



VIGNANA BHARATHI[®]
Institute of Technology

(A UGC Autonomous Institution, Approved by AICTE, Accredited by NBA & NAAC-A Grade, Affiliated to JNTUH)

Aushapur (V), Ghatkesar (M), Medchal – Dist. Telangana State – 501 301.

**DEPARTMENT OF
MECHANICAL ENGINEERING
(R22 B. TECH. ME)**

ACADEMIC YEAR : 2023-24

**I B.TECH(MECHANICAL)
COURSE STRUCTURE
&
SYLLABUS**



B.TECH. MECHANICAL ENGINEERING

EFFECTIVE FROM ACADEMIC YEAR 2023 - 24 ADMITTED BATCH

R22 COURSE STRUCTURE AND SYLLABUS

I YEAR I – SEMESTER

| S. No. | Course Code | Course Title | L | T | P | Credits |
|--------|-------------|--|-----------|----------|-----------|-----------|
| 1 | 22BS1111 | Matrices and Calculus | 3 | 1 | 0 | 4 |
| 2 | 22BS1113 | Applied Physics | 3 | 1 | 0 | 4 |
| 3 | 22CS1114 | C Programming and Data Structures | 3 | 0 | 0 | 3 |
| 4 | 22ME1156 | Engineering Workshop | 0 | 1 | 3 | 2.5 |
| 5 | 22HS1112 | English for Skill Enhancement | 2 | 0 | 0 | 2 |
| 6 | 22ME1155 | Elements of Mechanical Engineering | 0 | 0 | 2 | 1 |
| 7 | 22BS1153 | Applied Physics Laboratory | 0 | 0 | 3 | 1.5 |
| 8 | 22CS1154 | C Programming and Data Structures Laboratory | 0 | 0 | 2 | 1 |
| 9 | 22HS1152 | English Language and Communication Skills Laboratory | 0 | 0 | 2 | 1 |
| 10 | 22MC0002 | Environmental Science | 3 | 0 | 0 | 0 |
| 11 | 22MC0001 | Induction Programme | | | | |
| | | Total | 14 | 3 | 12 | 20 |

I YEAR II – SEMESTER

| S. No. | Course Code | Course Title | L | T | P | Credits |
|--------|-------------|---|-----------|----------|-----------|-----------|
| 1 | 22BS1211 | Ordinary Differential Equations and Vector Calculus | 3 | 1 | 0 | 4 |
| 2 | 22BS1212 | Engineering Chemistry | 3 | 1 | 0 | 4 |
| 3 | 22ME1255 | Computer Aided Engineering Graphics | 1 | 0 | 4 | 3 |
| 4 | 22ME1214 | Engineering Mechanics | 3 | 0 | 0 | 3 |
| 5 | 22ME1215 | Engineering Materials | 2 | 0 | 0 | 2 |
| 6 | 22CS1251 | Python Programming Laboratory | 0 | 1 | 2 | 2 |
| 7 | 22BS1252 | Engineering Chemistry Laboratory | 0 | 0 | 2 | 1 |
| 8 | 22ME1253 | Fuels & Lubricants Laboratory | 0 | 0 | 2 | 1 |
| | | Total | 12 | 3 | 10 | 20 |



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R22 B.Tech

ME

2023-2024

I Year – I Semester



22BS1111:MATRICES AND CALCULUS

I B Tech. I Semester

L T P C
3 1 - 4

Prerequisite(s): Mathematical knowledge at Pre university level.

Course Objectives: Develop ability to learn the concept of

1. Rank of the matrix and apply the same to know the consistency for the linear system of equations.
2. Eigen values and Eigen vectors to reduce the quadratic form to canonical form.
3. Geometrical approach to the mean value theorems and their application to the mathematical problems, Evaluation of surface areas and volumes of revolutions of curves and evaluation of improper integrals using Beta and Gamma functions.
4. Partial differentiation and Finding maxima and minima of function of two and three variables.
5. Evaluation of multiple integrals and their applications.

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

1. Write the matrix representation of a set of linear equations, find the rank and apply the same to analyse the solution of the system of equations.
2. Reduce the quadratic form to canonical form using orthogonal transformations by finding Eigenvalues and Eigen vectors.
3. Solve the applications on the mean value theorems, Evaluate the improper integrals using Beta and Gamma functions
4. Find the extreme values of functions of two variables with/ without constraints using partial differentiation.
5. Evaluate the multiple integrals and apply the concept to find areas and volumes.

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 Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

UNIT - II: Eigen values and Eigen vectors

Linear Transformation and Orthogonal Transformation: Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, 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 (without proof). Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates for known curves (circle, parabola, ellipse), 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 for known curves (circle, parabola, ellipse), Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and 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, Khanna Publishers, 44th 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, 9th Edition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.



22BS1113- APPLIED PHYSICS

I B Tech. I Semester

L T P C
3 1 0 4

Course Objectives:

The objectives of this course for the student are to:

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

Course Outcomes:

1. At the end of the course the student will be able to:
2. Understand physical world from fundamental point of view by the concepts of Quantum mechanics and visualize the difference between conductor, semiconductor, and an insulator by classification of solids.
3. Identify the role of semiconductor devices in science and engineering Applications.
4. Explore the fundamental properties of dielectric, magnetic and energy materials for their applications.
5. Appreciate the features and applications of Nano materials.
6. Understand various aspects of Lasers and Optical fibre and their applications in diverse
7. fields.

UNIT - I: QUANTUM PHYSICS AND SOLIDS

Quantum Mechanics: Introduction to quantum physics, blackbody radiation, Wein's and Rayleigh-Jean's law, Planck's radiation law (Qualitative) - photoelectric effect de-Broglie hypothesis and matter waves- Davisson and Germer experiment –Heisenberg uncertainty principle - Born interpretation of the wave function – time independent Schrodinger wave equation - particle in one dimensional potential box.

Solids: Free electron theory (Drude & Lorentz, Sommerfeld) (Qualitative) Bloch's theorem -Kronig-Penney model (Qualitative) origin of energy bands- classification of solids.

UNIT - II: 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, PIN diode, avalanche photo diode (APD) and solar cells, their structure, materials, working principle and characteristics.

UNIT - III: DIELECTRIC, AND MAGNETIC AND ENERGY MATERIALS

Dielectric Materials: Basic definitions- types of polarizations (qualitative) - ferroelectric, piezoelectric, and pyro electric materials.

Magnetic Materials: Basic definitions – classification of Magnetic materials – Domain theory of ferromagnetism in hysteresis - soft and hard magnetic materials - magnetostriction, magneto resistance.

Energy Materials: Conductivity of liquid and solid electrolytes- superionic conductors - materials and electrolytes for super capacitors.

UNIT - IV: NANOTECHNOLOGY



Nanoscale, quantum confinement, surface to volume ratio, **bottom-up fabrication**: sol-gel, precipitation, combustion methods – **top-down fabrication**: ball milling - physical vapor deposition (PVD) - chemical vapor deposition (CVD) - characterization techniques - XRD, SEM & TEM - applications of nanomaterials.

UNIT - V: LASER AND FIBER OPTICS

Lasers: Laser beam characteristics-three quantum processes-Einstein coefficients and their relations-lasing action - pumping methods, CO₂ laser, Nd: YAG laser- semiconductor laser-applications of laser.

Fiber Optics: Introduction to optical fiber- advantages of optical Fibers - total internal reflection- construction of optical fiber - acceptance 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 Text book 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 Principle – Donald A. Neamen, Mc Graw 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. Bhandhopadhyaya - 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.



22CS1114: C PROGRAMMING AND DATA STRUCTURES

B.Tech. I Year I Sem

L T P C

3 0 0 3

Course Objectives:

1. Learn adequate knowledge by problem solving techniques.
2. Understand programming skills using the fundamentals and basics of C Language.
3. Improve problem solving skills using arrays, strings, and functions.
4. Understand the dynamics of memory by pointers.
5. Study files creation process with access permissions.

Course Outcomes:

1. Explore the basic concepts in C Programming Language.
2. Develop modular and readable C Programs
3. Understand the basic concepts such as Abstract Data Types, Linear and Non-Linear Data structures.
4. Apply data structures such as stacks, queues in problem solving
5. To understand and analyze various searching and sorting algorithms.

UNIT – I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Software Development

Introduction to C Language – Background, Simple C programs, Identifiers, Basic data types, Variables, Constants, Input / Output

Structure of a C Program – Operators, Bit-wise operators, Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Statements.

UNIT – II

Statements – if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Recursion.

Designing Structured Programs- Functions, basics, user defined functions, inter function communication, standard functions.

Arrays – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays.

UNIT – III

Pointers – Introduction, Pointers for inter function communication, pointers to pointers, compatibility.

Pointer Applications – Passing an array to a function, Memory allocation functions:



malloc(),calloc(),realloc(),free(), array of pointers

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion.

UNIT – IV

Derived types – The Typedef, enumerated types, Structures – Declaration, definition and initialization of structures, accessing structures, operations on structures, complex structures. Unions – Referencing unions, initializers, unions and structures.

Input and Output – Text vs Binary streams, standard library functions for files, converting file types, File programs – copy, merge files.

UNIT – V:

Searching and Sorting Techniques- Basic searching in an array of elements (linear and binary search techniques),

Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms)

Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

TEXT BOOKS:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

REFERENCE BOOKS:

1. C & Data structures – P. Padmanabham, 3rd Edition, B.S. Publications.
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3. Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
4. C for Engineers and Scientists, H. Cheng, McGraw-Hill International Edition
5. Data Structures using C – A. M. Tanenbaum, Y. Langsam, and M.J. Augenstein, Pearson Education / PHI
6. C Programming & Data Structures, E. Balagurusamy, TMH.
7. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press
8. C & Data structures – E V Prasad and N B Venkateswarlu, S. Chand & Co.



22ME1156 - ENGINEERING WORKSHOP

I B Tech. I Semester

L T P C
0 1 3 2.5

Pre-requisites: Practical skill

Course Objectives:

1. To Study about different hand operated power tools, uses and their demonstration.
2. To gain a good basic working knowledge required for the production of various engineering products.
3. To provide hands on experience about use of different engineering materials, tools, equipment's and processes those are common in the engineering field.
4. To develop a right attitude, team working, precision and safety at workplace.
5. It explains the construction, function, use and application of different working tools, equipment and machines.

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

1. CO1: Study and practice on machine tools and their operations
2. CO2: Practice on manufacturing of components using work shop trades including plumbing, fitting, carpentry, foundry, house wiring and welding.
3. CO3: Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
4. CO4: Apply basic electrical engineering knowledge for house wiring practice.
5. CO 5: Study and Practice of arc welding process

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

1. Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
2. Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)
3. Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
4. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
5. Welding Practice – (Arc Welding & Gas Welding)
6. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
7. Black Smithy – (Round to Square, Fan Hook and S-Hook)

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools in construction and WoodWorking

TEXT BOOKS:

1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K. Venugopal / Anuradha.

REFERENCE BOOKS:

1. Work shop Manual - P. Kannaiah/ K.L. Narayana/ Scitech
2. Workshop Manual / Venkat Reddy/ BSP



22HS1112: ENGLISH FOR SKILL ENHANCEMENT

L T P C
2 0 0 2

B.Tech. I Year I Sem.

Course Objectives: This course will enable the students to:

1. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Develop study skills and communication skills in various professional situations.
3. Learn remedial and functional grammar related to various grammar items.
4. Prepare the students for examinations such as IELTS and TOEFL by sharpening their reading and writing skills
5. Equip students to study engineering subjects more effectively and critically using the theoretical and practical components of the syllabus.

Course Outcomes: Students will be able to:

1. Use a wide range of vocabulary and sentence structures and also acquire basic proficiency in reading and writing modules of English.
2. Choose appropriate vocabulary and sentence structures for their oral and written communication.
3. Demonstrate their understanding of the rules of functional grammar.
4. Develop comprehension skills from the known and unknown passages.
5. Take an active part in drafting paragraphs, letters, essays, abstracts, précis and reports in various contexts.

UNIT-I

Chapter entitled '*Toasted English*' by R.K. Narayan from "*English: Language, Context and Culture*" published by Orient Black Swan, Hyderabad.

Vocabulary: The Concept of Word Formation – The Use of Prefixes and Suffixes- Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and Its Importance – Techniques for Effective Reading.

Writing: Sentence Structures – Use of Phrases and Clauses in Sentences – Importance of Proper Punctuation – Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence- Organizing Principles of Paragraphs in Documents.

UNIT-II

Chapter entitled '*Appro JRD*' by Sudha Murthy from "*English: Language, Context and*



Culture published by Orient Black Swan, Hyderabad.

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

Writing: Nature and Style of Writing - Defining/Describing People, Objects, Places and Events
– Classifying – Providing Examples or Evidence.

UNIT-III

Chapter entitled '**Lessons from Online Learning**' by F.Haider Alvi, Deborah Hurstetal from "**English: Language, Context and Culture**" published by Orient Black Swan, Hyderabad.

Vocabulary: Words Often Confused – Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.

Writing: Format of a Formal Letter – Writing Formal Letters e.g. Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

UNIT-IV

Chapter entitled '**Art and Literature**' by Abdul Kalam from "**English: Language, Context and Culture**" published by Orient Black Swan, Hyderabad.

Vocabulary: Standard Abbreviations in English

Grammar: Redundancies and Clichés in Oral and Written Communication.

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) – Exercises for Practice

Writing: Writing Practices – Essay Writing – Writing Introduction and Conclusion – Précis Writing.

UNIT-V

Chapter entitled '**Go, Kiss the World**' by Subroto Bagchi from "**English: Language, Context and Culture**" published by Orient Black Swan, Hyderabad.

Vocabulary: Technical Vocabulary and their Usage

Grammar: Common Errors in English (*Covering all the other aspects of grammar which were not covered in the previous units*)

Reading: Reading Comprehension – Exercises for Practice

Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats - Structure of Reports (Manuscript



Note: Listening and Speaking Skills which are given under Unit -6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.

- **Note: 1.** As the syllabus of English given in AICTE *Model Curriculum-2018 for B.Tech First Year* is **Open-ended**, besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.
- **Note: 2.** Based on the recommendations of NEP2020, teachers are requested to be flexible to adopt Blended Learning in dealing with the course contents. They are advised to teach 40 percent of each topic from the syllabus in blended mode.

TEXTBOOK:

1. “English: Language, Context and Culture” by Orient Black Swan Pvt. Ltd, Hyderabad.2022. Print.

REFERENCEBOOKS:

- 1.Effective Academic Writing by Liss and Davis (OUP)
- 2.Richards, Jack C. (2022) Interchange Series. Introduction,1,2,3. Cambridge University Press
- 3.Wood, F. T. (2007). Remedial English Grammar. Macmillan.
- 4.Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of Functional Language, Grammar and Vocabulary. (2nd ed.,). Sage Publications India Pvt. Ltd.
5. (2019). Technical Communication. Wiley India Pvt. Ltd.
- 6.Vishwamohan, Aysha.(2013). English for Technical Communication for Engineering Students. Mc Graw-Hill Education India Pvt. Ltd.
7. Swan, Michael. (2016). Practical English Usage. Oxford University Press. Fourth Edition



22ME1155: ELEMENTS OF MECHANICAL ENGINEERING

B.Tech. I Year I Sem.

L T P C
0 0 2 1

Course Objectives: The objectives of this course are to

1. Make the student to experimentally measure the common geometric properties like length, diameter, flatness, curvature, volume and moment of inertia etc.
2. Give a practical knowledge to evaluate the friction between surfaces and also to evaluate the natural frequency of the system.
3. Correlate between theory and experimental results, directly observe the proof of principles and theories through practical knowledge
4. Introduce students to the basic concepts of manufacturing through the demonstration of various processes.
5. Understand the commonly used mechanical components like gear box, working of boilers and IC engine etc.

Course Outcomes: At the end of the course, students will be able to:

1. CO 1: Understand the operation, usage and applications of different measuring instruments and tools.
2. CO 2: Examine the different characteristics of instruments like accuracy, precision etc.
3. CO 3: Prepare simple composite components and joining different materials using soldering process.
4. CO 4: Identify tools & learn practically the process of turning, milling, grinding on mild steel pieces.
5. CO 5: Understand the basic components of IC engine, Gear box and boiler

List of Experiments to be performed:

1. Measurement of length, height, diameter by vernier calipers.
2. To measure diameter of a given wire and sphere, thickness of a given sheet and volume of an irregular lamina using micrometer screw gauge.
3. Use of straight edge and spirit level in finding the flatness of surface plate.
4. Determination of time period and natural frequency of simple pendulum.
5. Determination of time period and natural frequency of compound pendulum.
6. To measure the coefficients of static and kinetic friction between a block and a plane using various combination of materials.
7. To determine the radius of curvature of a given spherical surface.
8. The experimental determination of the Moment of Inertia of regular and irregular solids.
9. Metal joining process—soldering of metal alloys to any PCB board
10. A simple composite geometry preparation by hand layup method.
11. Grouping of Dry cells for a specified voltage and current and its measurement using ammeters and voltmeters etc.
12. Demonstration of lathe, milling, drilling, grinding machine operations.
13. Study of transmission system –gear box
14. Assembly /disassembly of Engines



15. Study of Boilers

Note: Perform any 10 out of the 15 Exercises.

R22-B.TECH-MECHANICAL



22BS1153 - APPLIED PHYSICS LABORATORY

B.Tech. I Year I Sem.

L T P C
0 0 3 1.5

Course Objectives:

The objectives of this course for the student to

1. Capable of handling instruments related to the Hall effect and photoelectric effect experiments and their measurements.
2. Understand the characteristics of various devices such as PN junction diode, Zener diode, BJT, LED, solar cell, lasers and optical fiber and measurement of energy gap and resistivity of semiconductor materials.
3. Understand the method of least square fitting
4. Study the behavior of B-H curve of ferromagnetic materials.
5. Study the behavior of passive components.

Course Outcomes:

The students will be able to:

1. Know the determination of the Planck's constant using Photo electric effect and identify the material whether it is n-type or p-type by Hall experiment.
2. Appreciate quantum physics in semiconductor devices and optoelectronics.
3. Carried out data analysis
4. Understand the variation of magnetic field and behavior of hysteresis curve.
5. Learn the characteristics of passive components like L, C and R and their applications.

LIST OF EXPERIMENTS:

1. Understanding the method of least squares – torsional pendulum as an example.
2. Determination of work function and Planck's constant using photoelectric effect.
3. Determination of Hall co-efficient and carrier concentration of a given semiconductor.
4. Characteristics of series and parallel LCR circuits.
5. V-I characteristics of a p-n junction diode and Zener diode
6. Input and output characteristics of BJT (CE, CB & CC configurations)
7. a). V-I and L-I characteristics of light emitting diode (LED)
b). V-I characteristics of a Laser diode
8. V-I Characteristics of solar cell
9. a). Determination of the beam divergence of the given LASER beam
b). Determination of Acceptance Angle and Numerical Aperture of an optical fiber.
10. Determination of Energy gap of a semiconductor.
11. Determination of time constant of RC Circuit.
12. Study B-H curve of a magnetic material.

Note: Any 8 experiments are to be performed.

REFERENCE BOOK:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.



**22CS1154: C PROGRAMMING AND DATA STRUCTURES
LABORATORY**

B.Tech. I Year I Sem (R22)

L T P C
0 0 2 1

Course Objectives:

1. To learn C-language Programs using the data types, input/ output statements and control statements.
2. Describe the importance of modular programming and arrays using C-Language Program.
3. Understand the concept and use of pointers for memory management techniques, structure, union, and enumerated types.
4. Understand the type definition, enumerated types, define and use structures, unions in programs using C language.
5. Understand the basic characteristics of text, binary files and C implementation of file I/O using streams.

Course Outcomes:

1. Ability to design and test programs to solve mathematical and scientific problems.
2. Ability to write structured programs using control structures and functions.
3. Able to Implement C programs using arrays & pointers.
4. Able to Use the type definition, enumerated types, define and use structures, unions in programs using C language.
5. Able to execute programs that read and write text, binary files using the formatting and character I/O functions.

List of Experiments:

WEEK-1:

- a. Write a C program to find simple interest and compound interest.
- b. Write a C program to convert Celsius to Fahrenheit.
- c. Write a C Program to swap two numbers.
- d. Write a C program to perform all arithmetic operations (+, -, *, / , %).
- e. Write a simple program that prints the results of all the operators available in C (Including pre/ post increment, bitwise and/or/not , etc.). Read required operand Values from standard input.

WEEK-2:

- a. Write a C program to find the sum of individual digits of a positive integer.
- b. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.
- c. Write a C program to generate the first n terms of the sequence.

WEEK-3:

- a. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
- b. Write a C program to find the roots of a quadratic equation.
- c. Write a C program to find the factorial of a given integer.

WEEK-4:



- a. Write a C program to find the GCD (greatest common divisor) of two given integers.
- b. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use Switch Statement)
- c. Write a C program to solve Towers of Hanoi problem.

WEEK-5:

- a. Write a C program to find both the largest and smallest number in a list of integers.
- b. Write a C program that uses functions to perform the following:
 - i) Addition of Two Matrices
 - ii) Multiplication of Two Matrices

WEEK-6:

- a. Write a C program that uses functions to perform the following operations:
- b. To insert a sub-string in to a given main string from a given position.
- c. To delete n Characters from a given position in a given string.

WEEK-7:

- a. Write a C program to determine if the given string is a palindrome or not
- b. Write a C program that displays the position or index in the string S where the string T begins, or - 1 if S doesn't contain T.

WEEK-8:

- a. Write a C program to count the lines, words and characters in a given text.
- b. Write a C program to generate Pascal's triangle.
- c. Write a C program to construct a pyramid of numbers

WEEK-9:

- a. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: $1+x+x^2+x^3+\dots+x^n$
For example: if n is 3 and x is 5, then the program computes $1+5+25+125$. Print x, n, the sum Perform error checking.

For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if $n < 0$, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal ? If so, test for them too.

- b. 2's complement of a number is obtained by scanning it from right to left and complementing

all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.

WEEK-10:

- a. Write a C program to convert a Roman numeral to its decimal equivalent.
- b. Write a C program that uses functions to perform the following operations:
 - i) Reading a complex number
 - ii) Writing a complex number
 - iii) Addition of two complex numbers
 - iv) Multiplication of two complex numbers(Note: represent complex number using a structure.)

WEEK-11:

- a. Write a C program which copies one file to another.
- b. Write a C program to reverse the first n characters in a file. (Note: The file name and n are specified on the command line.)
- c. Write a C program to display the contents of a file.
- d. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

WEEK-12:



Write a C program that implements the following sorting methods to sort a given list of integers in ascending order

- i) Bubble sort ii) Selection sort iii) Insertion sort

WEEK-13:

Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a Key value in a given list of integers:

- i) Linear search ii) Binary search

WEEK 14:

Write a C program that uses functions to perform the following operations on singly linkedlist.:

- i) Creation ii) Insertion iii) Deletion iv) Traversal

WEEK-15:

Write C programs that implements the following data structures

- i) Stacks (push,pop,display) ii) queues(insert,delete,display)

TEXT BOOKS:

1. C programming and Data Structures, P. Padmanabham, Third Edition, BS Publications
2. Computer Programming in C, V. Rajaraman, PHI Publishers.
3. C Programming, E.Balagurusamy, 3rd edition, TMH Publishers.
4. C Programming, M.V.S.S.N.Prasad, ACME Learning Pvt. Ltd.
5. C and Data Structures, N.B.Venkateswarlu and E.V.Prasad,S.Chand Publishers
6. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publishers.



22HS1152 - ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY

B.Tech. I Year I Sem.

L T P C
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The **English Language and Communication Skills (ELCS) Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:

1. To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning.
2. To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm.
3. To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking.
4. To improve the fluency of students in spoken English and neutralize the impact of dialects.
5. To train students to use language appropriately for public speaking, group discussions and interviews.

Course Outcomes: Students will be able to:

1. Make use of various online and web resources for independent language learning.
2. Understand the nuances of English language through audio-visual experience and group activities.
3. Neutralize their accent for intelligibility for enabling them to communicate with a global audience.
4. Speak with clarity and confidence which in turn improves their academic performance in the other courses.
5. Face and interact with various stakeholders leading to the enhancement of their employability skills.

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:

- a. **Computer Assisted Language Learning (CALL) Lab**
- b. **Interactive Communication Skills (ICS) Lab**

Listening Skills:

Objectives

1. To enable students develop their listening skills so that they may appreciate the role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening, so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening



- Listening for specific information

Speaking Skills:

Objectives

1. To involve students in speaking activities in various contexts
 2. To enable students express themselves fluently and appropriately in social and professional contexts
- Oral practice
 - Describing objects/situations/people
 - Roleplay – Individual/Group activities
 - Just A Mine (JAM) Sessions

The following course contents prescribed for the **English Language and Communication Skills Lab.**

Exercise-I

CALL Lab:

Understand: Listening Skill- Its importance – Purpose - Process - Types - Barriers - Effective Listening.

Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs - Consonant Clusters - Past Tense Marker and Plural Marker - Testing Exercises

ICS Lab:

Understand: Spoken vs. Written language – Formal and Informal English.

Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise-II CALL Lab:

Understand: Structure of Syllables–Word Stress–Weak Forms and Strong Forms– Stress pattern in sentences – Intonation.

Practice: Basic Rules of Word Accent – Stress Shift - Weak Forms and Strong Forms – Stress pattern in sentences – Intonation - Testing Exercises

ICS Lab:

Understand: Features of Good Conversation – Strategies for Effective Communication.

Practice: Situational Dialogues – Role Play – Expressions in Various Situations – Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise-III CALL Lab:

Understand: Errors in Pronunciation – Neutralising Mother Tongue Interference (MTI).

Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation -Testing Exercises

ICS Lab:

Understand: Descriptions – Narrations – Giving Directions and Guidelines – Blog Writing

Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions –Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

Exercise-IV

CALL Lab:

Understand: Listening for General Details.

Practice: Listening Comprehension Tests - Testing Exercises

ICS Lab:



Understand: Public Speaking – Exposure to Structured Talks - Non-verbal Communication - Presentation Skills.

Practice: Making a Short Speech – Extempore – Making a Presentation.

Exercise–V CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests – Testing Exercises

ICS Lab:

Understand: Group Discussion

Practice: Group Discussion

Minimum Requirement of infrastructural facilities for ELCSLab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self-study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

- i. Computers with Suitable Configuration
- ii. High Fidelity Headphones

1. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo – audio & video system and camcorder etc.

Source of Material (Master Copy):

1. *Exercises in Spoken English. Part1, 2, 3.* CIEFL and Oxford University Press

Note: Teachers are requested to make use of the master copy and get it tailor-made to suit the contents of the syllabus.

Suggested Software:

2. Cambridge Advanced Learners' English Dictionary with CD.
3. Grammar Made Easy by Darling Kindersley.
4. Punctuation Made Easy by Darling Kindersley.
5. Oxford Advanced Learner's Compass, 10th Edition.
6. English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
7. English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
8. English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
9. TOEFL&GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
10. Digital All
11. Orell Digital Language Lab (Licensed Version)

REFERENCE BOOKS:

1. (2022). *English Language Communication Skills – Lab Manual cum Workbook.* Cengage Learning India Pvt. Ltd.
2. Shobha, KN & Rayen, J. Lourdes. (2019). *Communicative English – A workbook.* Cambridge



University Press

3. Kumar, Sanjay & Lata, Pushp. (2019). *Communication Skills: A Workbook*. Oxford University Press
4. Board of Editors. (2016). *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities*. Orient Black Swan Pvt.Ltd.
5. Mishra, Veerendra et al. (2020). *English Language Skills: A Practical Approach*. Cambridge University Press.

R22-B.TECH-MECHANICAL



22MC0002 - ENVIRONMENTAL SCIENCE

B.Tech. I Year I Sem.

L T P C
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Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations

Course Outcomes:

- Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT - I : ECOSYSTEMS

Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT - II : NATURAL RESOURCES: CLASSIFICATION OF RESOURCES

Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT - III : BIODIVERSITY AND BIOTIC RESOURCES

Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT - IV : ENVIRONMENTAL POLLUTION AND CONTROL TECHNOLOGIES : ENVIRONMENTAL POLLUTION

Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT - V : ENVIRONMENTAL POLICY, LEGISLATION & EIA

Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data



acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

- 1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
- 2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.



VIGNANA BHARATHI[®]
Institute of Technology

(A UGC Autonomous Institution, Approved by AICTE, Accredited by NBA & NAAC-A Grade, Affiliated to JNTUH)

R22 B.Tech

ME

2023-2024

I Year – II Semester



22BS1211- ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

I B.Tech. II Semester

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Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives: Develop ability to learn

1. Methods of solving the Ordinary Differential Equations of first order.
2. Methods of solving the higher order Ordinary Differential Equations.
3. Concept, properties of Laplace transforms & using the same to solve ordinary differential equations.
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 vector integration.

Course outcomes: After successful completion of this course, student should be able to

1. Identify the type of first order Ordinary Differential Equation and solve them by appropriate method.
2. Apply the concept of higher order Ordinary Differential Equations to solve real world problems.
3. Solve ordinary differential equations by using Laplace transform techniques.
4. Calculate scalar potential for a vector and directional derivative of a scalar point function using vector differentiation.
5. Evaluate the line, surface and volume integrals and converting them from one to another.

UNIT-I: FIRST ORDER ODE

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 and higher order linear differential equations with constant coefficients: non-Homogeneous terms of the type e^{ax} , $\sin bx$, $\cos bx$, polynomials in x^k , ve^{ax} and $x V(x)$, method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation. Applications: Electric Circuits

UNIT-III: LAPLACE TRANSFORMS

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, second shifting theorem (without proof), 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, 44th Edition,
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, Sth 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, 9th Edition, 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.



22BS1212- ENGINEERING CHEMISTRY

B.Tech. I Year II Sem.

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Course Objectives:

1. To acquire knowledge about desalination of brackish water and treatment of municipal water
2. To include the fundamental aspects of battery chemistry, significance of corrosion and its control to protect the structures.
3. To gain the knowledge of conducting polymers, bio-degradable polymers and fiber reinforced plastics.
4. To understand the significance of green chemistry and green synthesis and to imbibe the green chemistry principles.
5. To acquire required knowledge about engineering materials like smart materials, lubricants, and biodiesel.

Course Outcomes:

1. Students will acquire the basic knowledge of electrochemical procedures related to corrosion and its control.
2. The students are able to understand the basic properties of water and its usage in domestic and industrial purposes.
3. They can substitute metals with conducting polymers and also produce cheaper biodegradable polymers to reduce environmental pollution.
4. The student can use real examples to illustrate how the principles of *green chemistry* can be applied to chemical process in engineering
5. They can predict potential applications of engineering materials and practical utility in order to become good engineers and entrepreneurs.

UNIT - I: WATER AND ITS TREATMENT:

Introduction to hardness of water – Estimation of hardness of water by complexometric method and related numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and breakpoint chlorination. Defluoridation, Determination of F⁻ ion by ion-selective electrode 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 – II BATTERY CHEMISTRY & CORROSION

Introduction - Classification of batteries- primary, secondary and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of: Zn-air and 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 and Solid oxide fuel cell. Solar cells - Introduction and applications of Solar cells.

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 - III: POLYMERIC MATERIALS:

Definition – Classification of polymers with examples – Types of polymerization – 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, Fiber reinforced plastics (FRP). **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 poly vinyl alcohol and their applications.

UNIT - IV: GREEN CHEMISTRY AND ENGINEERING FOR SUSTAINABLE DEVELOPMENT

Definition and history of Green chemistry, Concept and principles (Prevention, Atom Economy, Less Hazardous Chemical Syntheses, Designing Safer Chemicals, Safer Solvents and Auxiliaries, Design for Energy Efficiency, Use of Renewable Feedstock, Reduce, Derivatives, Catalysis, Design for Degradation, Real-time Analysis for Pollution Prevention, Inherently Safer Chemistry for Accident Prevention) of Green Chemistry with suitable examples.

UNIT - V: ENGINEERING MATERIALS:

Smart materials and their engineering applications

Shape memory materials- Poly L- Lactic acid. Thermoresponse materials- Polyacryl amides, Poly vinyl amides

Lubricants: Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

Bio Diesel: Sources and applications of Biodiesel

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. Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley Publications.
4. A text book of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K. Shashikala, Pearson Publications, 2021.
5. Engineering Chemistry by K Sesha Maheswaramma and Mridula Chugh, Pearson Publications.

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)



22ME1255 - COMPUTER AIDED ENGINEERING GRAPHICS

B.Tech. I Year II Sem.

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Course Objectives:

1. To develop the ability of visualization of different objects through technical drawings
2. To acquire computer drafting skill for communication of concepts, ideas in the design of engineering products
3. To draw sectional views and pictorial views for various types of solids.
4. To develop the lateral surfaces of basic engineering objects
5. To impart knowledge about standard principles of orthographic projection and isometric views of different objects.

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

UNIT – I: INTRODUCTION TO ENGINEERING GRAPHICS:

Principles of Engineering Graphics and their Significance, Scales – Plain & Diagonal, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Introduction to Computer aided drafting – views, commands and conics

UNIT- II: ORTHOGRAPHIC PROJECTIONS:

Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes. Computer aided orthographic projections – points, lines and planes

UNIT – III:

Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – 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
- 2 Engineering Drawing and graphics Using AutoCAD Third Edition, T. Jeyapooan, 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

Note: - External examination is conducted in conventional mode and internal evaluation to be done by both conventional as well as using computer aided drafting.



22ME1214: ENGINEERING MECHANICS

B.Tech. I Year II Sem.

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Course Objectives: The objectives of this course are to

1. Explain 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.
3. Locate the centroid of a body and compute the area moment of inertia and mass moment of inertia of standard and composite sections
4. Explain kinetics and kinematics of particles, projectiles, curvilinear motion, centroidal moment plane motion of rigid bodies.
5. Explain the concepts of work-energy method and its applications to translation, rotation and plane motion and the concept of vibrations

Course Outcomes: At the end of the course, students will be able to

1. CO 1: Determine resultant of forces acting on a body and analyse equilibrium of a body subjected to a system of forces.
2. CO 2: Solve problem of bodies subjected to friction.
3. CO 3: Find the location of centroid and calculate moment of inertia of a given section.
4. CO 4: Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory motion and rigid body motion.
5. CO 5: Solve problems using work energy equations for translation, fixed axis rotation and plane motion and solve problems of vibration.

UNIT - I:

Introduction to Engineering Mechanics - Force Systems: Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

UNIT - II:

Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;

Centroid and Centre of Gravity -Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications. – Theorem of Pappus

UNIT - III:

Area Moment of Inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Product of Inertia, Parallel Axis Theorem, Perpendicular Axis Theorem

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:

Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polarcoordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular,path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

UNIT - V:

Kinetics of Rigid Bodies -Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D' Alembert's principle and its applications in plane motion and connected bodies; Work Energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

TEXT BOOKS:

1. Shames and Rao (2006), Engineering Mechanics, Pearson Education
2. Reddy Vijay Kumar K. and J. Suresh Kumar (2010), Singer's Engineering Mechanics –Statics & Dynamics

REFERENCE BOOKS:

1. Beer F.P & Johnston E.R Jr., Vector Mechanics for Engineers – Statics and Dynamics, McGraw Hill, 12th Edition.
2. Dumir P.C, Sengupta, Srinivas, Engineering Mechanics- Universities Press, 2020.
3. Hibbeler R.C, Engineering Mechanics, Pearson, 14th Edition.
4. Arshad Noor, Zahid & Goel, Engineering Mechanics, Cambridge University Press, 2018.
5. Khurmi R.S, Khurmi N., Engineering Mechanics, S. Chand, 2020.
6. Basudeb Bhattacharyya, "Engineering Mechanics", Oxford University Press



22ME1215: ENGINEERING MATERIALS

B.Tech. I Year II Sem.

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Course Objectives: The objectives of this course are to

1. Provide basic understanding of engineering materials, their structure, classification and usage.
2. Introduce the testing methods for various material properties and ASTM standards used in testing.
3. Understand the various metals used in composite materials.
4. Understand the importance of ceramics, polymers and other new materials..
5. Introduce the Basic elements of Nano Technology.

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

1. Classify the various materials that will be essential for the mechanical engineering applications.
2. Express the mechanical properties of metals and their testing procedures.
3. Understand the application of materials and their processing
4. Understand the requirement and need for the development of the new materials.
5. Understand the need of Nano technology in the development of new materials.

UNIT-I:

Classification of Engineering Materials, Ashby chart, Mechanical Properties of Metals and their testing equipment/procedures, ASTM standards for testing, Stress–Strain Behavior of various materials, Sources of Material Data

UNIT –II:

Metals and Metal Alloys, Classification of Metal Alloys, Classification, composition, properties and usage of Ferrous alloys, steel, HSS, grey cast iron, white cast iron; Classification, composition, properties and usage of Non-ferrous materials, Aluminum, Titanium, Zinc, Copper, Nickel, Cobalt and their alloys

UNIT –III:

Composites: Definitions, Reinforcements and matrices, Types of reinforcements, Types of matrices, Classification of composites, Properties of composites in comparison with standard materials Manufacturing methods: Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs.

UNIT – IV:

Ceramics, Classification of ceramic materials, Crystal Structure, Applications and Properties of Ceramics, Ceramic fabrication techniques, Carbon: Diamond and Graphite.

Polymer Structures, Chemistry of Polymer Molecules, Classification scheme of polymer molecules, Thermoplastic and Thermosetting Polymers, Characteristics, Applications, and Processing of Polymers, Elastomers.



UNIT – V:

Materials in nano technology: Semiconductor Nanomaterials (Zinc oxide nano materials, titanium dioxide nanoparticles, Metal nanoparticles, ceramic nano materials metal nano particles (Silver, gold, iron and copper), applications, bio materials and other recent materials

TEXT BOOKS:

1. George Murray, Charles V. White, Wolfgang Weise, “Introduction to Engineering Materials”, CRC Press, 2007.
2. William. D. Callister, David G. Rethwisch, “Materials Science and Engineering: An Introduction”, John Wiley & Sons, 2018.

REFERENCE BOOKS:

1. Myer Kutz, “Mechanical Engineers’ Handbook”, John Wiley & Sons, 2015.
2. M.A. Shah, K.A. Shah, Nano technology, the science of Small, WILEY, Second Edition, 2019.
3. E. Paul De Garmo, J.T. Black, R.A. Kohler. Materials and Processes in Manufacturing, John Wiley and Sons, Inc., NY, 11 th Edition, 2012.
4. R.J. Crawford, plastics engineering, Pergamon Press, 2013.
5. Donald R Asklund and Pradeep P Phule “Essentials of Materials Science and Engineering”, by Pradeep P. Fulay (Author), Donald R. Askeland, 2013.
6. K. K. Chawala, Ceramic Matrix composite Materials, Kluwer Academic Publishers, 2002.



22CS1251: PYTHON PROGRAMMING LAB

B.Tech. I Year II Sem.

L T P C
0 1 2 2

Course Objectives:

1. To learn python programming language using the data types, input/ output statements.
2. To install and run the Python interpreter
3. To learn control structures.
4. To Understand Lists, Dictionaries in python
5. To Handle Strings and Files inPython

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

1. Develop the application specific codes using python.
2. Understand Strings, Lists, Tuples and Dictionaries in Python
3. Verify programs using modular approach, file I/O, Python standard library
4. Implement Digital Systems using Python
5. Capable to implement on hardwareboards

Note: The lab experiments will be like the following experiment examples

Week -1:

1. i) Use a web browser to go to the Python website <http://python.org>. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
i) Start the Python interpreter and type help() to start the online help utility.
2. Start a Python interpreter and use it as a Calculator.
3. i) Write a program to calculate compound interest when principal, rate and number of periods are given.
ii) Given coordinates (x1, y1), (x2, y2) find the distance between two points
4. Read name, address, email and phone number of a person through keyboard and print the details.

Week - 2:

1. Print the below triangle using for loop.
5
4 4
3 3 3
2 2 2 2
1 1 1 1 1
2. 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)
3. Python Program to Print the Fibonacci sequence using while loop
4. Python program to print all prime numbers in a given interval (use break)



Week - 3:

1. i) Write a program to convert a list and tuple into arrays.
ii) Write a program to find common values between two arrays.
2. Write a function called gcd that takes parameters a and b and returns their greatest common divisor.
3. 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.

Week - 4:

1. Write a function called is_sorted that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.
2. 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.

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.

- i). The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.
- ii). 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.
3. i) Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
ii) Remove the given word in all the places in a string?
iii) 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?
4. Writes a recursive function that generates all binary strings of n-bit length

Week - 5:

1. i) Write a python program that defines a matrix and prints
ii) Write a python program to perform addition of two square matrices
iii) Write a python program to perform multiplication of two square matrices
2. 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.
3. Use the structure of exception handling all general purpose exceptions.

Week-6:

1. a. Write a function called draw_rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.
b. Add an attribute named color to your Rectangle objects and modify draw_rectangle so that it uses the color attribute as the fill color.
c. Write a function called draw_point that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.



- objects. Write a function called `draw_circle` that draws circles on the canvas.
2. Write a Python program to demonstrate the usage of Method Resolution Order (MRO) in multiple levels of Inheritances.
 3. Write a python code to read a phone number and email-id from the user and validate it for correctness.

Week- 7:

1. Write a Python code to merge two given file contents into a third file.
2. 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.
3. Write a Python code to Read text from a text file, find the word with most number of occurrences
4. Write a function that reads a file *file1* and displays the number of words, number of vowels, blankspaces, lower case letters and uppercase letters.

Week - 8:

1. Import numpy, Plotpy and Scipy and explore their functionalities.
2. a) Install NumPy package with pip and explore it.
3. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
4. Write a program to implement Half Adder, Full Adder, and Parallel Adder
5. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

TEXT BOOKS:

1. Supercharged Python: Take your code to the next level, Overland
2. Learning Python, Mark Lutz, O'reilly

REFERENCE BOOKS:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Python Programming A Modular Approach with Graphics, Database, Mobile, and WebApplications, Sheetal Taneja, Naveen Kumar, Pearson
3. Programming with Python, A User's Book, Michael Dawson, Cengage Learning, India Edition
4. Think Python, Allen Downey, Green Tea Press
5. Core Python Programming, W. Chun, Pearson
6. Introduction to Python, Kenneth A. Lambert, Cengage



22BS1252 - ENGINEERING CHEMISTRY LABORATORY

B.Tech. I Year II Sem.

L T P C

0 0 2 1

Course Objectives: The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:

1. Estimation of hardness of water to check its suitability for drinking purpose.
2. Students are able to perform estimations of acids and bases using conductometry, potentiometry and pH metry methods.
3. Students will learn to prepare polymers such as Bakelite and nylon-6 in the laboratory.
4. Students will learn skills related to the lubricant properties such as saponification value, surface tension and viscosity of oils.

Course Outcomes: The experiments will make the student gain skills on:

1. Determination of parameters like hardness of water and rate of corrosion of mild steel in various conditions.
2. Able to perform methods such as conductometry, potentiometry and pH metry in order to find out the concentrations or equivalence points of acids and bases.
3. Students are able to prepare polymers like bakelite and nylon-6.
4. Estimations saponification value, surface tension and viscosity of lubricant oils.

List of Experiments:

- I. **Volumetric Analysis:** Estimation of Hardness of water by EDTA Complexometry method.
- II. **Conductometry:** Estimation of the concentration of an acid by Conductometry.
- III. **Potentiometry:** Estimation of the amount of Fe^{+2} by Potentiometry.
- IV. **pH Metry:** Determination of an acid concentration using pH meter.
- V. Preparations:
 1. Preparation of Bakelite.
 2. Preparation Nylon – 6.
- VI. **Lubricants:**
 1. Estimation of acid value of given lubricant oil.
 2. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.
- VII. **Corrosion:** Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.
- VIII. Virtual lab experiments
 1. Construction of Fuel cell and its working.
 2. Smart materials for Biomedical applications
 3. Batteries for electrical vehicles.
 4. 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).



22ME1253: FUELS AND LUBRICANTS LABORATORY

B.Tech. I Year II Sem.

L T P C
0 0 2 1

Prerequisite: Chemistry

Course Objectives:

1. To understand the fuel and lubricants properties.
2. To understand about importance of flash point and fire point of fuels
3. To understand about different types of viscometers and their uses
4. To understand about different types of calorimeters and their uses
5. To calculate the carbon residue

Course Outcomes: At the end of the course ,students will be able to

1. Find the kinematic viscosity of lubricants and its variation with temperature
2. Determine the flash point, fire point, cloud point and pour point of liquid fuels
3. Determine the calorific value of solid, liquid and gaseous fuels
4. Determination of the dropping point of lubricating grease
5. Determination of distillation characteristics of petroleum products

List of Experiments:

1. Determination of Flash and Fire points of Liquid fuels/Lubricants using: Abels Apparatus
2. Determination of Flash and Fire points of Liquid fuels/Lubricants using: Pensky MartensApparatus
3. Carbon residue test: Liquid fuels.
4. Determination of Viscosity of Liquid lubricants and Fuels using: Saybolt Viscometer
5. Determination of Viscosity of Liquid lubricants and Fuels using: Redwood Viscometer
6. Determination of Viscosity of Liquid lubricants and Fuels using: Engler Viscometer
7. Determination of Calorific value: of Gaseous fuels using: Junkers Gas Calorimeter.
8. Determination of Calorific value: Solid/Liquid/ fuels using: Bomb Calorimeter.
9. Drop point and Penetration Apparatus for Grease.
10. ASTM Distillation Test Apparatus.
11. Cloud and Pour Point Apparatus.