-independent Schrodinger wave equation − particle in one-dimensional potential box.

Band Theory of Solids:

Introduction to free electron theory, Classical free electron theory, quantum free electron theory(qualitative) , Bloch's theorem −Kronig−Penney model (qualitative) – E−K diagram− effective mass of electron, origin of energy bands− classification of solids.

UNIT 2: SEMICONDUCTORS AND DEVICES

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 bipolar junction transistor (BJT)–LED, and solar cells, their structure, materials, working principle, and characteristics.

UNIT 3: DIELECTRIC AND MAGNETIC MATERIALS

Dielectric Materials: Basic definitions− types of polarizations (qualitative) − ferroelectric, piezoelectric, and pyroelectric materials – applications.

Magnetic Materials: Introduction, Classification of magnetic materials- Hysteresis−soft and hard magnetic materials − magnetostriction, magnetoresistance − applications − magnetic field sensors, and multiferroics.

UNIT 4: NANOTECHNOLOGY

Nanoscale, quantum confinement, surface to volume ratio, bottom−up fabrication: sol − gel, chemical vapor deposition(CVD) – top − down fabrication: ballmilling, Laser Abalation − characterization techniques: XRD, SEM & TEM−applications of nanomaterials.

UNIT 5: LASER AND FIBER OPTICS

Lasers: Laser beam characteristics, three quantum processes−Einstein coefficients and their relations− lasing
action − pumping methods− ruby laser, He−Ne laser, and semiconductor laser−applications of laser.

Fiber Optics: Introduction to optical fiber− advantages of optical Fibers − total internal reflection – Construction of optical fiber- accepting angle- numerical aperture-Classification of optical fibers- losses in optical fiber- − optical fiber for communication system − applications.

TEXT BOOKS:

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy" A Textbook of Engineering Physics"− S. Chand Publications, 11th Edition 2019.
2. Engineering Physics by Shatendra Sharma and Jyotsna Sharma, Pearson Publication,2019
3. Semiconductor Physics and Devices− Basic Principles – Donald A Neamen, McGraw-Hill, 4th Edition, 2021.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2nd Edition, 2022.
5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1st Edition, 2021.

REFERENCE BOOKS:

1. Quantum Physics, H.C. Verma, TBS Publication, 2nd Edition, 2012.
2. Fundamentals of Physics – Halliday, Resnick, and Walker, John Wiley &Sons,11th Edition, 2018.
3. Introduction to Solid State Physics, Charles Kittel, Wiley Eastern, 2019.
4. Elementary Solid State Physics, S.L. Gupta and V. Kumar, Pragathi Prakashan, 2019.

5. A.K. Bhandhopadhya − Nano Materials, New Age International, 1st Edition, 2007.
6. Energy Materials: A Short Introduction to Functional Materials for Energy Conversion and Storage Aliaksandr S. Bandarenka, CRC Press Taylor & Francis Group.
7. Energy Materials, Taylor & Francis Group, 1st Edition, 2022.

Engineering Mechanics

Sl. No.	Course Code	Course	L	T	P	Credits
3	26ME206PC	Engineering Mechanics	3	0	0	3

Course Objectives:

1. To understand the resolution of a system of forces, compute their resultant and solve problems using equations of equilibrium.
2. Perform analysis of bodies lying on rough surfaces. To understand the concept of analysis of trusses using method of joints and method of sections.
3. Locate the centroid of a simple figure and composite figures.
4. Locate the centroid of a body and compute the area moment of inertia and mass moment of inertia of standard and composite sections.
5. To understand kinetics and kinematics of particles motion of rigid bodies.

Course Outcomes:

1. Gain the knowledge on the concepts of force and moment also apply the knowledge on drawing free body diagrams in problem solving.
2. Students able to do analysis of trusses using method of joints and method of sections.
3. Students are capable of finding centroid and Centre of gravity of simple and composite Figures.
4. Students are capable of finding centroid and moment of inertia, mass moment of Inertia of simple and composite figures.
5. Students able to understand the motion of a particle in a straight line and apply concepts of D'Alemberts principle in particle motion.

UNIT I

Resultants of Force System: Introduction, Parallelogram law –Forces and components-Resultant of coplanar Concurrent Forces Moment of Force-problems.

Equilibrium of Force Systems: Free Body Diagrams, Equations of Equilibrium - Equilibrium of planar Systems

UNIT II

Friction: Introduction – Theory of Friction – Angle of friction - Laws of Friction – Static and Dynamic Frictions

Centroids and Centers of Gravity: Introduction – Centroids and Centre of gravity of simple figures (from basic principles) – Centroids of Composite Figures - Theorem of Pappus – Center of gravity of bodies and centroids of volumes.

UNIT III

Moments of Inertia: Definition – Polar Moment of Inertia –Radius of gyration - Transfer formula for moment of inertia - Moments of Inertia for Composite areas.

Mass Moment of Inertia: Moment of Inertia of Masses - Transfer Formula for Mass Moments of Inertia – Mass moment of inertia of composite bodies.

UNIT IV

Kinematics of a Particle: Motion of a particle- Rectangular motion-motion curves-Rectangular components of curvilinear motion.

Kinetics of Particles: D'Alemberts Principle for plane motion and connected bodies.

UNIT V

Work-Energy Principle: Equation of translation, principle of conservation of energy, work-energy principle applied to particle motion and connected systems, fixed axis rotation.

Impulse– Momentum Principle: Introduction, linear impulse momentum, principle of conservation of linear momentum, elastic impact and types of impact, loss of kinetic energy.

TEXT BOOKS:

1. Engineering Mechanics/ S. Timoshenko and D.H. Young, Mc Graw Hill Book Company.
2. Engineering Mechanics - Statics and Dynamics by Vijaya Kumar Reddy K, Suresh Kumar J.BS Publications
3. Engineering Mechanics / S.S. Bhavikati & K.G. Rajasekharappa

REFERENCES:

1. A text of Engineering Mechanics / YVD Rao / K. Govinda Rajulu/ M. Manzoor Hussain, Academic Publishing Company
2. Engg. Mechanics / M.V. Seshagiri Rao & D Rama Durgaiah/ Universities Press
3. Engineering Mechanics, Umesh Regl / Tayal.
4. Engineering Mechanics / KL Kumar / Tata McGraw Hill.
5. Engineering Mechanics / Irving Shames / Prentice Hall

Communication Skills

Sl. No.	Course Code	Course	L	T	P	Credits
4	26EN204HS	Communication Skills	1	0	0	1

Course Objective:

1. To develop students' proficiency in technical and professional communication, with a focus on clarity, conciseness and accuracy.
2. To equip students with essential written communication skills, including technical reports, emails, proposals, and formal documentation.
3. To enhance verbal communication skills, including presentations, group discussions, and interviews.
4. To improve students' confidence and fluency in English, supporting both academic success and professional effectiveness.
5. To prepare students for real−world communication scenarios, including job interviews, workplace interactions and public speaking.

Course outcomes: After completion of course, students would be able to:

1. Develop proficiency in technical and professional communication.
2. Understand various technical writing skills.
3. Apply the technical writing and communication skills in their academic and professional life.
4. Gain self−confidence with improved command over English.
5. Understand the technical aspects of communication for better performance in extra− curricular activities, recruitment process and prospective jobs.

COURSE CONTENTS:

UNIT I:

Fundamentals of Communication Skills: Scope and Significance of Communication Skills, Listening, Speaking, Reading and Writing, Technical Communication, Tools of Effective Communication.

UNIT II :

Writing Skills: Basics of Grammar, Placing of Subject and Verb, Parts of Speech, Tenses – Types and uses, Active to Passive and vice-versa, Narration – Direct and Indirect Speech.

UNIT III :

Vocabulary Building and Writing: Word Formation, Synonyms and Antonims, Words Often Confused, One Word Substitutes, Idioms and Phrasal Verbs, Abbreviations of Scientific and Technical Words.

UNIT IV:

Speaking Skills: Introduction to Phonetic Sounds & Articulation, Word Accent, Rhythm and

Intonation, Interpersonal Communication, Oral Presentation, Body Language and Voice Modulation (Para linguistics and Non-Verbal), Negotiation and Persuasion, Group Discussion, Interview Techniques (Telephonic and Video Conferencing).

UNIT V:

Technical Writing: Job Application, CV Writing, Business Letters, Memos, Report Writing & Structure,

E−mail Etiquette, Blog Writing, Fundamentals of AI Tools.

Text Books:

1. Kumar, Sanjay, and Pushp Lata. Communication Skills. 3rd ed., Oxford University Press, 2018.
2. Rizvi, M. Ashraf. Effective Technical Communication. 2nd ed., McGraw Hill Education, 2017.
3. Raman, Meenakshi, and Sangeeta Sharma. Technical Communication: Principles and Practice. 3rd ed., Oxford University Press, 2015.

Online Sources

1. https://ocw.mit.edu/
2. https://learnenglish.britishcouncil.org/

Electronic Devices and Circuits

Sl. No.	Course Code	Course	L	T	P	Credits
5	26EC205ES	Electronic Devices and Circuits	2	0	0	2

Course Objectives:

1. To introduce the diode as a basic electronic component.
2. To know the applications of Diode.
3. To understand the characteristics of the BJT.
4. To understand the characteristics of the JFET and MOSFET.
5. To understand the characteristics of the Special Purpose Devices.

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

1. Understand the PN Junction diode operation and its characteristics.
2. Know the applications of Diode such as clippers and clampers.
3. Analyze the characteristics of the BJT.
4. Analyze the characteristics of the JFET and MOSFET
5. Acquire the knowledge about the special purpose devices and their applications.

COURSE CONTENTS:

UNIT I:

Diodes: Introduction to Semiconductors, Diode, V−I Characteristics, Equivalent circuit, Diffusion and Transition Capacitances, Diode as a switch− switching times.

UNIT II :

Diode Applications: Rectifier, Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive and Inductive Filters, Clippers, clipping at two independent levels, Clampers, Clamping Operation, Types of Clampers.

UNIT III:

Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch, switching times.

UNIT IV:

Junction Field Effect Transistor (FET): Construction, Principle of Operation, Pinch− Off Voltage, Volt− Ampere Characteristic, Comparison of BJT and FET, FET as Voltage Variable Resistor, MOSFET, MOSTET as a capacitor.

UNIT V:

Special Purpose Devices: Zener Diode, Characteristics, Zener diode as Voltage Regulator, Principle of Operation − SCR, Tunnel diode, UJT, Varactor Diode, Photo diode, Solar cell, LED, Schottky diode.

TEXT BOOKS:

1. Jacob Millman − Electronic Devices and Circuits, McGraw Hill Education
2. Robert L. Boylestead, Louis Nashelsky− Electronic Devices and Circuits theory, 11th Edition, 2009, Pearson**.**

REFERENCE BOOKS:

1. Horowitz −Electronic Devices and Circuits, David A. Bell – 5th Edition, Oxford.
2. Chinmoy Saha, Arindam Halder, Debaati Ganguly − Basic Electronics− Principles and Applications, Cambridge, 2018.

APPLIED PHYSICS LAB

Sl. No.	Course Code	Course	L	T	P	Credits
6	26PH206BS	Applied Physics	0	0	2	1

Course Objectives:

1. Understand basic physics laboratory experiments.
2. Use laboratory instruments safely and accurately.
3. Study semiconductor, optical, and electrical devices.
4. Analyze experimental data and graphs.
5. Develop practical and technical skills.

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

1. Determine physical constants and optical parameters experimentally.
2. Measure characteristics of semiconductor devices.
3. Determine semiconductor properties using standard methods.
4. Analyze LCR circuits and magnetic materials.
5. Record, analyze, and report experimental results accurately.

List of Experiments:

1. Determination of work function and Planck's constant using the photoelectric effect
2. Determination of V−I characteristics of a P−N junction diode and a Zener diode
3. Determination of V−I and L−I characteristics of light-emitting diode (LED).
4. Determination of V−I and P – I characteristics of a solar cell.
5. Determination of the Energy gap of a semiconductor.
6. Determination of the Hall coefficient and carrier concentration of a given semiconductor.
7. Determination of the resistivity of a semiconductor by two probe method.
8. Determination of the dielectric constant of a given material
9. Determination of characteristics of series and parallel LCR circuits.
10. Determination of input and output characteristics of BJT (NPN, CE configuration).
11. Determination of the beam divergence of the given LASER beam
12. Determination of Acceptance Angle and Numerical Aperture of an optical fiber.
13. To study the B−H curve of a magnetic material.
14. Understanding the method of least squares – torsional pendulum as an example

Python Programming Laboratory

Sl. No.	Course Code	Course	L	T	P	Credits
7	26CS208ES	Python Programming Laboratory	0	0	2	1

Course Objectives:

1. To install and run the Python interpreter
2. To learn control structures.
3. To Understand Lists, Dictionaries in python
4. To Handle Strings and Files in Python

Course Outcomes: After completion of the course, the student should be able to

1. Apply fundamental Python syntax, control structures, and loops to solve computational and mathematical problems.
2. Construct programs to manipulate dynamic data structures, including strings, lists, tuples, dictionaries, and matrices.
3. Develop modular Python programs using custom functions, recursion, standard modules, and exception-handling mechanisms.
4. Build file-processing applications to read, search, modify, and merge textual data from external files.
5. Utilize third-party Python libraries (such as NumPy and SciPy) for basic data manipulation and matrix computations.

LIST OF EXPERIMENTS:

1. Read name, address, email and phone number of a person through keyboard and print the details.
2. Start a Python interpreter and use it as a Calculator.
3. Write a Python Program to Find ASCII value of a character.
4. Write a program to calculate compound interest principal, rate and number of periods are given.
5. Given coordinates (x1, y1), (x2, y2) find the distance between two points.
6. Write a Python program to find the area of a triangle.
7. Write a Python program to swap two variables without temp variable.
8. Write a Python program to convert Celsius to Fahrenheit.
9. Write a Python program to display calendar.
10. Write a Python program to solve quadratic equation.
11. Write a Python Program to Check if a Number is Odd or Even.
12. Write a Python Program to Check Leap Year.
13. Write a Python Program to Check Prime Number.
14. Write a Python Program to Print all Prime Numbers in an Interval.
15. Print the below triangle using for loop. 5

    4 4

    3 3 3

    2 2 2 2

1 1 1 1 1

16. Write a program to check whether the given input is digit or lowercase character or uppercase character or a special character (use 'if-else-if' ladder)
17. Write a Python Program to Make a Simple Calculator with 4 basic mathematical operations.
18. Python program to print all prime numbers in a given interval (use break)
19. Write a Python Program to Find the Factorial of a Number.
20. Write a Python Program to Display the multiplication Table.
21. Write a Python Program to Print the Fibonacci sequence.
22. Write a program to convert a list and tuple into arrays.
23. Write a program to find common values between two arrays.
24. Write a function called gcd that takes parameters a and b and returns their greatest common divisor.
25. Write a Python Program to Find LCM.
26. Write a function called palindrome that takes a string argument and returns True if it is a palindrome and False otherwise. Remember that you can use the built-in function len to check the length of a string.
27. Write a Python program for removing ith character from a string.
28. Write a Python program to split and join a string.
29. Write a Python program to find and display uncommon words from two Strings.
30. Write a Python program to find and display all duplicate characters in string.
31. Write a function called has duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.
32. Write a function called remove_duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.
33. Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.
34. Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e' .
35. Remove the given word in all the places in a string?
36. Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?
37. Write a Python Program to Display Fibonacci Sequence Using Recursion.
38. Write a Python Program to Find Factorial of Number Using Recursion.
39. Write a Python Program to find sum of elements of an array.
40. Write a Python Program to find largest element in an array.
41. Write a Python Program for array rotation.
42. Write a python program that defines a matrix and prints.
43. Write a python program to perform addition of two square matrices.
44. Write a python program to perform multiplication of two square matrices.
45. Write a Python Program to Transpose a Matrix.
46. Write a program which takes 2 digits, X,Y as input and generates a 2-dimensional array. The element value in the i-th row and j-th column of the array should be i*j.
47. Write a Python Program to Sort Words in Alphabetic Order.

48. Write a Python program to find sum of elements in the list.
49. Write a Python program to Multiply all numbers in the list.
50. Write a Python program to find smallest and largest number in a list.
51. Write a Python program to print even and odd numbers in a list.
52. Write a Python program to Remove empty List from List.
53. Write a Python program to Count occurrences of an element in a list.
54. Write a Python program to find words which are greater than given length k.
55. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
56. Use the structure of exception handling all general purpose exceptions.
57. Write a Python program to Extract Unique dictionary values.
58. Write a Python program to find the sum of all items in a dictionary
59. Write a Python program to Merging two Dictionaries.
60. Write a Python program to convert key-values list to flat dictionary.
61. Write a Python program to insertion at the beginning in OrderedDict.
62. Write a Python program to check order of character in string using OrderedDict().
63. Write a Python program to sort Python Dictionaries by Key or Value.
64. Write a python code to read a phone number and email-id from the user and validate it for correctness.
65. Write a Python code to merge two given file contents into a third file.
66. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.
67. Write a Python code to Read text from a text file, find the word with most number of occurrences.
68. Write a function that reads a file *file1* and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.
69. Install NumPy package with pip and explore it.
70. Import numpy, Plotpy and Scipy and explore their functionalities.

Communication Skills Laboratory

Sl. No.	Course Code	Course	L	T	P	Credits
8	26EN209HS	Communication Skills Laboratory	0	0	2	1

Course Objectives:

1. To sensitize students to the nuances of English speech sounds, rhythm, and intonation, enabling them to speak with a clear and intelligible accent.
2. To train students through multi-media and audio-visual exercises so they can accurately comprehend spoken English in both formal and informal contexts.
3. To involve students in active speaking sessions (such as extempore, JAM, and role-plays) to build fluency and overcome public speaking anxiety.
4. To provide practice in essential corporate activities like group discussions, mock interviews, and resume writing to increase recruitment success.
5. To build effective team-building, active listening, and soft-skill abilities that are required to collaborate and interact smoothly in a professional environment.

Course Outcomes: After completion of course, students would be able to

1. Express ideas, thoughts, and technical information verbally with clarity, correct pronunciation, and reduce Mother Tongue Influence (MTI).
2. Comprehend spoken material and lectures, allowing them to extract specific information and respond appropriately in group or professional discussions.
3. Formulate grammatically correct sentences, draft professional emails, reports, and resumes with accuracy and proper vocabulary.
4. Successfully participate in corporate-style group discussions and deliver structured presentations using appropriate body language and non-verbal cues.
5. Navigate real-world situations, collaborate effectively in teams, and handle professional networking and client interactions gracefully.

List of Experiments

1. Introducing Oneself
2. Exercise on Parts of Speech
3. Exercise on Tense
4. Exercise on Agreement
5. Active-Passive Voice
6. Exercise on Narration
7. Dialogue Conversation.
8. Exercise on Writing Skills and Listening Comprehension (Audio CD).
9. Practice of Phonemes – Consonants and Vowel Sounds
10. Word Accent and Intonation
11. JAM Session
12. Individual Presentation, Extempore and Picture Interpretation.
13. Vocabulary Building Exercises: One Word Substitute, Synonyms, Antonyms, Words Often Confused etc.

14. Group Discussion
15. Writing Skills: Email and Paragraph Writing

Text Books

1. Balasubramanian, T. A Textbook of English Phonetics for Indian Students. 3rd ed., Macmillan Publishers India, 2013.
2. Murphy, Raymond. English Grammar in Use. 5th ed., Cambridge University Press, 2019.
3. Redman, Stuart. English Vocabulary in Use: Pre-Intermediate and Intermediate. 4th ed., Cambridge University Press, 2017.

Online Sources

1. https://learnenglish.britishcouncil.org/
2. https://owl.purdue.edu/index.html

Engineering Workshop/ Makers Lab

Sl. No.	Course Code	Course	L	T	P	Credits
9	26ME208ES	Makers Lab	1	0	2	2

Course Objectives:

1. To familiarize students with engineering tools, equipment, materials, and safety practices.
2. To develop hands-on skills in basic manufacturing and fabrication processes.
3. To provide practical exposure to assembly, disassembly, installation, and operation of engineering systems.
4. To introduce students to AI and emerging technologies including 3D printing, IoT, AR/VR, and robotics.
5. To develop creativity, problem-solving, teamwork, and practical engineering skills.

Course Outcomes:

1. Identify and safely use engineering tools, equipment, materials, and measuring instruments.
2. Perform basic fitting, carpentry, welding, tin smithy, foundry, black smithy, and house-wiring operations.
3. Demonstrate assembly, disassembly, installation, and operation of basic engineering systems.
4. Develop and demonstrate simple applications using AI, 3D printing, IoT, AR/VR, and robotics.
5. Apply engineering principles, safety practices, creativity, and teamwork to solve practical engineering problems.

List Of Experiments:

1. **ITWS:** a) Task 1-Introduction to peripherals of Computers, Assemble and Disassemble a PC.
   b) Task 2- Installation of Operating System Like Linux or MS Windows.
2. **AI Tools:** a) Introduction to AI- Tools.
   b) Creating AI content and images with Chatgpt, Claude & Google Gemini AI.
3. **Fitting:** Prepare a) Square fitting job according to given dimensions.
   b) V-fitting job according to given dimensions.
4. **Carpentry:** Prepare a) A wooden lap joint using carpentry tools.
   b) A wooden Cross-lap joint using carpentry tools.
5. **Welding:** a) Prepare a Lap joint using welding operation.
   b) Prepare a butt joint using welding operation.
6. **House Wiring:** a) Two Lights controlled by One Switch in Series

b) One Lights controlled by Two-Way Switch.

7. **Tin Smithy:** a) Prepare an Open Scoop using Sheet Metal.
   b) Prepare a Rectangular Tray using Sheet Metal.
8. **Foundry:** Prepare a mold using Single piece pattern.
9. **Black Smithy:** To make a square rod from round bar Using hand forging operation.
10. Disassemble and assemble of an IC engine model.
11. **3D Printing:** Design and Print a simple Component on 3D Printing Machine.
12. **IoT Operations:** Develop an IoT-based temperature monitoring system using a microcontroller.
13. **AR/VR:** Create a basic AR/VR application and study immersive visualization
14. **Robot Operations:** Program and operate a mobile robot for obstacle detection and navigation.

Note: Out of 14 Experiments 12 Experiments are mandatory.