B.TECH. HR-21 COURSE STRUCTURE
MECHANICAL ENGINEERING

(Applicable for the batch admitted from 2021-22 onwards)

Induction Program-2 Weeks

I Year I-Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course code</th>
<th>Subject</th>
<th>Hours Per Week</th>
<th>Credits</th>
<th>Scheme of Evaluation</th>
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<tr>
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<td>21ES1CS01</td>
<td>Problem Solving using C</td>
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<td>5</td>
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Non Credit Courses

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<td>9</td>
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<td>Engineering Projects in Community Services</td>
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I Year II-Semester

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<td>Int.  Ext.  Tot.</td>
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<td>21AC2HS01</td>
<td>Social and Health Consciousness</td>
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Matrix Algebra and Calculus

(Common to ME/ EEE/ECE/CSE/CSC/ CDS/CSM/CSO)

Pre-requisite: Basics of Matrices, Differentiation and Integration

Course Objectives:

Develop ability to
1. Understand various types of matrices, properties and rank of the matrix to find the solution for system of equations, if it exists.
2. Concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form of a matrix.
3. Geometrical approach to the mean value theorems and their applications to the mathematical problems.
4. Evaluation of surface areas and volumes of revolutions of curves.
5. Evaluation of improper integrals using Beta and Gamma functions.
6. Solve first and higher order differential equations of various types.
7. Identify the methods of solving the differential equations of first and higher order applications namely, orthogonal trajectories, and Newton’s law of cooling, Natural growth and decay, Electrical circuits.

MODULE I

Unit 1: MATRICES

Unit 2: LINEAR SYSTEM OF EQUATIONS
Solution of a linear algebraic system of equations (homogeneous and non-homogeneous). Gauss’s- Elimination and LU decomposition method.

MODULE II

Unit 1: EIGEN VALUES AND EIGEN VECTORS
Symmetric, Hermitian, skew-symmetric, skew-Hermitian, orthogonal and unitary matrices; Determination of eigenvalues and eigenvectors of a matrix, properties of eigenvalues and eigenvectors (without proof), Cayley-Hamilton theorem (without proof), Diagonalization of a matrix, Orthogonal diagonalization of symmetric matrices.

Unit 2: QUADRATIC FORMS
Definiteness and nature of a quadratic form, reduction of quadratic form to canonical forms by orthogonal transformation.

MODULE III

Unit 1: DIFFERENTIAL CALCULUS
Mean Value Theorems: Rolle’s Theorem, Lagrange’s theorem (Statement and Geometrical Interpretation) Cauchy’s mean value theorem. Taylor’s, Maclaurin’s series, applications and approximation of a function by Taylor’s series.
Unit 2: INTEGRAL CALCULUS
Applications of definite integrals to evaluate surface areas and volumes of revolution of curves (only in Cartesian coordinates).
Definition of improper integral: Beta and Gamma functions and their applications.

MODULE IV
Unit 1: FIRST ORDER ODE
Geometric interpretation of solutions of first order ODE $\frac{dy}{dx} = f(x, y)$, Exact differential equations, Integrating factors, Linear and Bernoulli’s equations.

Unit 2: APPLICATIONS

MODULE V
Unit 1: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER
Higher order homogeneous and non-homogeneous linear differential equations with constant coefficients. Non-homogeneous of the type $e^{ax}$, $\cos ax$, $\sin ax$, $x^k$, $e^{ax}V$ and $x^kV$. Method of variation of parameters.

Unit 2: LDE WITH VARIABLE COEFFICIENTS
Cauchy-Euler’s and Legendre’s differential equations. Applications: Electrical Circuits.

TEXT BOOKS:

REFERENCE BOOKS:

MOOC Courses:
1. Differential Equations: https://nptel.ac.in/courses/111/102/111102133/
2. Calculus: https://nptel.ac.in/courses/111/107/111107108/
3. Calculus: https://nptel.ac.in/courses/111/105/111105122/

E-Books:
1. Advanced Engineering Mathematics by R.K. Jain
   https://1lib.in/book/16822856/8e87eb
2. Higher Engineering Mathematics” B.S. Grewal
   https://1lib.in/book/2352263/9368cb
3. Advanced Engineering Mathematics by Erwin kreyszig
   https://1lib.in/book/1213502/92e465
4. Advanced Modern Engineering Mathematics by Glyn James
   https://1lib.in/book/1204739/431eb2

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

**CO1: Determine** the rank of a matrix, solution of the system of equations, Eigen values and
   Eigen vectors of the matrix also canonical form of quadratic form by orthogonal
   transformations.

**CO2: Solve** the applications of mean value theorems of the mathematical problems.

**CO3: Evaluate** applications of Definite integrals and improper integrals using Beta and
   Gamma functions.

**CO4: Apply** first and higher order differential equations to solve problems like
   orthogonal trajectories, Newton's law of cooling, Natural growth and
decay, Electrical circuits.

<table>
<thead>
<tr>
<th>Course Outcomes (COs)</th>
<th>Program Outcomes (POs)</th>
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<tbody>
<tr>
<td></td>
<td>PO 1</td>
</tr>
<tr>
<td>CO1</td>
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<td>CO2</td>
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<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
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ENIGNEERING PHYSICS
(MECHANICAL ENGINEERING)

Pre-requisite: Basic definitions and concepts of Intermediate Physics (10+2)

Course Objectives:
1. The course aims at making students to understand the basic concepts of Principles of Physics in a broader sense with a view to lay foundation for the various engineering courses.
2. Students will be able to demonstrate competency and understanding of the concepts found in Mechanics, Harmonic Oscillations, wave Optics, Lasers, Fiber Optics and a broad base of knowledge in physics.
3. The main purpose of this course is to equip engineering undergraduates with an understanding of the scientific method, so that they may use the training beneficially in their higher pursuits.
4. Today the need is to stress principles rather than specific procedures, to select areas of contemporary interest rather than of past interest, and to condition the student to the atmosphere of change he will encounter during his carrier.

Module I
Introduction to Mechanics (8hr)

Unit 1: Introduction to classical Mechanics
Transformation of scalars and vectors under Rotation transformation, Forces in Nature, Newton’s laws and its completeness in describing particle motion, Form invariance of Newton’s second law

Unit 2: Motion of Particle in coordinate systems
Solving Newton’s equations of motion in polar coordinates, Problems including constraints and friction, Extension to cylindrical and spherical coordinates

Module II
Harmonic Oscillations (8hr)

Unit 1: Simple Harmonic Motion
Equation of linear SHM in differential form, application to pendulum and rotating disc

Harmonic Oscillations Mechanical and electrical simple harmonic oscillators, Complex number notation and phase representation of simple harmonic motion

Unit 2: Damped harmonic oscillator
Equation of motion for Damped harmonic oscillator, heavy, critical and light damping, Energy decay in a damped harmonic oscillator, Quality factor, Mechanical and electrical oscillators, Mechanical and electrical impedance, Steady state motion of forced damped harmonic oscillator, Power observed by oscillator.
Module III Optics (8hr)

Unit 1: Interference
Interference: Coherence, Young’s double slit experiment, division of amplitude and division of wave front, interference in thin films (transmitted and reflected light), and Newton’s rings experiment.

Unit 2: Diffraction & Polarization: Diffraction: Distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction due to single slit, diffraction grating, determination of wavelength of light using diffraction grating. Introduction to Polarization, Malus’s law, double refraction, Nicol prism.

Module IV: Lasers and Fibre Optics (8hr)

Unit 1: Lasers

Unit 2: Fiber Optics
Introduction to fiber optics, Construction and working principle of Optical fiber, Acceptance angle, Acceptance cone and Numerical aperture, Step and Graded index fibres, Losses associated with optical fibres, Applications of optical fibres.

Module V: Ultrasonics and Nanoscience (8hr)

Unit 1: Ultrasonics
Introduction, Production of ultrasonic waves, Magnetostriction method, Piezo electric method, Detection of ultrasonic waves, Properties of ultrasonic waves, Use of ultrasonics for non-destructive testing, Applications of ultrasonics

Unit 2: Nanoscience
Origin of nanoscience, nanoscale, surface to volume ratio, quantum confinement, and bottom-up fabrication: Sol-Gel, top-down fabrication: ball mill method, characterization by XRD, SEM and TEM.

Text Books:

1. Applied Physics, Dr. M. N. Avadhanulu, Dr. TVS Arun Murthy, - S Chand and Company Ltd. Publications.
4. Engineering Physics by Dr. S.L. Gupta and Sanjeev Gupta- Dhanpat Rai publications
Reference Books:
1. Engineering Mechanics, 2\textsuperscript{nd} Edition – MK Harbola
2. O.Svelto “Principles of Laser” - Springer
4. Modern Engineering Physics by Dr.K.Vijaya Kumar, Dr.S.Chandralingam, S.CHAND & COMPANY LTD

MOOCS Courses:
1. “Nanotechnology, Science and Applications” By Prof. Prathap Haridos IIT Madras NPTEL visit https://onlinecourses.nptel.ac.in/noc19_mm21

Course Outcomes:
1. CO1: Solve Newton’s equation of motion of a particle in polar, Spherical and Cylindrical coordinates
2. CO2: Analyze the Physical bodies how they generate and Transmit the waves upon the action of forces on them
3. CO3: Apply the optical phenomenon for the production of laser radiation and optical fibers applications
4. CO4: Determine wavelength of the light radiation based on properties of light which are interference and Diffraction

<table>
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<tr>
<th>CO-PO Mapping Chart</th>
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<tbody>
<tr>
<td>(3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low</td>
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<tr>
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<td>CO1</td>
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ENGLISH
(Common to CSE/EEE/ECE/CSM/CSD/CSC/CSO/ME)

PREREQUISITE(S):

1. Basic knowledge of English language
2. Structure of Sentences/ Sentence formation
3. Basic Grammar rules (LSRW Skills)
4. Basic Communication Skills

COURSE OBJECTIVES:

1. To improve the language proficiency of students in English with an emphasis on vocabulary, Grammar, Reading and Writing skills.
2. To comprehend the given texts and respond appropriately
3. To be able to integrate their ideas with those of others using summary, paraphrase, analysis, and synthesis of relevant sources.
4. To develop study skills and communication skills in formal and informal situations.
5. The students will analyse work(s) of literature in one or more interpretive contexts or frameworks

Module I ‘The Raman Effect’

UNIT 1: The Raman Effect

UNIT 2: Vocabulary- The concept of Word formation, Use of Suffix & Prefixes.
Grammar-Identifying common errors in Articles.
Reading Skills- Reading and its importance, techniques of effective reading.
Writing Skills- Sentence structures, Phrases and clauses, Punctuation, Techniques for writing precisely, Paragraph writing, organises principles (coherence & cohesion) of paragraph in documents.

Module II My Struggle for an Education

UNIT 1: My Struggle for an Education

UNIT 2: Vocabulary- Synonyms and Antonyms, Homophone, Homonym, Homograph, Prepositions and Phrasal verbs
Grammar- Identifying Common errors in Noun-pronoun Agreement and Subject-verb Agreement.
Reading- Improving Comprehension Skills, Techniques for Good Comprehension Writing- Format of a Formal Letter, Letter of complaint & Requisition, Job Application and Resume.
Module III ‘Blue Jeans’

UNIT 1: ‘Blue Jeans’

UNIT 2: Vocabulary: Acquaintance with Prefixes and Suffixes from Foreign Languages, to form Derivatives- Words from Foreign Languages and their Use in English.
Grammar: Misplaced Modifiers, Info-Transfer, Tenses.
Reading: Sub-skills of Reading- Skimming and Scanning
Writing: Nature and Style of effective writing- Defining- Describing (objects, Places and Events) Classifying- providing examples or evidence.

Module IV What Should You Be Eating

UNIT 1: What Should You Be Eating

UNIT 2: Vocabulary: Standard Abbreviations in English
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Comprehension- Intensive Reading and Extensive Reading
Writing: Writing Practices—Writing Introduction and Conclusion - Essay Writing.

Module V How a Chinese Billionaire Built Her Fortune’

UNIT 1: How a Chinese Billionaire Built Her Fortune

UNIT 2: Vocabulary: Technical Vocabulary and their usage.
Grammar: Practice exercises in common mistakes, Active & Passive Voice
Reading: Reading Comprehension-Exercises.

Textbook:


E-books:
High School English Grammar (issuhub.com)

References:
Equivalent MOOC Courses:

1.  [http://nptel.ac.in/courses/109106066/](http://nptel.ac.in/courses/109106066/)
2.  [http://nptel.ac.in/courses/109106067/](http://nptel.ac.in/courses/109106067/)
3.  [http://nptel.ac.in/courses/109104030/](http://nptel.ac.in/courses/109104030/)
4.  [http://nptel.ac.in/courses/109104031/](http://nptel.ac.in/courses/109104031/)
6.  Technical English for Engineers - Course (nptel.ac.in)

Course Outcomes:
After undergoing this course, students will be able to:
CO 1: Understand explicit and implicit meaning of a text through known and unknown passages.
CO 2: Demonstrate Language skills in both formal and informal communication.
CO 3: Construct sentences using logical flow of thought and organize ideas.
CO 4: Select appropriate words, phrases & grammatical units and apply them in both spoken & written communications.

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Problem Solving using C
(Common to CSE/CSM/CDS/CSC/CSO/ECE/EEE/IOT)

Prerequisite: NIL

Course Objectives:

1. To learn the fundamentals of computers.
2. To understand the various steps in program development.
3. To learn the syntax and semantics of C programming language.
4. To learn the usage of structured programming approach in solving problems.

Module I
Unit 1: Introduction to components of a computer
Memory, processor, I/O Devices, storage, operating system; Concept of assembler, compiler, interpreter, loader and linker.


Unit 2: Introduction to C Programming Language
History of C, Basic structure of a C program, Process of compiling and running a C program; C Tokens: Keywords, Identifiers, Constants, Strings, Special symbols, Variables, Data types; Operators, Precedence of Operators, Expression evaluation, Formatted Input/Output functions, Type Conversion and type casting.

Module II
Unit 1: Decision Making Statements and Unconditional Control Structures
Simple if, if-else, else if ladder, Nested if, switch case statement;
break, continue and goto statements.

Unit 2: Loop control statements
for, while and do while loops, nested loops.

Module III
UNIT 1: Arrays:
Introduction, Single dimensional array and multi-dimensional array: declaration, initialization, accessing elements of an array; Operations on arrays: traversal, reverse, insertion, deletion, merge, search; Strings: Arrays of characters, Reading and writing strings, String handling functions, Operations on strings; array of strings.
UNIT 2: Functions

Concept of user defined functions, Function declaration, return statement, Function prototype, Types of functions, Inter function communication, Function calls, Parameter passing mechanisms; Recursion; Passing arrays to functions, passing strings to functions; Storage classes.

Module- IV

UNIT 1: Pointers:

Basics of pointers, Pointer arithmetic, pointer to pointers, array of pointers, Generic pointers, Null pointers, Pointers as functions arguments, Functions returning pointers; Dynamic memory allocation.

UNIT 2: Structures

Structure definition, initialization, structure members, nested structures, arrays of structures, structures and functions, structures and pointers, self-referential structures; Unions: Union definition, initialization, accessing union members; bit fields, typedef, enumerations, Preprocessor directives.

Module V

UNIT 1: Preprocessor

Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef

UNIT 2: File Handling

Concept of a file, text files and binary files, streams, standard I/O, formatted I/O, file I/O operations, error handling, Line I/O, miscellaneous functions; Applications in C.

TEXT BOOKS:


REFERENCE BOOKS:

WEB RESOURCES:

3. https://www.nptel.ac.in/courses/108106073/

E-BOOKS:

Course Outcomes:

CO1 - Apply the fundamentals of computer and programming language, to draw flow chart, algorithm to solve given program.
CO2 - Comprehend the general structure of C program using control structures, functions, recursion to support reusability.
CO3 - Apply searching and sorting algorithms for the given list of elements
CO4 - Design an application to solve real world problem.

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<th>Program Specific Outcomes*</th>
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<tr>
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<tr>
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BUSINESS ECONOMICS AND FINANCIAL ANALYSIS
(Common to CSE/ECE/EEE/ME/CSM/CSD/ CSC/CSO)

Pre-requisite: Nil

Course Objectives:
1. Describe concepts of business economics and demand analysis to help in optimal decision making in business environment
2. Differentiate the functional relationship between Production and factors of production and able to compute break-even point to illustrate the various uses of break-even analysis
3. Identify various market structures and discuss their implications for resource allocation
4. Explain various accounting concepts and different types of financial ratios for knowing financial positions of business concern.
5. Demonstrate an understanding of the concept of capital budgeting and allocations of the resources through capital budgeting methods and compute simple problems for project management.

Module I INTRODUCTION TO BUSINESS AND ECONOMICS
Unit-1: Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company

Module II DEMAND AND SUPPLY ANALYSIS
Unit-1: Elasticity of Demand: Demand, Law of Demand, Elasticity, Types of Elasticity, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand.
Unit-2: Demand Forecasting: Steps in Demand Forecasting, Methods of Demand Forecasting.
Supply Analysis: Determinants of Supply, Supply Function & Law of Supply

Module III PRODUCTION, COST, MARKET STRUCTURES & PRICING
Unit-1: Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions. Cost analysis: Types of Costs, Short run and Long run Cost Functions.
Module IV INTRODUCTION TO FINANCIAL ACCOUNTING
Unit-2: Final Accounts: Elements of Financial Statements, Preparation of Final Accounts: Trading account, Profit & Loss Account, Balance sheet

Module V CAPITAL BUDGETING
Unit 1: Capital and its Sources: Significance, types of capital, estimation of fixed and working capital requirements, methods and sources of raising capital
Unit 2: Capital budgeting: Features of capital budgeting proposals; Methods of capital budgeting: Payback period, accounting rate of return (ARR), net present value method and internal rate of return method (simple problems).

Text Books:

Reference Books:

Web Resources:
1. https://books.google.co.in/books/about/Managerial_economics_and_financial_analysis.html
3. http://all4ryou.blogspot.in/2012/06/mefa-managerial-economics-andfinancial-analysis.html
4. http://books.google.com/books/about/Managerial_economics_and_financial_analysis.html

Course Outcomes:
1. CO1: Students will be able to understand economics and business economic concepts
2. CO2: Students will be able to differentiate different business organisations and nurture the idea of start-ups
3. CO3: Students will be able to analyze operations of markets under varying competitive conditions
4. CO4: Apply accounting concepts and methods to interpret financial statements for evaluating the financial position and performance of organizations
## CO-PO Mapping Chart

(3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low

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<th>Course Outcomes (COs)</th>
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ENGENEERING PHYSICS LAB
(MECHANICAL ENGINEERING)

Pre-requisite: Basic concepts of Intermediate Physics (10+2)

Experiments:
Perform any 8 of the following experiments

1. Coupled oscillator- To determine the spring constant
2. Melde’s experiment- To determine the frequency of a vibrating bar or tuning fork using Melde’s arrangement
3. Torsional pendulum- To determine the rigidity modulus of the material of the given wire using Torsional pendulum
4. Newton’s rings - To determine the radius of the curvature of a lens by forming Newton’s rings
5. Diffraction grating- To determine the number of lines per inch of the grating
6. Dispersive power of prism- To determine the dispersive power of prism by using spectrometer
7. LCR Circuit- To determine the quality factor and resonant frequency of LCR circuit
8. LASER diode characteristics- To study the V-I Characteristics of LASER source
9. Optical fiber - To find bending loses of optical fiber
10. Optical fiber- To determine the Numerical Aperture of a given fiber

Course Outcomes

CO 1: Design the equivalent circuit of semiconductor optoelectronics devices to study their V-I characteristics of Laser
CO 2: Apply the Knowledge of Waves and oscillations in determination of Frequency of standard waves, spring constant and Elastic properties of given solid wire
CO3: Apply the concepts of optics for study the characteristics of Optical fiber
CO4: Apply the properties of light in determination of wavelength of Monochromatic light and dispersive power of prism
### CO-PO Mapping Chart

(3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low

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English Language Communication Skills Laboratory
(Common to CSE/EEE/ECE/CSM/CSD/CSC/CSO/ME)

Pre-requisite: The knowledge of following concepts is essential to understand the subject
1. Basic knowledge of English language
2. Structure of Sentence/ Sentence formation
3. Basic Grammar rules (LSRW Skills)
4. Basic Communication Skills

Course Objectives:
1. To facilitate computer-assisted multimedia 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 speaking in English and neutralize their mother tongue interference.
5. To train students use language appropriately speaking in various activities like role plays, group discussions, interviews and presentation skills etc.

Note: All the given below exercises have to be performed

Exercise I
CALL Lab- Introduction to Speech Sounds
Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.

ICS Lab- Ice-Breaking activity and JAM session
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, Discussion on eating habits

Exercise II

Exercise III
CALL Lab- Word Stress & Formation

ICS Lab- Descriptions and Giving Directions

Exercise IV
CALL Lab - Interpersonal Communication Skills & Building Vocabulary
Starting a conversation – responding appropriately and relevantly – using the right body language –Discourse Skills- using visuals-Graphical organization - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word

ICS Lab- Oral Presentation Skills
Understand: Structured Talks - Non-verbal Communication- Presentation Skills-Individual and Group,
Practice: Making a Short Speech – Extempore- Making a Presentation- Individual and Group

Exercise V
CALL Lab- Reading Skills
Understand: Reading Comprehension and different techniques of it- Extensive- Intensive- Skimming- Scanning

ICS Lab - Group Discussion- Interview Skills
Understand: Group Discussion- Interview Skills. Practice: Group Discussion- Mock Interviews through Tele-conference & video-conference. Etiquette

Lab Manuals

Suggested Software
1) Cambridge Advanced Learners’ English Dictionary with CD.
2) Grammar Made Easy by Darling Kindersley.
3) Punctuation Made Easy by Darling Kindersley.
5) English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
7) TOEFL and GRE (KAPLAN, AARCO and BARRONS, USA, Cracking GRE by CLIFFS).
Reference Books:
1. *Effective Communication Skills: Tips on How to Improve Your Social Skills and Interact with Others Effectively* by Robert Cunningham, Independently Published, 2018

Course Outcomes:
1. CO1: Acquire vocabulary and use it contextually
2. CO2: Apply listening and speaking skills effectively
3. CO3: Develop proficiency in academic reading and writing
4. CO4: Build up the possibilities of job prospects

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CO-PO Mapping Chart (3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low
Problem Solving using C Lab

(Common to CSE/CSM/CDS/CSC/CSO/ECE/EEE/IOT)

Pre-requisite: Nil

Course Objectives:

1. To learn the fundamentals of computers.
2. To understand the various steps in program development.
3. To learn the syntax and semantics of C programming language.
4. To learn the usage of structured programming approach in solving problems.

Week – 1: OPERATORS AND EVALUATION OF EXPRESSIONS

a. Design and develop a flowchart and algorithm to read a number and implement using a C program to check whether the given number is even or odd using ternary operator.
b. Design and develop a flowchart and algorithm to read two integers and implement using a C program to perform the addition of two numbers without using + operator.
c. Develop a C program to evaluate the following arithmetic expressions by reading appropriate input from the standard input device. Understand the priority of operators while evaluating expressions.
   i. 6*2/(2+1 * 2/3 +6) +8 *(8/4)
   ii. 17 – 8/4 * 2 + 3 - ++2
   iii. !(x > 10 ) && ( y == 2 )
d. Develop a C program to display the size of various built-in data types in C language.

Week – 2: CONTROL STRUCTURES

a. Design and develop a flowchart and algorithm to read a year as an input and find whether it is leap year or not. Implement a C program for the same and execute for all possible inputs with appropriate messages. Also consider end of the centuries.
b. Design and develop a flowchart and algorithm to find the square root of a given number N. Implement a C program for the same and execute for all possible inputs with appropriate messages. (Note: Don’t use library function sqrt(n), Hint: Use Newton-Raphson method to find the square root).
c. Design and develop a flowchart and algorithm to generate a Fibonacci sequence up to a given number N. A 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. Implement a C program for the developed flowchart/algorithm and execute the same to generate the first N terms of the sequence.
d. Design and develop a flowchart and algorithm that takes three coefficients (a, b, and c) of a Quadratic equation (ax^2+bx+c=0) as input and compute all possible roots. Implement a C program for the developed flowchart/algorithm and execute the same to output the possible roots for a given set of coefficients with appropriate messages.
Week – 3: CONTROL STRUCTURES

a. Design and develop an algorithm to find the reverse of an integer number N and check whether it is PALINDROME or NOT. Implement a C program for the developed algorithm that takes an integer number as input and output the reverse of the same with suitable messages. Ex: N: 2020, Reverse: 0202, Not a Palindrome.

b. Draw the flowchart and write C Program to compute sin(x) using Taylor series approximation given by

\[\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots\]

Compare the result with the built-in Library function and print both the results with appropriate messages.

c. Design and develop an algorithm and flowchart to read a three digit number and check whether the given number is Armstrong number or not. Write a C program to implement the same and also display the Armstrong numbers between the ranges 1 to 1000.

d. Design and develop an algorithm for evaluating the polynomial \( f(x) = a_4x^4 + a_3x^3 + a_2x^2 + a_1x + a_0 \), for a given value of \( x \) and its coefficients using Horner’s method. Implement a C program for the same and execute the program for different sets of values of coefficients and \( x \).

Week – 4: ARRAYS

a. Develop, implement and execute a C program to read a list of integers and store it in a single dimensional array. Write a C program to print the second largest integer in a list of integers.

b. Develop, implement and execute a C program to read a list of integers and store it in a single dimensional array. Write a C program to count and display positive, negative, odd and even numbers in an array.

c. Develop, implement and execute a C program to read a list of integers and store it in a single dimensional array. Write a C program to find the frequency of a particular number in a list of integers.

d. Develop, implement and execute a C program that reads two matrices A (m x n) and B (p x q) and Compute the product A and B. Read matrix A and matrix B in row major order respectively. Print both the input matrices and resultant matrix with suitable headings and output should be in matrix format only. Program must check the compatibility of orders of the matrices for multiplication. Report appropriate message in case of incompatibility.

Week – 5: STRINGS

a. Develop a user-defined function \texttt{STRCOPY (str1, str2)} to simulate the built-in library function \texttt{strcpy (str1, str2)} that copies a string \texttt{str2} to another string \texttt{str1}. Write a C program that invokes this function to perform string copying. Also perform the same operation using built-in function.

b. Develop a user-defined function \texttt{STRCONCT (str1, str2)} to simulate the built-in library function \texttt{strcat (str1, str2)} that takes two arguments \texttt{str1} and \texttt{str2}, concatenates \texttt{str2} and \texttt{str1} and stores the result in \texttt{str1}. Write a C program that invokes this function to perform string concatenation. Also perform the same operation using built-in function.

c. Develop a C program that returns a pointer to the first occurrence of the string in a
given string using built-in library function `strstr()`. Example: `strstr()` function is used to locate first occurrence of the string “test” in the string “This is a test string for testing”. Pointer is returned at first occurrence of the string “test”.
d. Develop a C program using the library function `strcmp (str1, str2)` that compares the string pointed to by `str1` to the string pointed to by `str2` and returns an integer. Display appropriate messages based on the return values of this function as follows –

```c
if return value < 0 then it indicates str1 is less than str2.
if return value > 0 then it indicates str2 is less than str1.
if return value = 0 then it indicates str1 is equal to str2.
```

**Week – 6: FUNCTIONS**

a. Design and develop a recursive and non-recursive function `FACT (num)` to find the factorial of a number, n!, defined by `FACT(n) = 1, if n = 0. Otherwise FACT (n) = n * FACT(n-1).` Using this function, write a C program to compute the binomial coefficient. Tabulate the results for different values of n and r with suitable messages.
b. Design and develop a recursive function `GCD (num1, num2)` that accepts two integer arguments. Write a C program that invokes this function to find the greatest common divisor of two given integers.
c. Design and develop a recursive function `FIBO (num)` that accepts an integer argument. Write a C program that invokes this function to generate the Fibonacci sequence up to num.
d. Design and develop a C function `ISPRIME (num)` that accepts an integer argument and returns 1 if the argument is prime, a 0 otherwise. Write a C program that invokes this function to generate prime numbers between the given ranges.
e. Design and develop a function `REVERSE (str)` that accepts a string arguments. Write a C program that invokes this function to find the reverse of a given string.

**Week – 7: POINTERS**

a. Develop a C program using pointers to compute the sum, mean and standard deviation of all elements stored in an array of n real numbers.
b. Develop a C program to read a list of integers and store it in an array. Then read the array elements using a pointer and print the value along with the memory addresses.
c. Design and develop non-recursive functions `input_matrix (matrix, rows, cols)` and `print_matrix(matrix, rows, cols)` that stores integers into a two-dimensional array and displays the integers in matrix form. Write a C program to input and print elements of a two dimensional array using pointers and functions.
d. Develop a C program to store a list of integers in a single dimensional array using dynamic memory allocation (limit will be at run time) using `malloc ()` function. Write a C program to read the elements and print the sum of all elements along with the entered elements. Also use `free ()` function to release the memory.
Week – 8: STRUCTURES AND UNIONS

a. Write a C program that uses functions to perform the following operations:
   i. Reading a complex number
   ii. Writing a complex number
   iii. Addition and subtraction of two complex numbers
   Note: represent complex number using a structure.

b. Write a C program to compute the monthly pay of 100 employees using each employee’s name, basic pay. The DA is computed as 52% of the basic pay. Gross-salary (basic pay + DA). Print the employees name and gross salary.

c. Create a Book structure containing book_id, title, author name and price. Write a C program to pass a structure as a function argument and print the book details.

d. Create a union containing 6 strings: name, home_address, hostel_address, city, state and zip. Write a C program to display your present address.

Week – 9: ADDITIONAL PROGRAMS

a. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: $1 + x + x^2 + x^3 + \ldots + x^n$. 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. Develop a C program to find the 2’s complement of a given binary number. 2’s complement 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.

c. Develop a C program to convert a Roman numeral to its decimal equivalent. E.g. check for the inputs - Roman number IX is equivalent to 9 and Roman number XI is equivalent to 11.

Week – 10: PREPROCESSOR DIRECTIVES

a. Define a macro with one parameter to compute the volume of a sphere. Write a C program using this macro to compute the volume for spheres of radius 5, 10 and 15 meters.

b. Define a macro that receives an array and the number of elements in the array as arguments. Write a C program for using this macro to print the elements of the array.

c. Write symbolic constants for the binary arithmetic operators +, -, *, and /. Write a C program to illustrate the use of these symbolic constants.

Week – 11: FILES

a. Create an employee file employee.txt and write 5 records having employee name, designation, salary, branch and city. Develop a C program to display the contents of employee.txt file.

b. Create a studentolddata.txt file containing student name, roll no, branch, section,
address. Develop a C program to copy the contents of \texttt{studentolddata.txt} file to another file \texttt{studentnewdata.txt}.

c. Develop a C program to create a text file \texttt{info.txt} to store the information given below. Implement using a C program to count the number of words and characters in the file \texttt{info.txt}.

\textbf{Test Data:}

Input the file name to be opened: \texttt{info.txt}

\textbf{Expected Output:}

The content of the file info.txt are:

Welcome to IARE

Welcome to Computer Programming

The number of words in the file info.txt are: 7

The number of characters in the file info.txt are: 46

d. Given two university information files “\texttt{studentname.txt}” and “\texttt{roll_number.txt}” that contains students Name and Roll numbers respectively. Write a C program to create a new file called “\texttt{output.txt}” and copy the content of files “\texttt{studentname.txt}” and “\texttt{roll_number.txt}” into output file. Display the contents of output file “\texttt{output.txt}” on to the screen.

\begin{tabular}{|l|l|}
\hline
\texttt{studname.txt} & \texttt{roll_number.txt} \\
\hline
Asha & 20951A1201 \\
Bharath & 20951A0502 \\
Uma & 20951A0456 \\
Shilpa & 20951A0305 \\
\hline
\end{tabular}

\textbf{Week – 12: COMMAND LINE ARGUMENTS}

a. Develop a C program to read a set of arguments and display all arguments given through command line.

b. Develop a C program to read a file at command line argument and display the contents of the file.

c. Develop a C program to read N integers and find the sum of N integer numbers using command line arguments.

d. Develop a C program to read three integers and find the largest integer among three using command line argument.
Text Books:

REFERENCE BOOKS:


Course Outcomes:

The candidate is expected to be able to

1. CO1 - Formulate the algorithms for simple problems, translate given algorithms to a working and correct program, correct syntax errors as reported by the compilers.
2. CO2 - Identify and correct logical errors encountered during execution, represent and manipulate data with arrays, strings and structures
3. CO3 - use pointers of different types, create, read and write to and from simple text and binary files
4. CO4 - modularize the code with functions so that they can be reused

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CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 - Low
Subject Code: 21AC1ME02

Engineering Project in Community Service
(Common to All Branches)

Pre-requisite: Nil

Course Objectives:
1. Apply domain knowledge to solve the real world problems.
2. Identify and acquire new knowledge as a part of the problem solving / design process.
3. Design products on multidisciplinary concepts and an appreciation for the contributions from individuals from multiple disciplines.
4. Build a role that their discipline can play in social contexts.
5. Provide significant service to the community while learning; gain an understanding of the role that engineering (and their discipline) can play in society.

Module 1

Unit 1: Problem Identification
Introduction to EPICS, Idea Generation (brain storming/workshop/seminar), Brain storming

Unit 2: Societal Survey
Rural area Survey (societal issues), interaction with NGOs, Idea Generation and Group Discussions.

Module II

Unit 1: Specification Development
Customer Requirement, Design Constraints, Engineering Specifications

Unit 2: Product Survey
Community Partner allotment, Design Thinking activity

Module III

Unit 1: Conceptual Design
Decision matrix, community partner interview, Brainstorming (possible solutions)

Unit 2: Poster Presentation
Documentation & Team wise presentation

Module IV:

Unit 1: Project Specification
Prototype-1 Development, Testing, customer feedback

Unit 2: Project Specification
Prototype-1 presentation, Feedback Report of customer & advisor, Action plan for the next prototype
Module V:

Unit 1: Detailed Design
Video preparation on conceptual design, Prototype-2 Development, Testing, customer feedback, Presentation

Unit 2: Detailed Design
Make progress on the project and appropriately engage project partners, Complete Design review feedback summary, and Individual and Project documentation, Project Expo

Text Books:

Reference Books:

Web Resources:
https://engineering.purdue.edu/EPICS/Resources/Lectures,
https://unnatbharatabhiyan.gov.in:8443/new-website/
http://www.engineeringchallenges.org/GrandChallengeScholarsProgram.aspx
https://www.ewb-india.org/

Course Outcomes:
  CO1: Formulate the idea with the clear context
  CO2: Derive the functional and non-functional requirements using Design Thinking Process,
  CO3: Contribute as an individual and in team.
  CO4: Develop a project addressing the ethical and societal needs.

| Course Outcomes (COs) | Program Outcomes (POs) | Program Specific Outcomes*
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Advanced Calculus
(Common to ME/ EEE/ECE/CSE/CSC/CSD/CSM/CSO)

Pre-requisite: Mathematics of 10+2 level

Course Objectives: To provide the student with

1. Compute partial derivatives, composite functions of several variables.
2. Finding maxima and minima of function of two and three variables.
3. Evaluate multiple integrals and apply the same to solve engineering problems.
4. Explain properties of vector operators. To determine solenoidal/ irrotational vectors, directional derivatives of vectors.
5. The skill of calculating work done by a field and flux across a surface.
6. The skill of using specialized theorems for fast computation of work and flux.
7. Solve partial differential equations using method of separation of variables and their applications to solve heat and wave equations.

Module I

Unit 1: PARTIAL DIFFERENTIATION
Definitions of Limit and continuity. Partial Differentiation and total differentiation, Jacobian, Functional dependence & independence, Taylor’s series in two variables.

Unit 2: APPLICATIONS OF PARTIAL DIFFERENTIATION
Maxima and Minima of functions of two variables without constraints and with constraints, Method of Lagrange Multipliers.

Module II

Unit 1: MULTIPLE INTEGRALS
Double integrals: Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), change of variables (Cartesian to polar coordinates).
Triple Integrals: Evaluation of triple integrals, Change of variables (Cartesian to Spherical and Cylindrical polar coordinates).

Unit 2: APPLICATIONS OF MULTIPLE INTEGRALS
Areas (by double integrals) and volumes (by double integrals and triple integrals), Centre of mass and Gravity (constant and variable densities) by double and triple integrals.

Module III
Unit 1: FOURIER SERIES
Introduction, Fourier series of periodic functions, Fourier series of even and odd functions, Change of interval, Half range sine and cosine series.

Unit 2: PARTIAL DIFFERENTIAL EQUATIONS
Classification of second order partial differential equations, method of separation of variables for second order partial differential equations, Solution of one-dimensional wave and heat equations.

Module IV
Unit 1: VECTOR DIFFERENTIATION
Introduction: Scalar and vector point functions, Concepts of gradient, divergence and curl of functions in Cartesian framework, Solenoidal fields, irrotational fields.

Unit 2: LINE INTEGRALS
Evaluation of the line integral, concept of work done by a force field, Conservative fields and Potentials.

Module V
Unit 1: SURFACE AND VOLUME INTEGRATION
Surface integration: Evaluation of surface and volume integrals, flux across a surface.

Unit 2: VECTOR INTEGRAL THEOREMS
Vector integral theorems: Green’s, Gauss and Stokes theorems (without proofs) and their applications.

TEXT BOOKS:

REFERENCE BOOKS:

MOOC Courses:
1. Functions of several variables: https://nptel.ac.in/courses/111/104/111104125/
2. Partial Differential equations: https://nptel.ac.in/courses/111/101/111101153/
3. Multivariable calculus: https://nptel.ac.in/courses/111/105/111105122/
Course Outcomes: After learning the contents of this paper the student must be able to

1) **CO1**: Compute the extreme values of functions of two variables with/ without constraints.
2) **CO2**: Find the areas, volumes, Centre of mass and Gravity for cubes, sphere and rectangular parallelepiped by using multiple integrals.
3) **CO3**: Apply method of separation of variables to solve problems like one dimensional wave and heat equations that arise in engineering branches.
4) **CO4**: Calculate scalar potential for a vector, directional derivative of a scalar point function also length of a curve, area between the surfaces & volumes of solids using vector integrations.

### CO-PO/PSO Mapping Chart

(3/2/1 indicates strength of correlation)

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<th>Course Outcomes (COs)</th>
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**ENGINEERING CHEMISTRY**

(Common to CSE/EEE/ECE/MECH/CSM/CSD/CSC/CSO)

**Pre-requisite:** Basic knowledge of chemistry (Physical, Organic, Inorganic and Analytical chemistry)

**Course Objectives:**
1. To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.
2. To impart the basic knowledge of atomic, molecular and electronic modifications which makes the student to understand the technology based on them.
3. To acquire the knowledge of electrochemistry, corrosion and water treatment which are essential for the Engineers and in industry.
4. To acquire the skills pertaining to spectroscopy and to apply them for medical and other fields.
5. To impart the knowledge of genetics and biomolecules.

**Module I: MOLECULAR STRUCTURE**

**UNIT 1: Molecular structure and Theories of Bonding**

Atomic and Molecular orbitals. Linear Combination of Atomic Orbitals (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams of N₂, O₂ and F₂ molecules. π molecular orbitals of butadiene and benzene.

**UNIT 2: Crystal Field Theory (CFT)**

Salient Features of CFT – Crystal Field Splitting of transition metal ion d-orbitals in Tetrahedral, Octahedral and square planar geometries. Band structure of solids and effect of doping on conductance.

**Module II: WATER AND ITS TREATMENT**

**UNIT 1: PROPERTIES OF WATER**


**UNIT 2: TREATMENT OF WATER**

Module III: ELECTROCHEMISTRY AND CORROSION

UNIT 1: Electrochemistry

Electrochemical cells - electrode potential, standard electrode potential, types of electrodes - calomel, Quinhydrone and Glass electrode. Nernst equation, Determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Numerical Problem

Batteries: Primary battery (Lithium cell) and Secondary battery (lead acid and lithium ion cell).

UNIT 2: Corrosion


Module IV: SPECTROSCOPY AND ITS APPLICATIONS

UNIT 1: UV-Visible and IR Spectroscopy


Principles of IR spectroscopy, types of vibrations (stretching & bending), selection rules, instrumentation, number of fundamental vibrations, functional group interpretation and applications of IR spectroscopy.

UNIT 2: NMR Spectroscopy

Introduction and Principle to NMR, selection rules, Instrumentation, Desheilding and shielding, Chemical shifts, Measurement of chemical shifts, Interpretation of number of PMR signals in molecules (acetaldehyde, ethanol, vinyl chloride, acetone, benzene and toluene) and applications. Introduction to Magnetic resonance imaging (MRI) and its applications.

Module V: GENETICS AND BIOMOLECULES

UNIT 1: Genetics

Introduction to cell and its components, gene, mendel’s laws, Concept of segregation and independent assortment. Concept of genetic material passes from parent to offspring. Concept of allele, Gene mapping, Gene interaction, Gene editing, Introduction to CRISPR technology Concept of genetic code.
UNIT 2: Biomolecules

Introduction, Molecules of life- carbohydrates (Glucose and fructose), Amino acids (Types and classification), peptides and proteins (structural and active sites), DNA (single/double stranded) RNA (Types). Protein structural predictions-Homology modelling, Biological Data bases (NCBI, RCSB-PDB)

Text Books:
1. Engineering chemistry by Dr. Jaya Shree-Wiley Publications, 6th edition,2018

Reference Books:
1. Engineering Chemistry by Jain and Jain, Dhanpath ray publishing company,2018
2. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher,2018
4. Engineering chemistry by Dr. Bharathi Kumari- VGS Publications 10th edition,2018
5. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons,2017

E- Books: http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Equivalent MOOC Courses: Concepts of Chemistry for Engineering
https://onlinecourses.nptel.ac.in/noc21_cy49/announcements?force=true

Course Outcomes:
After completion of this course student will able to do

CO1: Explain the configuration and structure of the molecules with theories of bonding and qualitative and quantitative analysis of molecules by spectroscopy

CO2: Identify the suitable method for the treatment of given water sample for industrial and domestic purpose.

CO3: Explain the concepts of electrochemistry and corrosion with their engineering applications.

CO4: Understand the concept of genetics and biomolecules.

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Engineering Graphics

(Common to ME, EEE, ECE, CSE, CSM, CSO, CSD and CSC)

Pre-requisite: Basic Geometry and maths.

Course Objectives:
1. To provide basic concepts in engineering drawing.
2. To impart knowledge about standard principles of orthographic projection of objects.
3. To draw sectional views and pictorial views of solids.
4. To know development of different types of surfaces.
5. To draw Isometric to Orthographic Projections and Vice-versa.

Module I

Unit 1: Introduction to Engineering Drawing & CAD
Drawing Instruments and their uses, types of lines, Lettering, Rules of dimensioning. Construction of polygons - practice only. Conic Sections: Ellipse, Parabola, Hyperbola including the Rectangular Hyperbola - General method only. Introduction to CAD software packages commands.

Unit 2: Engineering Curves & Introduction to Scales
Cycloid, Epicycloid and Hypocycloid, Involute of a circle, Scales – Construction of Plain & Diagonal scales.

Module II

Unit 3: Orthographic Projections of Points and Lines
Orthographic Projection of points and straight lines: Projection of points placed in different quadrants, Projection of straight lines inclined to one and two reference planes placed in first quadrant only.

Unit 4: Orthographic Projections of Planes
Projections of Planes inclined to one and two reference planes placed in first quadrant only.

Module III

Unit 5: Orthographic Projections of Solids
Projections of Solids: Projections of Regular Solids – Regular Polyhedra, solids of revolution, Axis inclined to both planes.

Unit 6: Sections of Solids
Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views
Module IV

Unit 7: Development of Surfaces
Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone.

Unit 8: Intersections of Solids
Intersection of Prism Vs Prism, Cylinders Vs Cylinder - simple treatment only.

Module V

Unit 9: Isometric Projections/views:

Unit 10: Transformation of Projections:
Conversion of Orthographic Views to Isometric Views and Isometric views to orthographic views.

Text Books:

Reference Books:

Equivalent Mooc Courses:
1. https://nptel.ac.in/courses/112/104/112104172/
2. https://nptel.ac.in/courses/112/103/112103019/
4. https://www.greatlearning.in/academy/learn-for-free/courses/engineering-graphics-drawing

Course Outcomes:
CO1 – Construct engineering curves and different scales used in engineering graphics.
CO2 – Demonstrate the orthographic projections of all geometry.
CO3 – Illustrate the position of the sectional planes for given sections of solids.
CO4 – Convert the isometric to orthographic projections and orthographic to isometric projections of solids.
### CO-PO Mapping Chart

(3/2/1 indicates strength of correlation)

**3 – High; 2 – Medium; 1 - Low**

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Pre-requisite: Basics of Engineering Mathematics I & Engineering Physics

Course Objectives:
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 motion and 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

Module I
Unit 1: Fundamentals of mechanics
Introduction to Engineering Mechanics; Rigid body, Force and Force Systems; Coplanar Concurrent Forces - Resolution of forces, Resultant, Moment of Force and its Application; Free body diagrams, Equilibrium of coplanar concurrent forces.

Unit 2: Spatial force system
Forces in Space – Components of forces in space, Resultant; Moment of forces in space; Equilibrium of spatial system of forces.

Module II
Unit 1: Friction
Types of friction, limiting friction, laws of friction, static and dynamic friction, motion of bodies, screw jack and differential screw jack.

Unit 2: Centroid and Centre of Gravity
Centroid of lines and areas from first principle, centroid of composite sections, centre of gravity and its applications; Theorems of Pappus.

Module III
Unit 1: Area moment of inertia
Moment of inertia; parallel axis theorem and perpendicular axis theorem; Moment of Inertia of plane sections from first principles, moment of inertia of composite sections, Product of inertia – definition.
Unit 2: Mass moment of inertia
Transfer formula for Mass moment of inertia, Mass moment of inertia of standard bodies and composite bodies.

Module IV
Unit 1: Kinematics of particles
Rectilinear motion of Particle - Displacement, velocity and acceleration; Curvilinear motion of Particle, Rectangular components of velocity, rectangular components of acceleration. General plane motion - introduction.
Unit 2: Kinematics of rigid bodies
Rotational motion about a fixed axis - Linear and angular velocity, Linear and angular acceleration in fixed axis rotation.

Module V
Unit 1: Kinetics of particles
D’Alembert’s principle and its applications in connected bodies;
Principle of impulse and momentum and its applications.; Impact of Elastic bodies Coefficient of restitution, direct central impact, oblique impact.
Unit 2: Kinetics of rigid bodies
Work- energy principle and its application in connected bodies and rigid body rotation.

Text Books:

Reference Books:

Web Resources:
https://youtu.be/nGfVTNfNwnk
https://youtu.be/TnWBAnkCDuc
Course Outcomes:
1. CO1 – Describe static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions.

2. CO2 – Apply the principles of statics, dynamics to solve engineering problems and also importance of frictional force in real world problems.

3. CO3 – Analyze the properties of surfaces, solids in relation to center of gravity and moment of inertia.

4. CO4 – Illustrate the laws of motion, kinematics and kinetics of motion and their interrelationship.

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ENGINEERING CHEMISTRY LAB
(Common to CSE/EEE/ECE/CSM/CSD/CSC/CSO)

Pre-requisite: Concepts of Chemistry at 10+2 level

Course Objectives:

The student will learn

- Estimation of hardness and chloride content in water to check its suitability for drinking purpose.
- The measurement of physical properties like adsorption and viscosity.
- To synthesize the drug molecules and check the purity of organic molecules by thin layer chromatographic (TLC) technique.
- To quantify the sample by instrumental techniques.

List of Experiments:

Note: Any 10 of the below experiments must be conducted

1. Determination of total hardness of water by complexometric method using EDTA
2. Determination of chloride content of water by Argentometry
3. Estimation of an HCl by Conductometric titrations
4. Estimation of Acetic acid by Conductometric titrations
5. Estimation of HCl by Potentiometric titrations
6. Synthesis of Aspirin and Paracetamol
7. Estimation of copper by colorimetric method.
8. Estimation of iron by colorimetric method
10. Thin layer chromatography calculation of Rf values. Eg ortho and para nitro phenols.
11. Determination of viscosity of castor oil by using Ostwald’s viscometer
12. Determination of surface tension of a given liquid using stalagmometer.

Reference Books:

3. Laboratory manual of engineering chemistry, Bharthi kumari, VGS Techno series 1st Edition

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

CO1: Estimate the hardness and chloride content in given water sample.
CO2: Determination of physical properties like acid value, surface tension and viscosity.
CO3: Apply the knowledge to synthesize drug molecules and check the purity of sample by TLC technique.
CO4: Determine the strength of the given sample by appropriate instrumental method.
## CO-PO Mapping Chart

(3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low

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MATLAB & SIMULINK

Pre-requisite: Basic Mathematics & Physics

Course Objectives:
1. To provide knowledge in the design of schematics for basic circuits.
2. To make the students to gain more proficient of MATLAB Modules.
3. To train the students to create their own designs using MATLAB.
4. Apply MATLAB for the control of industrial applications.

All experiments are compulsory by using any open source software (Scilab)

1. Compute the basic mathematical calculations like trigonometric, exponential, logarithmic functions, complex numbers, logical.
2. Compute the matrix operations and arrays.
3. Write a program for computing the factorial of any integer n and the geometric series $1+r+r^2+r^3+...+r^n$ for a given r and n.
4. Write a program for printing the Fibonacci series using ‘for’ loop.
5. Create sine plot, cosine plot and show them in the two of 4 subplots by using MATLAB Graphic commands.
6. Draw 3D plots using MATLAB commands.
7. Draw sine wave and measure the current and voltage using SIMULINK.
8. Design the rectifier and Inverter using SIMULINK.
9. Introduction to tool boxes in SIMULINK.
10. Design of simple RLC circuits and measurement of voltage and current using SIMULINK.

TEXT BOOKS:
1. “MATLAB and Its Applications in Engineering”, by Ashok K. Goel, Manoj Kumar Sharma, and Raj Kumar Bansal.

REFERENCE BOOKS:

Web Resources:
E-Books:

3. Introduction to MATLAB for Engineers William J. Palm III.

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

1. CO1 – Apply different types of commands to execute the instructions in MATLAB.
2. CO2 – Able to understand the functions and loops to implement for real-time applications.
3. CO3 – Able to analyse the various tool box with real-time applications
4. CO4 – Able to design the multidisciplinary projects.

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CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 – Low
Engineering Prototyping Lab

(Common to CSE/EEE/ECE/CSM/CSD/CSC/CSO/ME)

Prerequisites: Practical skill

Course Objectives:
1. To provide the basic knowledge of fundamental tools used by engineers in manufacturing environment, wiring in electrical circuits, design of electronic components on PCB and knowledge on computer peripherals.
2. To gain a basic working knowledge required for the production of various engineering products.

List of Experiments:

PART A: Mechanical Workshop

Note: Any Seven experiments should be conducted from all Trades
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)
5. Welding Practice – (Arc Welding & Gas Welding)
7. House wiring-(One lamp control using two 2-way switches (staircase wiring), Wiring of distribution box with MCB, Wiring of three bulbs - Series & parallel connections).

PART B: IT Workshop

Note: Any three experiments should be conducted
1. Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.
2. Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.
3. Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.
4. Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.
5. Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.
6. Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.
7. Internet & World Wide Web: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations.

**TEXT BOOKS:**

1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K. Venugopal / Anuradha
3. Experiments in Basic Electrical Engineering by S.K.Bhattacharya, Rastogi- NAI.
4. Industrial Safety management by Deshmukh –TMH

**REFERENCE BOOKS:**

2. Workshop Manual / Venkat Reddy/ BSP
3. Residential and Commercial Industrial Electrical systems Vol.2 by Joshi-TMH
4. Residential and Commercial Industrial Electrical systems Vol.3 by Joshi-TMH
5. Industrial Safety management by Deshmukh –TMH

**Web resources:**


**Course Outcomes:**

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

1. Fabricate basic electrical circuit networks.
2. Identify and apply suitable tools for different trades of engineering processes.
3. Apply the learnt knowledge for installing operating system, presentations, and documentation.
4. Make a prototype by applying domain knowledge.

**CO-PO Mapping:**

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ENVIRONMENTAL SCIENCE
(Common to CSE/EEE/ECE/MECH/CSM/CDS/CSC/CSO)

Course Objectives:
1. Understanding the importance of ecological balance for sustainable development.
2. To educate students about natural resources and their exploitation
3. Understanding the concepts of green chemistry and its applications.

Module I ECOSYSTEMS AND ECOLOGY

UNIT-1: Ecosystem
Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids.

UNIT-2: Ecology
Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

Module II NATURAL RESOURCES

UNIT-1: 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,

UNIT-2: Land and Energy resources
Land resources: Forest resources, Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

Module III BIODIVERSITY AND BIOTIC RESOURCES

UNIT-1: Biodiversity
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

UNIT-2: Biotic Resources
Module IV ENVIRONMENTAL POLLUTION AND SOLID WASTE

UNIT-1: 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. Municipal Solid Waste management, composition and characteristics of e-Waste and its management

UNIT-2: Global Environmental Issues and Global Efforts


Module V Green Chemistry & Hazardous chemicals

UNIT-1: Green Chemistry
Introduction & Principles, green solutions for chemical energy storage, green chemistry solutions will be discussed within the fields of Chemical production: choice of feedstock, solvents, catalysts, synthesis routes including microwave and ultrasonic assisted synthesis.

UNIT -2: Hazardous Chemicals
Classification of hazardous chemicals, transportation of hazardous chemicals, Hazchem code, Storage and handling of hazardous substances, Emergency preparedness (on site & offsite), Safety audit, Concept of fire and explosion, Major accidents involving hazardous substances

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.

Course Outcomes:

CO-1: Understand the importance of ecosystem and ecological balance in conservation of biodiversity.

CO-2: Understand the concepts of natural resources and its exploitation.

CO-3: Explain the control of pollution for sustainable environment.

CO-4: Explain the concepts of green chemistry and its applications.
CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 - Low

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| CO1 | 3 |                              |
| CO2 | 3 | 1 |
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| CO4 | 3 | 1 |
Social and Health Consciousness
(Common to ECE, EEE, ME, CSE, CSD, CSO, CSC, CSM)

Prerequisites: Nil

Course Objectives:

1. To promote positive health, prevention of stress related to health problems and rehabilitation through Yoga.
2. To impart skills in the students to introduce Yoga for health to general public
3. To invoke scientific attitude and team spirit to channelize their energies in to creative and constructive endeavours.
4. The main objective of National Service Scheme is personality development through social service or community service and through physical education.

Module I

Unit 1: Introduction to Yoga and Importance of Yogic practices
Definition, nature and scope of yoga - Elements of Yoga in Vedic and Upanashadic literature. - Development of yoga through the ages. - Schools of yoga: Karma Yoga, Bhakti Yoga, Jnana Yoga, Hatha yoga, Raja yoga and Mantra Yoga. General benefits of Yoga Practices, preparing oneself for yoga practices, Comparison between yoga practices and other systems of physical exercises though practical examples.

Unit 2: Concept of Yoga Practices and its Types
Types of Yoga - Hatha Yoga, Raja Yoga, Laya Yoga, Bhakti Yoga, Gyan Yoga, Karma Yoga, Asthang Yoga, Relevance of Yoga in modern life. Yama and Niyama (Attitude Training Practices), Asana (Steady Postures), Pranayama (control of the breathing process), Mudras and Bandhas (seal and lock for energy), Shat Kriya (six purification techniques), Dhyana (Meditation)

Module II

Unit 1: Asana
Definition, Scope and limitations of Asana, Classification of Asanas and different types of Asanas relating to posture, Role of asana in yogic spiritual Yogic culture and Physical culture, different stage and phases in the performing of asana, Comparison between Asanas and other systems of physical exercises through practical examples.

Unit 2: Pranayama
Definition, Different phases of Pranayama, Importance of Pranayama in Yogic Curriculum, Comparison between pranayama & deep breathing exercises with practical examples.
Module III

Unit 1: Introduction to the physical education and ethics in sports


Unit 2: Olympic, Commonwealth and Asian Games

Ancient Olympic Games –Historical Background, Significance of Ancient Games. - Modern Olympic Games: Olympic Motto, Emblem, Rings, International Olympic Committee (IOC), functions of IOC - Asian Games

Module IV

Unit 1: Philosophy of National Service Scheme (NSS)

Introduction and Basic Concepts of NSS, History and Philosophy & Definition of NSS, Aims & Objectives of NSS, Emblem, flag, Motto, Song, Badge, NSS day etc., Organizational structure (from national to regional level), Roles and responsibilities of various NSS functionaries

Unit 2: NSS Programmes and Activities

NSS Programmes and Activities, Concept of regular activities (one day camp), special seven-day conduction camping, day and night camps and relevance of celebration of important days recognized by united nations, Centre, State Govt. & University, Basis of adoption of village/slums, methodology of conduction survey, financial pattern of the scheme, Coordination with different agencies, Maintenance of the diary

Module V

Unit 1: Community Mobilization

Functioning of community stakeholders, Designing the message in the context of the problem and the culture of the community, Identifying methods of mobilization, Youth-Adult partnership, Concept of Community development

Unit 2: Volunteerism and Government Organisations /Non-Government Organisations

Indian tradition of volunteerism, Value system of volunteerism, Motivation and constraints of volunteerism, Role of NSS volunteers in Swatch Bharat Abhiyan, Role of NSS volunteers in Digital India, Sources of funding National Service Scheme (NSS)- Government organisations (GO) and Non-Government organisations (NGO).

Text Books:

1. The Heart of Yoga: Developing a Personal Practice by T.K.V. Desikachar
2. The Yoga Sutras by Satchidananda
3. Freeman – Physical Education in Changing Society

Reference Books:
1. Yoga The Spirit and Practice of Moving into Stillness by Erich Schiffmann
2. Yoga Anatomy by Leslie Kaminoff
3. Essentials of Physical Education” By Ajmer Singh & Jagdish

Web Resources:

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

CO1: Enable the student to have good health and mental hygiene.
CO2: Possess emotional stability to integrate moral values through social service.
CO3: Attain higher level of consciousness in both physical and mental status.
CO4: Understand the concept of ill health and their remedies through yoga.

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<th>Course Outcomes (COs)</th>
<th>Program Outcomes (POs)</th>
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<td><strong>CO2</strong></td>
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<tr>
<td><strong>CO3</strong></td>
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<tr>
<td><strong>CO4</strong></td>
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CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 – Low